Exercises for mechanical neck disorders (Review)

Kay TM, Gross A, Goldsmith CH, Rutherford S, Voth S, Hoving JL, Brønfort G, Santaguida PL

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2012, Issue 8

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[Intervention Review]

Exercises for mechanical neck disorders

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Editorial group: Cochrane Back Group.
Publication status and date: New search for studies and content updated (no change to conclusions), published in Issue 8, 2012.
Review content assessed as up-to-date: 29 May 2012.

Citation: Kay TM, Gross A, Goldsmith CH, Rutherford S, Voth S, Hoving JL, Brønfort G, Santaguida PL. Exercises for mechanical neck disorders. *Cochrane Database of Systematic Reviews* 2012, Issue 8. Art. No.: CD004250. DOI: 10.1002/14651858.CD004250.pub4.

ABSTRACT

Background

Neck disorders are common, disabling and costly. The effectiveness of exercise as a physiotherapy intervention remains unclear.

Objectives

To improve pain, disability, function, patient satisfaction, quality of life and global perceived effect in adults with neck pain.

Search methods

Computerized searches were conducted up to February 2012.

Selection criteria

We included single therapeutic exercise randomized controlled trials for adults with neck pain with or without cervicogenic headache or radiculopathy.

Data collection and analysis

Two review authors independently conducted selection, data extraction, 'Risk of bias' assessment, and clinical relevance. The quality of the body of evidence was assessed using GRADE. Relative risk and standardized mean differences (SMD) were calculated. After judging clinical and statistical heterogeneity, we performed meta-analyses.

Main results

Six of the 21 selected trials had low risk of bias. Moderate quality evidence shows that combined cervical, scapulothoracic stretching and strengthening are beneficial for pain relief post treatment (pooled SMD -0.35, 95% confidence interval (CI): -0.60, -0.10) and at intermediate follow-up (pooled SMD -0.31, 95% CI: -0.57, -0.06), and improved function short term and intermediate term (pooled SMD -0.45, 95% CI: -0.72, -0.18) for chronic neck pain. Moderate quality evidence demonstrates patients are very satisfied with their care when treated with therapeutic exercise. Low quality evidence shows exercise is of benefit for pain in the short term and for function

up to long-term follow-up for chronic neck pain. Low to moderate quality evidence shows that chronic neck pain does not respond to upper extremity stretching and strengthening or a general exercise program.

Low to moderate quality evidence supports self-mobilization, craniocervical endurance and low load cervical-scapular endurance exercises in reducing pain, improving function and global perceived effect in the long term for subacute/chronic cervicogenic headache. Low quality evidence supports neck strengthening exercise in acute cervical radiculopathy for pain relief in the short term.

Authors' conclusions

Low to moderate quality evidence supports the use of specific cervical and scapular stretching and strengthening exercise for chronic neck pain immediately post treatment and intermediate term, and cervicogenic headaches in the long term. Low to moderate evidence suggests no benefit for some upper extremity stretching and strengthening exercises or a general exercise program. Future trials should consider using an exercise classification system to establish similarity between protocols and adequate sample sizes. Factorial trials would help determine the active treatment agent within a treatment regimen where a standardized representation of dosage is essential. Standardized reporting of adverse events is needed for balancing the likelihood of treatment benefits over potential harms.

PLAIN LANGUAGE SUMMARY

Exercise for Neck Pain

Neck pain is common; it can limit a person's ability to participate in normal activities and is costly. Exercise therapy is a widely used treatment for neck pain. This review includes active exercises (including specific neck and shoulder exercises, stretching, strengthening, postural, functional, eye-fixation, and proprioception exercises) prescribed or performed in the treatment of neck pain. Studies in which exercise therapy was given as part of a multidisciplinary treatment, multimodal treatment (along with other treatments such as manipulation or ultrasound), or exercises requiring application by a trained individual (such as hold-relax techniques, rhythmic stabilization, and passive techniques) were excluded. Twenty-one trials were used to assess if exercise could help reduce neck pain; improve function, patient satisfaction and/or quality of life. In these trials exercise was compared to either a placebo treatment, or no treatment (waiting list), or exercise combined with another intervention was compared with that same intervention (which could include manipulation, education/advice, acupuncture, massage, heat or medications). Results showed that exercise is safe, with temporary and benign side effects, although almost half of the trials did not report on adverse effects. An exercise classification system was used to ensure similarity between protocols when looking at the effects of different types of exercises. Exercise did show an advantage over the other comparison groups. There appears to be a role for exercises in the treatment of chronic neck pain and cervicogenic headache if stretching and strengthening exercises are focused on the neck and shoulder blade region. There appears to be no advantage to arm stretching and strengthening exercises or a general exercise program. There were a number of challenges with this review; for example, the number of participants in most trials was small and there was limited evidence on optimum doseage requirements.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION compared to THAT SAME INTERVENTION for chronic mechanical neck disorders

Patient or population: patients with mechanical neck disorders
Settings: ambulatory care clinic
Intervention: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION
Comparison: THAT SAME INTERVENTION

Outcomes	Effects	No of Participants (studies)	Quality of the evidence (GRADE)
Pain Intensity: VAS 0 no pain to 10 worst pain (follow-up: 6 months)	Three trials showed a small reduction in pain. Pooled scores estimated using a mean difference of -0.67 (-1.32 to -0.02)	241 (3 studies)	⊕⊕⊕◯ **moderate**[1]
Function: NDI 0 no disability to 50 maximum disability (follow-up: 6 month)	Three trials showed a small to moderate improvement in function Pooled scores estimated using a mean difference of -2.80 (-6.36 to 0.76)	241 (3 studies)	⊕⊕⊕◯ **moderate**[1]
Quality of Life: SF-36 (physical component) 0 worse to 100 better (follow-up: Immediate post treatment)	Two trials showed no significant difference Pooled scores estimated using a mean difference of -1.53 (-4.46 to 1.40)	165 (2 studies)	⊕⊕◯◯ **low**[1]
Patient Satisfaction: 1 to 7; completely satisfied to completely dissatisfied (follow-up 24 months)	One trial showed moderate improvement in satisfaction Scores estimated using a mean difference of -33.90 (-47.96 to -19.84)	101 (1 study)	⊕⊕⊕◯ **moderate**
Global Perceived Effect: Patient Rated Improvement 1 more improvement to 9 less improvement (follow-up: 24 months)	One trial showed a small to moderate improvement in global perceived effect Scores estimated using a mean difference of -17.40 (-33.45 to -1.35)	101 (1 study)	⊕⊕⊕◯ **moderate**
Adverse Effects	One study reported increased neck or headache pain Intervention group (n = 8), comparison group (n = 6); increased radicular pain intervention group (n = 1); severe thoracic pain comparison group (n = 1); all cases self-limiting and no permanent injuries (Bronfort 2001). 3 trials reported no complications or serious adverse events (Chiu 2005, Franca 2008, Martel 2011)		

Moderate quality evidence: Moderate pain relief and improved function up to long-term follow-up for combined cervical, scapulothoracic stretching and strengthening for chronic neck pain. A clinician may need to treat 6 to18 people to achieve this type of pain relief and 4 to 13 to achieve this functional benefit. Changes in global perceived effect measures indicate a difference immediately post treatment and at long-term follow-up

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: 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.
Very low quality: We are very uncertain about the estimate.

[1] Two of the pooled studies had low risk of bias scores (Franca 4/12 and Martel 5/12).

BACKGROUND

Description of the condition

Neck disorders are common (Côté 1998; Hogg-Johnson 2008; Rajala 1995), painful, and limit function in the general population (Carroll 2008a), workers (Côté 2008) and people with whiplash associated disorders (WAD) (Carroll 2008b). The estimated one-year prevalence of neck pain varies between 3.9% to 75% in Scandinavia, Europe, South Pacific, North America (Fejer 2006), Hong Kong (Chiu 2006) and Iran (Alipour 2008). Nationally, the total annual Swedish costs for back and neck problems were at least 1% of the GNP (Hansson 2005). Côté 2008 reported 3% to 11% of claimants in the work force were sufficiently disabled to lose time from work each year. Direct and indirect costs are substantive (Borghouts 1998; Borghouts 1999; Linton 1998; Skargren 1997).

Description of the intervention

We adopted the Therapeutic Exercise Intervention Model to subclassify exercise (Sahrmann 2002). This model is based on the elements of movement system. Sahrmann 2002 originally described movement as a system made up of five elements. Hall 2005 further developed this concept into a three dimensional model. The elements of movement system intersect with two other axes - activity and dosage. After determining which element of the movement system needs to be addressed to restore function, the activity or technique to achieve the functional goal is chosen. The dosage parameters are modified according to the tissues involved and the principles of tissue healing. A brief description of each element follows.

1. *Support Element*: An exercise categorized under this element would affect the functional status of the cardiac, pulmonary and metabolic systems (e.g. **aerobic** endurance activities).

2. *Base Element*: Exercises categorized under base would affect the functional status of the muscular and skeletal systems and is commonly linked to the biomechanical element. This element provides the basis for movement as follows:

- **extensibility**/stiffness properties of muscle, fascia and periarticular tissues for range of motion and stretching exercises,
- **mobility** of neuromeningeal tissue for neural mobilization exercises,
- force or torque capability of muscles and the related muscle length-tension properties for **strengthening** exercises, and
- **endurance** of muscle also involved in strengthening for endurance-strength training.

3. *Modulator Element*: Exercises under this element relate to motor control for neuromuscular reeducation as follows:

- **patterns and synchronization** of muscle recruitment, and
- feed-forward or feedback systems using verbal, visual, tactile and other **proprioceptive input** to the patient.

4. *Biomechanical Element*: This element is an interface between the motor control associated with the modulator element and musculoskeletal function associated with the base element. Components of the biomechanical element include:

- **static stabilization** forces involved in alignment and muscle recruitment, and

- **dynamic stabilization** forces involved in arthrokinetics, osteokinetics and kinematics.

5. *Cognitive or Affective Element*: Exercises in this category affects the functional status of the psychological system as it is related to movement as follows:

- the cognitive **ability to learn**,
- patient and caregiver **compliance**,
- **motivation**, and
- **emotional** status.

How the intervention might work

Exercise has both physical and mental benefits through its effects on numerous systems such as the cardiovascular system; immune system; brain function; sleep; mood; and the musculoskeletal system. Exercise can influence the following.

- Increase flexibility and mobility of structures; improve muscle strength and endurance; increase tensile strength of ligaments and capsule; amplify strength and prevent injury of tendons and cartilage; and is also important for repair of these tissues.
- Improve cardiovascular function resulting in less chance of developing heart conditions, strokes, or high blood pressure.
- Relieve stress, anxiety and depression; improve mood; and increase self-esteem and weight management by producing positive biochemical changes in the body and brain. Endorphins released post exercise act as a natural pain reliever and antidepressant in the body.
- Reduce the risk of premature mortality; improve functional capacity and help older adults maintain independence. Exercise increases circulation throughout the spine and supporting structures, which is crucial to promote healing.
- Improve quality and duration of sleep and help sleep disorders such as insomnia.
- Enhance cognitive function in older adults through physical activity and aerobic exercise.
- Positively benefit the human immune system if done in moderation.

Central to these benefits are the stages of change, encompassing the health belief and cognitive behavior models, used to help patients make the lifestyle changes necessary for successful adherence to exercise, maintain new behaviors over time and address anticipated relapses (Zimmerman 2000). Helping patients change behavior is an important role for all clinicians.

Why it is important to do this review

In our last update on exercise therapy, we found strong evidence of benefit for specific exercises on neck pain with or without cervicogenic headache in the short and long term. The relative benefit of other types of exercise was not clear (Kay 2005). Since then, other reviews have been published reporting on a variety of trials as follows: 1) Stretching and strengthening (Salt 2011); 2) postural exercise (Drescher 2008); 3) manual therapy and exercise Miller 2010 4) neuromuscular exercises (Conlin 2005; Gross 2007; Leaver 2010; Teasell 2010a; Verhagen 2007); 5) stretching and range of motion (ROM) exercises (Leaver 2010); 6) dynamic and isometric resisted exercise (Ylinen 2007); 7) stretching, strengthening, endurance training, balance/coordination, cardio and cognitive/affective elements (Lee 2009; Salt 2011; Teasell 2010c); 8) Qigong exercises (Lee 2009); and 9) exercise for chronic WAD (Teasell 2010c).

A number of these reviews included studies that were not clearly categorized; they also included studies that were not single intervention trials. Therefore, the true impact of exercise alone can not be determined. Although there is some evidence of benefit as noted above, it has become clear that categorizing exercises according to their elements is essential in differentiating the intended effect that different types of exercises may have. In this update, it is our objective to adapt a therapeutic model for exercise and sub classify the different exercises. This allowed us to link the specific aims of the exercise activity to its biological and anatomical rationale. We feel that this provides a better perspective on the intended aim of the specific exercise allowing us to clarify some of the reporting variances and the variance in exercise types that may be affecting the estimates of effect size.

OBJECTIVES

This systematic review assessed the short to long term effect of exercise therapy on pain, function, patient satisfaction, quality of life, and global perceived effect in adults experiencing mechanical neck pain with or without cervicogenic headache or radiculopathy. Where appropriate, the influence of risk of bias, duration of the disorder and subtypes of neck disorder on the treatment effect was assessed.

METHODS

Criteria for considering studies for this review

Types of studies

Any published or unpublished randomized controlled trial (RCT) in any language was included. Quasi-RCT and clinical controlled trials (CCTs) were excluded.

Types of participants

Participants included in the review were adults (males or females aged 18 years or older) with acute (less than 30 days), subacute (30 days to 90 days) or chronic (greater than 90 days) neck disorders categorized as:

- mechanical neck disorders (MND), including whiplash associated disorders (WAD) category I and II (Spitzer 1987; Spitzer 1995), myofascial neck pain, and degenerative changes including osteoarthritis and cervical spondylosis (Schumacher 1993),
- cervicogenic headache (CGH) (Olesen 1988; Olesen 1997; Sjaastad 1990; Sjaastad 1998; Sjaastad 2008), and
- neck disorders with radicular findings (NDR) (Spitzer 1987; Spitzer 1995).

Studies were excluded if they investigated neck disorders with definitive or possible long tract signs (e.g. myelopathies); neck pain caused by other pathological entities (Schumacher 1993); headache associated with the neck, but not of cervical origin; co-existing headache, when either neck pain was not dominant or the headache was not provoked by neck movements or sustained neck postures; and 'mixed' headache.

Types of interventions

Studies were included if they used one or more type of exercise therapy (such as specific neck exercises, shoulder exercises, active exercise, stretching, strengthening, postural, functional, eye-fixation, and proprioception exercises), prescribed or performed in the treatment of neck pain. For the purposes of this review, studies in which exercise therapy was given as part of a multidisciplinary treatment, multimodal treatment (e.g. manual therapy plus exercise), or exercises requiring manual therapy techniques by a trained individual (such as hold-relax techniques, rhythmic stabilization, and passive techniques) were excluded.

Types of comparisons

Interventions were contrasted against the following comparisons:

- sham or placebo,
- no treatment or wait list, and
- exercise plus another intervention versus that same intervention (for example exercise plus manual therapy vs manual therapy).

All other comparisons were excluded.

Types of outcome measures

A study was included if it used at least one of the four primary outcome measures of interest:

- pain,
- measures of function/disability (including but not limited to neck disability index, activities of daily living, return to work, and sick leave),
- patient satisfaction, and
- global perceived effect/quality of life.

Adverse events and costs of care were extracted when available. The duration of follow-up was defined as:

- immediately post treatment ($\leq$ one day),
- short-term follow-up (one day to three months),
- intermediate-term follow-up (three months up to, but not including, one year), and
- long-term follow-up (one year or longer).

Search methods for identification of studies

A research librarian searched computerized bibliographic databases, without language restrictions, for medical, chiropractic and allied health literature. Subject headings (MeSH) and key words included anatomical terms, disorder or syndrome terms, treatment terms and methodological terms.

Electronic searches

The following databases were searched from their start to February 2012: Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, Manual Alternative and Natural Therapy (MANTIS), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Index to Chiropractic literature (ICL), and the Cochrane Back Review Group Trials Register. See Appendix 1 for the Search Strategy used for MEDLINE.

Searching other resources

We also screened references of all retrieved full text articles, identified content experts and searched conference proceedings from the World Confederation of Physical Therapist 2007/2011, International Federation of Orthopaedic and Manipulative Therapists 2008, and searched personal files for grey literature.

Data collection and analysis

For continuous data, standardized mean differences (SMD) (95% confidence interval (CI)) were calculated using a random-effects model. Standard mean difference was selected over weighted mean difference (WMD) because different types of exercises were assessed and most interventions used different outcome measures that used different scales.

Selection of studies

Two review authors with expertise in medicine, physiotherapy, chiropractic, massage therapy, statistics, or clinical epidemiology independently conducted citation identification and study selection using pre-piloted forms. The assembled group did not author any of the primary trials. Agreement was assessed for study selection using the quadratic weighted Kappa statistic (Kw), Cicchetti weights (Cicchetti 1976). Disagreements were resolved through consensus and consultation with a third party if required.

Data extraction and management

Two review authors independently conducted data abstraction on pre-piloted forms. Disagreements were resolved through consensus. A neutral third party was consulted if consensus was not reached. We contacted study authors for missing information and data clarification. We extracted data on design (RCT, number analyzed/number randomized, intention-to-treat analysis, power analysis), participants (disorder subtype, duration of disorder), intervention (treatment characteristics for the treatment and comparison group, dosage/ treatment parameters, co-intervention, treatment schedule, duration of follow-up), and outcomes (baseline mean, end of study mean, absolute benefit, reported results, point estimate with 95% CI, power, side effects, cost of care, and adverse events). These factors are noted in the Characteristics of included studies table.

Assessment of risk of bias in included studies

Two review authors independently conducted assessment of risk of bias in included studies using pre-piloted forms. Disagreements were resolved through consensus (Graham 2011). The Cervical Overview Group used a calibrated team of assessors and at least two assessors independently assessed the risk of bias. 'Risk of bias' tables were presented and discussed by the broader validity assessment team to maximize inter-rater reliability (Graham 2011), and consensus was reached on final 'Risk of bias' assessments. We did not exclude studies from this review on the basis of the 'Risk of bias' assessment results. The following biases were assessed: selection bias (random sequence generation, allocation concealment, groups similarity at baseline); performance bias (blinding of personnel/care providers, co-intervention, and compliance); detection bias (blinding of outcome assessor); attrition bias (incomplete outcome data); reporting bias (selective reporting) (see Appendix 2 for the Cochrane 'Risk of bias' criteria).

Measures of treatment effect

We used SMD with 95% CIs for continuous data. The estimation of minimum clinically important difference (MCID) for pain, function and disability were in accordance with the Cochrane Back Group recommendations (Furlan 2009). For the purpose of the review, the MCID for pain was 10 on a 100-point pain intensity scale (Farrar 2001; Felson 1995; Goldsmith 1993). To assign some descriptors on the size of the difference between the treatment group and control groups, we considered the effect to be small when it was less than 10% of the VAS scale, medium when it was between 10% and 20% of the VAS scale, and large when it was 20% to 30% of the VAS scale. For the neck disability index (NDI), we used a MCID of 7/50 neck disability index units (MacDermid 2009). It is noted that the minimal detectable change varies from 5/50 for non-complicated neck pain to 10/50 for cervical radiculopathy (MacDermid 2009). 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). Risk ratios (RR) were calculated for dichotomous outcomes.

Unit of analysis issues

When neither continuous nor dichotomous data were available, we extracted the findings and the statistical significance as reported by the author(s) in the original study.

Dealing with missing data

Where data were not extractable, we contacted the primary authors. For continuous outcomes reported as medians, we calculated effect sizes (Kendal 1963; p 237).

Assessment of heterogeneity

Prior to calculation of a pooled effect measure, the reasonableness of pooling was assessed, based on clinical judgement. Using a random-effects model, statistical heterogeneity was tested using the Chi^2 method between the studies. In the absence of heterogeneity (p greater than 0.10), a pooled SMD or RR was calculated.

Assessment of reporting biases

Reporting Bias: We planned to assess reporting bias using sensitivity analysis but this was not possible due to a paucity of trials in any one category. Assessment of publication bias included use of the graphical aide funnel plot.

Data synthesis

The quality of the body of the evidence was assessed using the GRADE approach (Furlan 2009; Higgins 2009). 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 generalizable), 5) imprecision (insufficient data), other factors (e.g. reporting bias). The quality of the evidence was adjusted by a level based on the performance of the studies against the five domains.

All plausible confounding factors were considered as were their effects on the demonstrated treatment effects and their impact on the dose-response gradient (Atkins 2004).
Levels of evidence were defined as follows.

- **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 generalize to the population in question. There are sufficient data, with narrow confidence intervals. There are no known or suspected reporting biases (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 (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 (two of the domains are not met).
- **Very low quality evidence**: We are very uncertain about the estimate (three of the domains are not met).
- **No evidence**: No RCTs were identified that measured this outcome.

We utilized the Cochrane GRADE approach and considered a number of additional factors (adverse events, costs, temporality, plausibility, dose response, strength of association, and clinical applicability) to place the results into a larger context. The number needed to treat to benefit (NNTB) and treatment advantages were calculated to communicate the magnitude of effect for main findings (Gross 2002).

Subgroup analysis and investigation of heterogeneity

Not conducted due to lack of data.

Sensitivity analysis

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

RESULTS

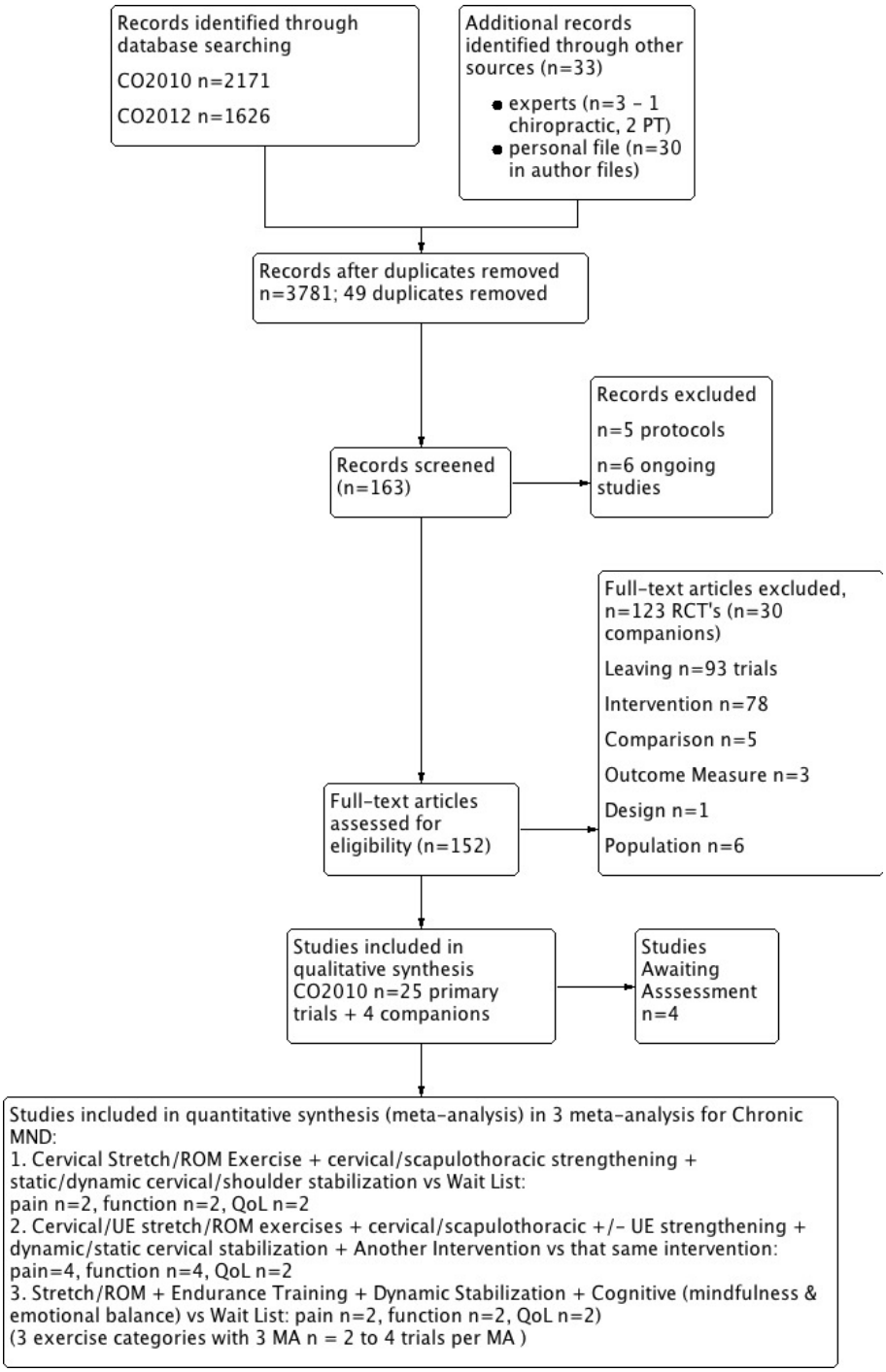
Description of studies

See: Characteristics of included studies; Characteristics of excluded studies; Characteristics of studies awaiting classification; Characteristics of ongoing studies.

Results of the search

Considering all sources, 3781records were identified through database searches and 33 records were found from other sources searched from start up to February 2012. Following screening of 163 full text articles, 152 were assessed for eligibility, (agreement on selection showed weighted kappa: 0.85; 95% CI 0.75 to 0.94). After further application of the eligibility criteria, we found 21 trials that used exercise treatment for non-specific subacute and chronic neck pain, and selected them for this review; Figure 1 describes the flow of included, excluded, and ongoing, as well as those awaiting classification.

Figure 1. Study flow diagram (PRISMA).



Included studies

Twenty-one trials (2159/2010 randomized/analyzed participants) were selected for this review.

- Two studies described different aspects of the same study population under additional publications (Bronfort 2001 - one trial, four publications; Stewart 2007- one trial, three publications),

- Nineteen trials evaluated neck pain: one evaluated acute/subacute/chronic neck pain (Kjellman 2002); one evaluated subacute neck pain (Chiu 2005); three evaluated subacute/chronic neck pain (Andersen 2008; Andersen 2011, Stewart 2007); twelve trials evaluated chronic neck pain (Allan 2003; Ang 2009; Bronfort 2001; Franca 2008; Goldie 1970; Helewa 2007; Lundblad 1999; Martel 2011; Rendant 2011; Revel 1994; Viljanen 2006; von Trott 2009), and one trial did not specify the duration of neck pain (Takala 1994),

- One study reported on neck disorder with radicular signs and symptoms (Kuijper 2009) and seven did not specify if radicular signs and symptoms were present (Andersen 2011; Hall 2007; Helewa 2007; Lundblad 1999; Rendant 2011; Viljanen 2006; von Trott 2009),

- Two trials investigated cervicogenic headache, one subacute (Hall 2007) and the other chronic (Jull 2002),

- One trial investigated acute radiculopathy (Kuijper 2009).

Studies varied in sample size from 16 to 354 (n analyzed), and 20 of 21 trials were considered small (less than 70 participants per intervention arm).

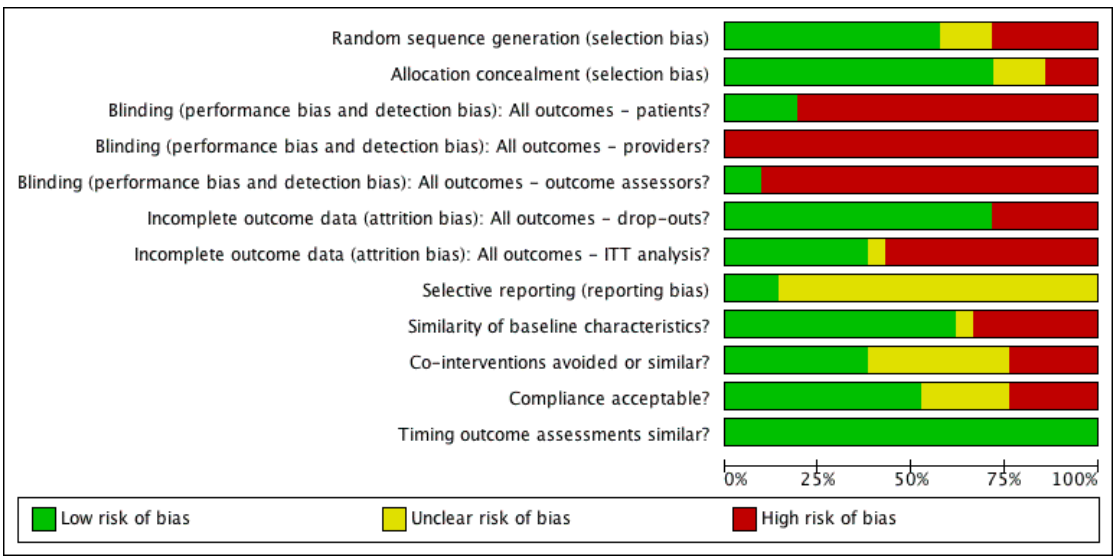
Excluded studies

Studies were excluded for the following reasons: one used a quasi-RCT design, five examined a different type of participant (e.g. chronic tension headache), one reported on a subgroup of the included population, 72 tested a different intervention (e.g. not active exercise, the exercise was the same in all groups, or the exercise group could not be separated out from a multimodal intervention), four trials used a comparison group, and six did not measure any of the identified primary outcomes.

Risk of bias in included studies

The quadratic weighted Kappa (Kw) statistic was used to assess agreement on a per question basis (Kw 0.23 to 1.00). Each 'Risk of bias' item is presented as a percentage across all included studies in Figure 2. Common methodological weaknesses included each of the criteria listed below (see 'Risk of bias' tables). Methodological quality did not appear to influence the end results of the reviews, both high and low quality studies had similar outcome directions. This relationship between risk of bias and end results of the review was not formally tested using sensitivity analysis or meta-regression as there were not enough trials in any one meta-analysis.

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



Allocation

There was failure to describe or use appropriate concealment of allocation in 28.6% of studies.

Blinding

There was a lack of effective "blinding" procedures - the minimum expectation being blinding of the outcome assessor in 90.5% of trials.

Incomplete outcome data

There were incomplete outcome data provided by 28.6% of the trials.

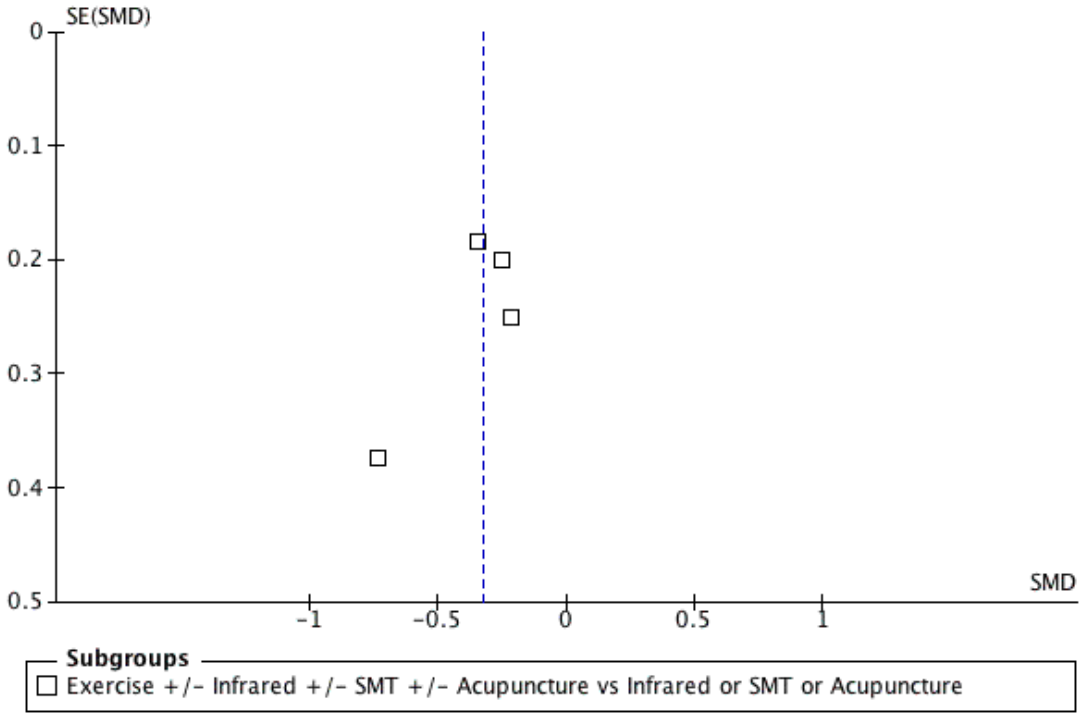
Selective reporting

There was selective reporting bias with 85.7% of the trials.

Other potential sources of bias

Compliance was monitored in only 52.5% of trials, and co-intervention was not avoided in 61.9% of trials. The funnel plot has the classic small negative trial missing that may suggest language bias we did not search non-English databases, alternatively it could reflect the poor method quality leading to inflated effects in smaller trials (Figure 3).

Figure 3. Funnel plot of comparison: 8 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, outcome: 8.1 Pain Intensity: Immediate Post Treatment (<11w of treatment).



Effects of interventions

See: **Summary of findings for the main comparison** Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION compared to THAT SAME INTERVENTION for mechanical neck disorders; **Summary of findings 2** Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization compared to WAIT LIST for mechanical neck disorders; **Summary of findings 3** Chronic MND: Qigong Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) compared to WAIT LIST for mechanical neck disorders

Chronic Mechanical Neck Pain

1. Support Element

Cardiovascular/Aerobic Training

General Fitness Training versus Control

One trial (Andersen 2008), compared a general exercise program with a control intervention. Two trials combined cardiovascular or aerobic training with other exercise approaches (Bronfort 2001; Takala 1994) and are reported in subsequent sections below.

- *Pain Intensity Outcomes*

One trial showed no difference in pain immediately post treatment or at short-term follow-up.

Conclusion: There is low quality evidence (one trial, 30 participants) that a general fitness training exercises has no effect on pain when compared with a reference intervention for (sub)acute/chronic neck pain either immediately post treatment or after short-term follow-up.

2. Base Element

a) Stretching

Cervical Stretch/ROM Exercises + Another Intervention versus That Same Intervention

One trial (Allan 2003) evaluated neck stretching either before or after manipulation compared with manipulation alone.

- *Pain Intensity Outcomes*

No difference in pain between all groups immediately post treatment.

- *Function Outcomes*

No difference in function between all groups immediately post treatment.

Conclusion : There is low quality evidence (one trial, 16 participants) that stretching exercises either before or after a manipulation had similar effects on pain and function when compared with that same manipulation for chronic neck pain immediate post treatment. Manipulation was the control group in both arms of the trial and therefore, the contribution of the base element of stretching can be factored out.

Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization versus Sham

One trial (Kjellman 2002) compared cervical movement exercises (McKenzie protocol) with sham ultrasound.

- *Pain Intensity Outcomes*

There is no evidence of benefit on pain immediately post treatment, at intermediate- and long-term follow-up.

- *Function Outcomes*

There was no evidence of benefit on function immediately post treatment, at intermediate- or long-term follow-up.

Conclusion : In this trial cervical movement exercises (McKenzie protocol) were classified as a program focusing on stretching. Low quality evidence (one trial, 50 participants) suggests no difference between this program and a sham treatment for chronic neck pain and function when measured from immediate post treatment to long-term follow-up.

b) Strengthening

Static Cervical Strengthening + Static Stabilization versus No Intervention or Wait List

Two trials (three comparisons) studying chronic neck pain compared either manually (1) resisted isometric neck exercise plus postural training with mirror feedback to a control, or (2) these same isometric neck exercises and the use of an orthopaedic pillow compared with use of an orthopaedic pillow (Helewa 2007) or (3) isometric exercise alone against no intervention or wait list control (Goldie 1970).

- *Pain Intensity Outcomes*

Of two comparisons, one showed no evidence of benefit (exercise versus control of massage + thermal modalities) while the other showed evidence of benefit (exercise + an intervention versus that same intervention) on pain immediately post treatment and at short-term follow-up. (Helewa 2007).

- *Function Outcomes*

Of the two comparisons, one showed no evidence of benefit (exercise versus control) while the other showed evidence of benefit (exercise + an intervention versus that same intervention) on function immediately post treatment and at short-term follow-up. (Helewa 2007).

- *Quality of Life*

In two comparisons (exercise versus control, exercise + an intervention versus that same intervention), there was no evidence of benefit immediately post treatment and at short-term follow-up on quality of life (Helewa 2007), albeit there may be a clinically important effect favouring exercise + pillow versus pillow alone.

- *Global Perceived Effect (GPE)*

Patient's reported isometric neck strengthening exercises to be slightly superior to a wait list control immediately post treatment (Goldie 1970).

Conclusion : Evidence exists from two trials (three comparisons) where data are not combinable. Low quality evidence one trial (two independent comparisons), 50 participants, Helewa 2007 gives varying results. Evidence of benefit when exercise was added to a pillow versus a pillow alone NNTB = 9, however, this was not observed when isometric exercise alone was evaluated for function and quality of life, from immediate post treatment to short-term follow-up. Low quality evidence (one trial, 47 participants, Goldie 1970) supports patient GPE favouring isometric exercise immediate post treatment. A clinician may need to treat three people to achieve this type of benefit in one patient.

Scapulothoracic + U/E Strengthening versus Control

One trial (Andersen 2008) compared specific strength training of the scapulothoracic region and upper extremity with a reference intervention.

- *Pain Intensity Outcomes:*

There was evidence of benefit on pain post treatment and at short-term follow-up.

Conclusion : Low quality evidence (one trial, 32 participants, Andersen 2008) notes that a scapulothoracic and upper extremity strengthening program reduces pain intensity immediately post treatment and at short-term follow-up when compared with a control for sub(acute) and chronic neck pain. A clinician may need to treat four people to achieve short-term pain relief in one.

c) Stretch and Strengthening

Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization versus Placebo or Sham

One trial (Kjellman 2002) compared general exercises including neck and shoulder ROM, active neck endurance and strength exercises with sham ultrasound.

- *Pain Intensity Outcomes*

There was no evidence of benefit on pain at post treatment, intermediate- and long-term follow-up.

- *Function Outcomes*

There was no evidence of benefit post treatment, at intermediate- and long-term follow-up.

Conclusion : Low quality evidence (one trial, 50 participants) notes that a neck and upper extremity stretch and strengthening program is no different from a sham treatment for chronic neck pain and function post treatment up to long-term follow-up.

Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization versus Wait List

Two trials (Rendant 2011, von Trott 2009) compared a standardized exercise program for neck pain including repeated active cervical rotations, strength and flexibility exercises to a wait list. The two trials appeared clinically similar and were pooled.

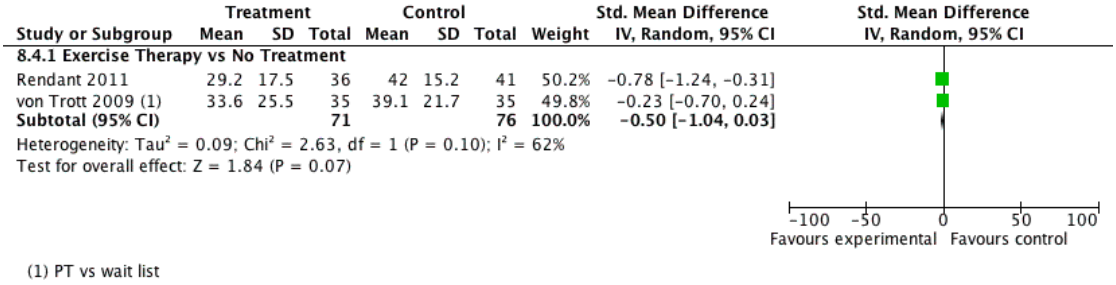
- *Pain Intensity Outcomes*

One trial (Rendant 2011) showed evidence of benefit for pain post treatment. Although the other trial (von Trott 2009) showed no significant pain relief at immediate post treatment and at short-term follow-up, there was a positive trend favouring the exercise program given the very small sample size. When the two studies were pooled there was a significantly different, moderate clinically important 15-point change post treatment. Heterogeneity: Chi^2 = 0.74, df = 1 (P = 0.39); I^2 = 0% WMD pooled -14.90 [-22.40 to -7.39], NNTB is four.

- *Function Outcomes*

One trial (Rendant 2011), showed evidence of benefit for function post treatment. One trial (von Trott 2009) showed no significant difference immediate post treatment and at short-term follow-up. When the two studies were pooled there was a significantly different, clinically important, moderate change in function. Heterogeneity: Tau^2 = 0.09; Chi^2 = 2.63, df = 1 (P = 0.10); I^2 = 62% SMD pooled:-0.50 [-1.04 to 0.03], NNTB is five (Figure 4).

Figure 4. Forest plot of comparison for chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST in the outcome Function (NPDS) at 12 weeks of treatment.



- *Global Perceived Effect (GPE)*

No significant difference in GPE was found at any time points.

- *Quality of Life (QoL)*

When the two trials were pooled, no significant difference in QoL was found at any time points. Heterogeneity: Tau² = 0.00; Chi² = 0.95, df = 1 (P = 0.33); I² = 0% WMD pooled -1.42 (-4.57 to 1.73).

Conclusion: Low quality evidence (two trials, 147 participants, von Trott 2009; Rendant 2011) suggest evidence of benefit for pain and function, but not GPE and QoL at immediate post treatment and short-term follow-up. A clinician may need to treat four people to achieve moderate degree of pain relief and five to achieve moderate functional benefit in one patient.

Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic/+/-UE Strengthening + Dynamic/Static Cervical Stabilization + Another Intervention versus That Same Intervention

Four trials studying chronic neck pain compared the following exercise interventions with a control group:

1. deep neck flexor retraining with pressure biofeedback and resisted neck flexion/extension strengthening using multicervical rehabilitation unit (Chiu 2005);
2. low technology exercise including progressive resisted neck and upper body strengthening using dumb bells and pulley systems, light stretching and a short aerobic warm-up program (Bronfort 2001);
3. muscle stretching and strengthening exercises of the neck and upper limbs regions including strengthening of the deep cervical flexion muscles (Franca 2008);
4. a home exercise program of ROM, stretching/mobilization and strengthening exercises of the cervical and upper thoracic spine (Martel 2011)

Both treatment arms of all groups received another intervention and were compared with that same intervention combined with exercise. We considered the exercise protocols to be clinically similar; that is, they all contained an exercise component which applied a resistance force directly to the cervicoscapular region. Other similar clinical elements included the dosage and duration of care. We judged these exercise trials to be both clinically and statistically homogeneous (P = 0.67, I^2 = 0%).

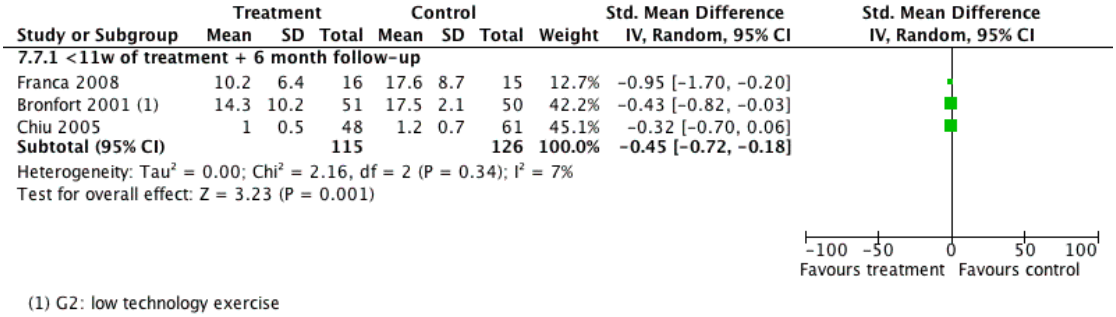
- *Pain Intensity Outcomes*

When data were pooled into a summary estimate, we found consistent evidence of reduced pain from immediate post treatment pooled SMD -0.33 (95% CI:-0.55 to -0.10) (Bronfort 2001; Chiu 2005; Franca 2008; Martel 2011 to intermediate- and long-term follow-up (Bronfort 2001). This suggests an initial small to longer term large treatment benefit. The number needed to treat for one patient to benefit varies from six to 18.

- *Function Outcomes*

There was evidence of benefit in function at immediate post treatment pooled SMD -0.25 (95% CI: -0.48 to -0.01), intermediate-term pooled SMD -0.45 (95% CI: -0.72, to -0.18) (Figure 5, Bronfort 2001; Chiu 2005; Martel 2011) and long-term follow-up (Bronfort 2001). This latter represents the largest improvement. The number needed to treat for one patient to benefit varies from four to 13.

Figure 5. Forest plot of comparison for chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION in the outcome Function at intermediate term follow-up.



- *Global Perceived Effect and Quality of Life*

There was statistically important difference in GPE noted immediately post treatment and at long-term follow-up (Bronfort 2001; Martel 2011).

- *Patient Satisfaction*

There was statistically and clinically important differences for patient satisfaction noted at all time points (Bronfort 2001).

Conclusion : Moderate quality evidence (four trials, 341 participants, Bronfort 2001; Chiu 2005; Franca 2008; Martel 2011) shows moderate pain relief and improved function up to long-term follow-up for combined cervical, scapulothoracic stretching and strengthening for chronic neck pain. A clinician may needs to treat six to18 people to achieve this type of pain relief and four to 13 to achieve this functional benefit. Moderate quality evidence (one trial, 101 participants) demonstrates patients are very satisfied with their care. Changes in quality of life are suggestive of benefit but not conclusive. Changes in global perceived effect measures indicate a difference immediately post treatment and at long-term follow-up.

d) Stretching and Endurance Training

Cervical/Scapulothoracic/UE Stretch + UE Endurance Training versus No Intervention

One trial (Viljanen 2006) compared dynamic muscle training with free weights with ordinary activity.

- *Pain Intensity Outcomes*

There was no significant pain relief at immediate post treatment, short- or long-term follow-up.

- *Function Outcomes*

There was no significant functional change at the same three time points.

Conclusion: Moderate quality evidence (one trial, 265 participants), shows no support for upper extremity stretching and endurance training for chronic neck pain and function at immediate post treatment, short- and long-term follow-up.

e) Strengthening and Endurance Training

Cervical/Scapulothoracic Strengthening + Endurance Training versus Control

One trial (Ang 2009) compared non-postural and postural strengthening exercises and endurance-strength exercises versus a control group.

- Pain Prevalence Outcomes

There was no significant decrease in pain prevalence at immediate post treatment or long-term follow-up.

Conclusion: Very low quality evidence (one trial, 68 participants, Ang 2009) shows no support for cervical/scapulothoracic strengthening and endurance-strength exercises in reducing the prevalence of neck pain in chronic neck pain at immediate post treatment and long-term follow-up.

f) Endurance Training

Scapulothoracic/UE Endurance Training versus Control

One trial (Andersen 2011) with two comparisons compared shoulder abduction endurance training for two minutes or 12 minutes with a control group.

- Pain Intensity Outcomes

There was evidence of benefit immediate post treatment for a reduction in pain intensity for both the two-minute and 12-minute training programs.
Conclusion: Moderate quality evidence (one trial, 198 participants, Andersen 2011) shows support for a two-minute and 12-minute scapulothoracic endurance training program reducing pain in (sub)acute/chronic neck pain immediately post treatment. A clinician may need to treat four people to achieve this type of pain relief.

3. Modulator Elements

Neuromuscular Exercise (eye-neck coordination/proprioception) + Another Intervention versus That Same Intervention

One trial (Revel 1994) compared eye-neck coordination exercises and analgesic/antiinflammatory medication with that same medication only for chronic neck pain.

- *Pain Intensity*

There was evidence of benefit on pain at short-term follow-up. The number needed to treat for one patient to benefit is four.

- *Function*

There was evidence of benefit on function at short-term follow-up. The number needed to treat for one patient to benefit is three.
Conclusion: Very low quality evidence (one trial, 60 participants, Revel 1994) shows a moderate reduction in pain and improved function in chronic neck pain in the short term for eye-neck coordination exercises. A clinician may need to treat four people to achieve this type of pain relief and three to achieve this functional benefit in one person.

4. Base + Modulator Elements + Support

Trunk and Extremity Stretch + Pattern/Synchronization: Balance Coordination + Cardiovascular/Aerobic versus No Intervention

One trial (Takala 1994) with unspecified duration of neck pain at baseline, compared a group whole body exercise program, which included aerobic training and shoulder/thoracic exercises, with no treatment.

- *Pain Intensity*

There was no evidence of benefit for pain reduction immediately post treatment.
Conclusion: Low quality evidence (one trial, 44 participants) shows no benefit for pain reduction immediately post treatment in patients with neck pain of unspecified duration when treated with group exercise that combined extensibility and coordination exercises with cardiovascular training.

General Endurance Training + Dynamic/Static Lowback/pelvic Stabilization + General Stretching + Neuromuscular/body Mechanics Movement Training versus No Intervention

One trial (Lundblad 1999) compared lumbopelvic stabilization, ergonomic exercises, endurance, general strengthening, and coordination exercises to no treatment.

- *Pain Intensity*

There was no evidence of benefit for pain reduction at short-term follow-up.
Conclusion: Low quality evidence (one trial, 38 participants, Lundblad 1999) shows no benefit for pain reduction with a combined exercise approach of stabilization of the low back and pelvis, posture awareness, ergonomic training, and strength, coordination, endurance, flexibility/smoothness and rhythm exercises when compared to no intervention or a wait list control in chronic neck pain at short-term follow-up.

5. Base + Cognitive/Affective Element

Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) versus Wait List

Two trials (Rendant 2011; von Trott 2009) compared a program of Qigong exercises (Dantian) including relaxation of mind body and conscious breathing, and movement exercises of hip, legs, shoulders, arms and the head with a wait list.

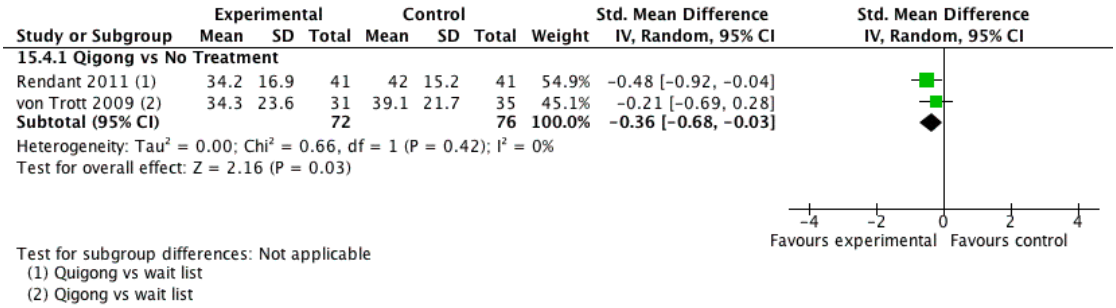
- *Pain Intensity*

When data were pooled into a summary estimate, there was evidence of reduced pain post treatment [pooled SMD -0.34 (95% CI :-0.67 to -0.01)] (Rendant 2011; von Trott 2009).

- *Function*

There was evidence of benefit on function post treatment when data were pooled SMD -0.36 (95% CI: -0.68 to -0.03 (Rendant 2011; von Trott 2009; Figure 6).

Figure 6. Forest plot of comparison for chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST in the outcome Function (NPDS) at 12 weeks of treatment.



- *Global Perceived Effect*

There was no evidence of benefit for global perceived effect immediately post treatment and at short-term follow-up.

- *Quality of Life*

There was evidence of benefit for SF36 physical component immediately post treatment pooled SMD -0.32 (95% CI: -0.64 to 0.01); but not at short-term follow-up (Rendant 2011; von Trott 2009).

Conclusion: Low quality evidence (two trials, 191 participants, Rendant 2011; von Trott 2009) shows small benefit for Qigong exercises (Dantian Qigong) when compared with a wait list control. There was a reduction in chronic neck pain, moderate improvement in function and small benefit for quality of life post treatment but no benefit for global perceived effect immediately post treatment and at short-term follow-up. A clinician may need to treat for to six people to achieve this type of pain relief, five to eight people to achieve this functional benefit, and seven to10 people for this improvement in quality of life.

6. Base + Modular + Cognitive Affective + Support

Stretch/ROM + Strength and Endurance Training (trunk and limb) + Pattern/Synchronization: Balance Coordination + cardiovascular/aerobic + cognitive (coaching + motivational) versus that same intervention

One trial (Stewart 2007) compared an individualized, progressive submaximal program which included aerobic training, trunk and limb exercises and advice compared with advice alone.

- *Pain Intensity*

There was evidence of benefit on pain post treatment but not at long-term follow-up.

- *Function*

There was evidence of benefit on function post treatment and at long-term follow-up.

- *Global Perceived Effect (GPE)*

There was evidence of benefit on GPE post treatment but not at long-term follow-up.

- *Quality of Life (QoL)*

There was evidence of benefit on QoL post treatment but not at long-term follow-up.

Conclusion: Low quality evidence (one trial, 132 participants, Stewart 2007) shows benefit for pain, function, global perceived effect and quality of life post treatment and for function at long-term follow-up when exercise and advice were compared with advice alone for chronic mechanical neck disorder.

Cervicogenic Headache

1. Base Element

Stretch/ROM exercises versus Sham

One trial (Hall 2007) investigated patients with (sub)acute cervicogenic headache; this trial compared C1 to C2 self-sustained natural apophyseal glide (SNAG) exercises with a sham mobilization

- *Pain Intensity Outcomes*

There was pain reduction at both short- and long-term follow-up. The number needed to treat for one patient to benefit is three.

Conclusion: Low quality evidence (one trial, 32 participants, Hall 2007) shows a large pain reduction at short- and long-term follow-up with the use of C1 to C2 self-SNAG exercises when compared with a sham for (sub)acute cervicogenic headache. A clinician may

need to treat three people to achieve this type of long-term pain relief.

2. Base and Modular Element

Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization versus No Intervention

One trial (Jull 2002) studied chronic cervicogenic headache and compared endurance exercises including pressure biofeedback for the cervicoscapular region with no treatment. Additionally in another comparison, this same exercise was combined with manual therapy and compared with manual therapy alone.

- *Pain Intensity*

When compared with no treatment, there was evidence of a large benefit post treatment and a moderate size benefit at long-term follow-up for pain relief. The number needed to treat for one patient to benefit is six. However, when combined with manual therapy and compared with manual therapy alone, this benefit was not observed.

- *Function*

When compared with no treatment, there was evidence of a moderate degree of benefit at post treatment and at long-term follow-up on function. The number needed to treat for one patient to benefit is six. Just as with pain, when combined with manual therapy and compared with manual therapy alone, this benefit was not observed.

- *Global Perceived Effect (GPE)*

When compared with no treatment, there was evidence of a large benefit at post treatment and at long-term follow-up on GPE. Again, the comparison between combined manual therapy and exercise versus exercise did not show evidence of benefit immediately post treatment but had a clinically important but not statistically different change at long-term follow-up.

Conclusion : Moderate level evidence (one trial, 100 participants, Jull 2002) shows a large reduction in pain and large beneficial global perceived effect, as well as a moderate improvement in function for chronic cervicogenic headache. This benefit was observed when using low load cervical endurance exercises compared with no treatment at long-term follow-up. A clinician may need to treat six people to achieve this type of pain relief and functional benefit in one patient. This degree of benefit was not observed when exercise combined with manual therapy is compared with manual therapy alone.

Acute Radiculopathy

1. Base Element

a) Stretching and Strengthening

Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization versus Wait List

One trial (Kuijper 2009) studying acute cervical radiculopathy compared cervical mobilizing and stabilizing exercises with a wait list control.

- *Pain Intensity*

There was a significant difference in reduction of pain immediately post treatment but no difference at intermediate-term follow-up.

- *Function*

There was no statistical significant difference in improved function immediately post treatment and at intermediate-term follow-up.

- *Patient Satisfaction*

There was no difference between groups in patient satisfaction at immediate post treatment follow-up.

Conclusion : There is low quality evidence (one trial, 133 participants, Kuijper 2009) demonstrating benefit in the level of pain but not in function and patient satisfaction immediately post treatment when cervical mobilization and stabilization exercises are compared with a control for acute cervical radiculopathy. However, there is no difference in pain and functional improvement at intermediate-term follow-up.

Adverse Events

Ten of the 21 trials did not report on adverse events (Andersen 2008; Ang 2009; Goldie 1970; Hall 2007; Kjellman 2002; Kuijper 2009; Lundblad 1999; Revel 1994; Takala 1994; Viljanen 2006); five trials found patients did not report any adverse events (Allan 2003; Chiu 2005; Franca 2008; Helewa 2007; Martel 2011); six studies reported self-limiting side effects such as headache, neck, or thoracic pain or worsening of symptoms (Andersen 2011; Bronfort 2001; Jull 2002; Rendant 2011; Stewart 2007; von Trott 2009).

ADDITIONAL SUMMARY OF FINDINGS *[Explanation]*

Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization compared to WAIT LIST for mechanical neck disorders

Patient or population: patients with chronic mechanical neck disorders
Settings: residential community
Intervention: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization
Comparison: WAIT LIST

Outcomes	Effects	No of Participants (studies)	Quality of the evidence (GRADE)
Pain Intensity: VAS 0 no pain to 100 worst pain (follow-up: immediate post treatment)	Two trials showed a medium reduction in pain. Pooled scores estimated using a mean difference of -14.90 (-22.40 to -7.39)	147 (2 studies)	⊕⊕◯◯ **low**[1,2]
Function: NPDI 0 no disability to 100 maximum disability (follow-up: immediate post treatment)	Two trials showed a medium improvement in function. Pooled scores estimated using a mean difference of -10.38 (-17.11 to -3.64)	147 (2 studies)	⊕⊕◯◯ **low**[1,2]
Quality of Life: SF-36 (physical component) 0 worse to 100 better (follow-up: immediate post treatment)	Two trials showed no significant difference in quality of life scores Pooled scores estimated using a mean difference of -2.22 (-5.17 to 0.72)	143 (2 studies)	⊕⊕◯◯ **low**[1,2]
Global Perceived Effect: General Health Perception 0 worse to 100 better (follow-up immediate post treatment and short term)	On trial showed no significant difference in GPE.	70 (1 study)	⊕⊕⊕◯ **moderate**[2]
Patient Satisfaction	Not Measured		
Adverse Effects	Reported by 18 patients in exercise group: muscle soreness (n = 15), myogelosis (n = 11), headaches (n = 5), vertigo (n = 2), change in mood (n = 1), worsening of neck pain (n = 1), worsening of tinnitus (n = 1), nausea (n = 1), muscle tensions (n = 2)		

Low quality evidence: benefit for pain and function, but not GPE and QoL at immediate post treatment and short-term follow-up. A clinician may need to treat 4 people to achieve moderate degree of pain relief and 5 to achieve moderate functional benefit in one patient

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: 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.
Very low quality: We are very uncertain about the estimate.

[1] One of the studies (Rendant 2011) scored 6/12 on risk of bias assessment.
[2] Small studies

Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) compared to WAIT LIST for mechanical neck disorders

Patient or population: patients with chronic mechanical neck disorders
Settings: residential community
Intervention: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance)
Comparison: WAIT LIST

Outcomes	Effects	No of Participants (studies)	Quality of the evidence (GRADE)
Pain Intensity: VAS 0 no pain to 100 worst pain (follow-up: immediate post treatment)	Two trials showed a moderate reduction in pain Pooled scores estimated using a mean difference of -13.28 (-20. 98 to -5.58)	148 (2 studies)	⊕⊕◯◯ **low**[1,2]
Function NPDI 0 no disability to 100 maximum disability (follow-up: immediate post treatment)	Two trials showed a small improvement in function Pooled scores estimated using a mean difference of -0.36 (-0.68 to -0.03)	148 (2 studies)	⊕⊕◯◯ **low**[1,2]
Quality of Life: SF-36 (physical component) 0 worse to 100 better (follow-up: immediate post treatment)	Two trials showed no significant different in quality of life Pooled scores estimated using a mean difference of -0.32 (-0.64 to -0.01)	148 (2 studies)	⊕⊕◯◯ **low**[1,2]
Global Perceived Effect: General Health Perception 0 worse to 100 better (follow-up immediate post treatment and short term)	One trial showed no significant difference in GPE.	70 (1 study)	⊕⊕⊕◯ **moderate**[2]

Patient Satisfaction	Not Measured	
Adverse Effects	Reported by 23 patients in qigong group including: muscle soreness (n = 17), myogelosis (n = 12), vertigo (n = 10), other pain (n = 4), headache (n = 3) , thirst (n = 1), engorged hands (n = 1), twinge in the neck (n = 1), urinary urgency (n = 1), bursitis of left shoulder (n = 1), nausea (n = 2), muscle tension (n = 1)	

Low quality evidence: Small benefit for Qigong exercises (Dantian Qigong) when compared with a wait list control. There was a reduction in chronic neck pain, moderate improvement in function and small benefit for quality of life post treatment but no benefit for global perceived effect immediate post treatment and at short-term follow-up. A clinician may need to treat 4 to 6 people to achieve this type of pain relief, 5 to 8 people to achieve this functional benefit, and 7 to10 people for this improvement in quality of life

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: 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.
Very low quality: We are very uncertain about the estimate.

[1] One included study (Rendant 2011) scored 6/12 on risk of bias assessment.
[2] Small studies.

DISCUSSION

Summary of main results

Limiting the eligible trials to those with single interventions that compared exercise with a control or comparative group maximized the opportunity to evaluate the treatment effect of exercise interventions. Moreover, selecting a priori an exercise classification system allowed us to use a clinical rationale for selecting studies with similar interventions for interpretation and inclusion within meta-analyses, particularly for the outcomes of pain and function. Although there were only 21 studies eligible for this systematic review, these two new strategies provided greater clarity in our conclusions about the effectiveness of exercise therapy. In summary:

- Moderate and low GRADE evidence favours specific neck stretching and strengthening exercises for chronic neck pain relief, improved function and satisfaction with care post treatment to long term.
- Moderate and low GRADE evidence favours craniocervical endurance and low load endurance exercises for subacute/chronic cervicogenic headache from post treatment through to long term.
- Low GRADE evidence supports neck strengthening exercise for acute onset cervical radiculopathy for pain relief but not function post treatment.
- Very Low GRADE evidence favours cervical proprioceptive training for cervicogenic headache in the short term.
- Moderate and low GRADE evidence suggests upper extremity stretching and strengthening or a general exercise program were of no benefit.

Knowledge of key multimodal approaches like exercise and manual therapy is still needed as this model of combined care is commonly used in clinical practice.

Overall completeness and applicability of evidence

Exercise is a fundamental treatment modality used in most rehabilitation for a variety of health conditions. The rehabilitation literature has emphasized the need to examine the role that exercise plays within the treatment strategies that include other modalities (De Jong 2004; Helewa 2007; Van Langeveld 2008; Whyte 2003). Carrying out a meta-analysis across all exercise studies is not useful or appropriate. The judgement regarding similarity of exercise interventions can be complicated with the limited descriptions provided in the report of the primary study. In addition, it is unclear the importance of other features that are part of an broader package of interventions such as behavioral or organizational changes, professional guidance in exercises, working time availability for exercise, in making interventions dissimilar.

One way to judge the similarity of interventions is based on their proposed mechanism of action. This concept is discussed in Verbeek 2012. The "Exercise Intervention Model" is useful, clinically applicable, and inclusive depicting both physical and body-mind benefits, although as a classification system it still needs to be validated. By applying the proposed exercise classification system, there may be improved understanding of mechanisms that lead to any benefits demonstrated within the literature. Previously published systematic reviews evaluating neck pain have not utilized a standardized classification system to categorize exercise treatment interventions. A classification system that describes the physiological effect of exercise on the body rather than describing the types of activity used to produce the physiological effect was implemented in this review. This classification system allows placement of similar exercise interventions from different trials into more homogeneous subgroups enabling meta-analyses.

In general, there is also limited evidence on optimal dosage requirements (Bronfort 2001; Jull 2002) for exercise therapies, and other modalities used to treat neck disorders. To address questions regarding the dose of therapies used to treat the neck, researchers (Gross 2007) have recommended using factorial designs and studying only single interventions (Carroll 2008b; Helewa 2007). Subsequently, dosage comparisons of similar types of exercises (or exercises that address the same element) can be made; these comparisons can be used to evaluate the impact of dosage variation of the exercise element on the magnitude of treatment outcomes. Specific dosage information is clinically relevant and specific therapeutic recommendations can be drawn from such clinical trials.

Forty-eight per cent (10/21) of the trials in this review did not report on adverse events and none evaluated the cost of care. More consistent reporting over many trials is required to understand the type and severity of potential negative effects from exercise therapy. To better understand the direct and indirect costs of the different treatments and make decisions regarding the most effective and efficient type of care, attempts to evaluate and report cost-related outcomes is required.

Quality of the evidence

One of the major methodological difficulties inherent to studies evaluating exercise interventions, is blinding of therapists and patients. None of the trials in this review blinded the care provider, as this is not possible in an exercise trial. Patient blinding can minimize expectation bias by ensuring the treatments are equally credible and acceptable to patients; patients have limited experience or expectations for either the index treatment or control condition. However, the nature of exercise interventions makes it difficult to blind the patient and care provider. Therefore, it is very important to control for measurement bias by blinding the outcome assessor and the data analyst. A caveat to this is that the use of self-report outcome measures de facto makes the patient the outcome assessor and blinding cannot be achieved easily. Two of the 21 trials did blind the outcome assessor and therefore, blinding can be obtained for certain outcomes.

Other issues that are important in studies evaluating exercise therapy is that of compliance, co-intervention and contamination as the intervention requires patient motivation and therefore strategies to support behavior changes (Zimmerman 2000). Eleven of the 21 studies had acceptable compliance, and eight of 21 monitored co-interventions. This provides greater confidence that the outcome is due to the exercise intervention and that the dosage is consistent between individual participants and treatment groups. Adequate randomization is a crucial component for a randomized controlled trial. However, adequate sequence generation was evident in only 57% (12/21) of the trials included in this review. Greater care should be taken to ensure the method of randomization is adequate and clearly reported.

Ninety-three per cent (20/21) of the clinical trials contained small sample sizes (< 70 per arm). The results of some of these trials are suggestive of benefit, but the magnitude of change is not statistically significant. However, in these studies the changes in outcomes are very close in magnitude to what are clinically important differences. Thus further investigation is warranted.

Potential biases in the review process

The validity of any systematic review is dependent on the selection of all relevant studies. Although studies published in any language were accepted, many scientific journals in non-English languages are not indexed in MEDLINE and EMBASE. We did not search non-English databases, which may introduce 'language bias' in the review. Studies without a control or comparative group were excluded so that exercise treatment effectiveness and efficacy could be properly ascertained (Carroll 2008b). This review contains only published studies therefore 'publication bias' was not guarded against.

Agreements and disagreements with other studies or reviews

This review has provided more detailed information with respect to the degree of evidence and the types of exercise that have an impact on neck pain.

There were no trials that added to the evidence with respect to **acute whiplash associated disorders (WAD).**

For **chronic neck pain**, Leaver 2010 showed evidence (one trial) supporting **range of motion (ROM) exercises** for pain relief immediately post treatment but no change in the intermediate and long term for pain and no evidence in improving function. Our review found low quality evidence (one control trial and one sham trial) of no difference to pain or function with ROM exercises post treatment to long-term follow-up. The discordance stems from the inclusion criteria for comparisons as this review included control trials.

For **chronic neck pain,** Ylinen 2007 found moderate evidence supporting the effectiveness of both long-term dynamic as well as isometric resistance exercises of the neck and shoulder musculature. Ylinen found no evidence supporting the long-term effectiveness of postural and proprioceptive exercises or other very low intensity exercises. Three reviews including stretching, strengthening, endurance training, balance/coordination, cardio and cognitive/affective elements (Lee 2009; Salt 2011; Teasell 2010c) showed no evidence of benefit in the short term, but (Teasell 2010c) found exercise effective on pain in the short term for chronic WAD. Our review appears discordant with these reviews. The over arching feature being the subclassification and restriction to use of control trials. Our first step is to establish a firm foundation of the effect of exercise in clinical control trials and not include head-to-head comparison trials. We believe once this is sorted the next step is to review comparison trials to establish superiority. **Cervical and scapulothoracic stretching and strengthening exercises** (Helewa 2007; Rendant 2011; von Trott 2009, and Bronfort 2001; Chiu 2005; Franca 2008; Martel 2011 when meta-analyzed) **and endurance training** (Andersen 2011) showed evidence of benefit on pain and function up to long term. The subclassification of exercise that included whole body exercises and cardio training was not beneficial for reducing pain, improving function, global perceived effect and quality of life. Albeit other outcomes were not explored. Previous reviews showed no evidence of benefit in chronic neck pain with **Qigong exercises** (Lee 2009), but because of an additional trial and meta-analysis our review elevated this to moderate evidence of small benefit for pain reduction, function and quality of life post treatment and at short-term follow-up.

Trials that explored neuromuscular exercises (Conlin 2005; Gross 2007; Leaver 2010; Teasell 2010b; Verhagen 2007) showed evidence of benefit for exercise in **subacute/chronic neck pain with or without WAD** in the short term for pain and function. This review found very low quality evidence (Revel 1994) for a moderate reduction in pain and improved function in the short term for eye-neck coordination exercises. Again discordance in number of trials stems from our evaluation of only clinical controlled trials. Salt 2011 found a multimodal exercise approach favoured exercise post treatment and in the short term for function but not for pain in **acute radiculopathy**, and concluded that there was no evidence to support general physiotherapy. Looking at the same data we found low quality evidence (Kuijper 2009) demonstrating immediate benefit in the level of pain but not in function and patient satisfaction. At intermediate-term follow-up, there was no difference in pain and functional improvement. The challenge in acute radiculopathy is determining the utility of exercise that provide immediate relief but not longer-term benefit.

Our review is in agreement with the reports by Bronfort 2009, Hurwitz 2008, Macauley 2007 suggesting evidence of benefit for exercise in **subacute/chronic cervicogenic headache**.

AUTHORS' CONCLUSIONS

Implications for practice

Neck stretching and strengthening exercises were of benefit in patients with chronic neck pain and neck endurance training was of benefit for patients with acute cervicogenic headache, for reducing pain, improving function in the short term and long term. Neck proprioceptive training was of benefit for headache in the short term. There was no evidence for upper extremity strength, endurance and extensibility exercises for neck pain.

The relative benefit of different exercise approaches and the relative benefit of exercise therapy when compared with other treatments is not reported in this review. It was not possible to determine which technique or dosage was more beneficial or if certain subgroups benefit more from one form of care than another.

Implications for research

Additional single intervention studies in all categories of exercise therapies and with adequate sample sizes are needed to confirm the findings of this systematic review. Patient satisfaction measured concurrently with functional progress and pain is a key consideration, particularly in subacute and chronic populations. Additionally, future studies should pay close attention to evaluating the dosage of the applied exercise therapies as an important determinant of treatment effect. Factorial study designs are ideal to evaluate dose and the active treatment within the treatment mix.

ACKNOWLEDGEMENTS

We thank the Cervical Overview Group, Rob McCall, and Bruce Craven for their contribution to this document. Mr. Craven was

instrumental in directing us to the exercise classification framework that was used as our foundation within this review.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

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

Allan 2003

Methods	Type of Trial: RCT Number Analysed/Randomized: 16/16 Intension-to-treat Analysis: N/A Power Analysis: NR
Participants	Chronic MND (Myofascial Pain Syndrome) Radicular signs/symptoms: Absent Setting: Outpatient university teaching clinic Country: UK
Interventions	INDEX TREATMENT Stretch before: Static passive stretches in lateral flexion and rotation on both sides of neck, held for 15 sec, administered by chiropractor with patient in supine position, immediately followed by cervical manipulation given in accordance with the motion palpation findings. Maipulation was administered with patient in supine position and the chiropractor making an index-finger contact on the affected cervical segment(s); 8 sessions over 4 weeks Stretch after: Cervical manipulation given in accordance with the motion palpation findings. Maipulation was administered with patient in supine position and the chiropractor making an index-finger contact on the affected cervical segment(s) immediately followed by static passive stretches in lateral flexion and rotation on both sides of neck, held for 15 sec, administered by chiropractor with patient in seated position; 8 sessions over 4 weeks COMPARISON TREATMENT Manipulation: Cervical manipulation given in accordance with the motion palpation findings. Maipulation was administered with patient in supine position and the chiropractor making an index-finger contact on the affected cervical segment(s); 8 sessions over 4 weeks Treatment Schedule: 4 weeks, 20 sessions Duration of Follow-up: none CO-INTERVENTION: avoided in trial design
Outcomes	PAIN [Numeric Rating Scale (NRS-101)] Baseline Mean: Manip 30, Stretch before 58, Stretch After 63 Reported Results: no significant difference between groups FUNCTION [Neck Disability Index (NDI 0 to 50)] Baseline Mean: Manip 5, Stretch before 16, Stretch After 11 Reported Results: no significant difference between groups REASON FOR DROP-OUTS: N/A SIDE EFFECTS: none COST OF CARE: NR
Notes	

Allan 2003 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	No description
Allocation concealment (selection bias)	Unclear risk	No description given
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	See abstract
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	No drop-outs
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	ROM different between groups
Co-interventions avoided or similar?	Unclear risk	No mention
Compliance acceptable?	Low risk	See abstract
Timing outcome assessments similar?	Low risk	Table 1 and 2

Andersen 2008

Methods	Type of Trial: RCT Number Analysed/Randomized: 42/48 Intension-to-treat Analysis: NR Power Analysis: NR
Participants	(sub) Acute/Chronic MND (Trapezius Myalgia) Radicular signs/symptoms: Absent Setting: Seven workplaces

	Country: Denmark
Interventions	INDEX TREATMENT Specific Strength Training (SST): High intensity specific strength training locally for neck and shoulder muscles. 5 dumbbell exercises (arm row, shoulder abduction, shoulder elevation, reverse flies, and upright row) Training program progressively increased using the principles of periodization and progressive overload from 12 repetitions max (RM;~70% of maximal intensity) at beginning to 8 RM (~80% of maximal intensity) later. Performed using consecutive concentric and eccentric muscle contractions (raising and lowering pair of dumbbells) in a controlled manner without pause, each set lasting 25-35 seconds. 30 of 5 different exercises with 3 sets per exercise were performed during each training session in an alternating manner (shoulder elevation was performed during each session). Doubled training load by end of 10 weeks. 20 minutes, 3x/week for 10 weeks of intervention for an average of 26 ± 3. 6 sessions General Fitness Training (GFT): High-intensity general fitness training upright position without holding onto the handlebars with legs only on a Monark bicycle ergometer (relaxing shoulders during training). Relative workloads of 50% (initial training level) to 70% (increased during following weeks and maintained) of maximal oxygen uptake ($V0_{2max}$). Heart rate monitor (Polar Sport Tester, Polar, Kempele, Finland) used to adjust workload to meet the intended relative level. Doubled training load by end of 10 weeks. 20 minutes 3x/week for 10 weeks of intervention for an average of 25 ± 4.8 sessions COMPARISON TREATMENT REF: Health Counseling group: Lectures with information on activities promoting general health and individual: workplace ergonomics, diet, health, relaxation, and stress management. 1 hour per week for 10 weeks for an average of average 27±2.8 sessions Treatment Schedule: 10 weeks, 20 sessions Duration of Follow-up: 10 weeks CO-INTERVENTION: Not avoided
Outcomes	PAIN intensity in trapezius muscle [VAS (100 mm)] Baseline Mean: SST 44, GFT 50, REF 43 Reported Results: no significant difference between groups SMD immediate post: -1.51 (95% CI: -2.46 to -0.57) SMD ST: -0.89 (95% CI: -1.76 to -0.01) REASON FOR DROP-OUTS: 6 in Reference group, reason not specified SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Not described
Allocation concealment (selection bias)	Unclear risk	No description of concealment

Andersen 2008 (*Continued*)

Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to intervention
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to intervention
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	High risk	p 90 Table 1 drop-outs in the references group
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Unclear risk	p 90 - 6 drop outs in the REF group - not analyzed
Selective reporting (reporting bias)	Unclear risk	No protocol
Similarity of baseline characteristics?	Unclear risk	Table 1 p 88
Co-interventions avoided or similar?	Unclear risk	Not reported
Compliance acceptable?	High risk	p 87
Timing outcome assessments similar?	Low risk	Unclear whether post test occurred at the same time

Andersen 2011

Methods	Type of Trial: RCT Number Analysed/Randomized: 192/198 Intension-to-treat Analysis: calculated Power Analysis: 95% power
Participants	(sub) Acute/Chronic MND (Myofascial Pain Syndrome) Radicular signs/symptoms: Not specified Setting: 2 large white collar organizations Country: Denmark
Interventions	INDEX TREATMENT 2 Minute Training (2-min): Progressive resistance training with theraband. Shoulder abduction- lateral raise. 2 minutes, 5x/week for 10 weeks of intervention for an average of 26 ± 3.6 sessions 12 Minute Training (12-min): 12 minutes 5x/week for 10 weeks of intervention for an average of 25±4.8 sessions

	COMPARISON TREATMENT Control Group:Weekly e-mailed information on various aspects of general health and internet links with additional relevant information Treatment Schedule: 10 weeks, 20 sessions Duration of Follow-up: 10 weeks CO-INTERVENTION: Not avoided
Outcomes	PAIN intensity Neck/Shoulder [Modified VAS (0 to 10)] Baseline Mean: 2 min 3.5, 12 min 3.9, Control 3.5 Reported Results: ANOVA showed a strong group-by-time effect for neck/shoulder pain intensity (p<0.0001). Compared with the control group, pain intensity decreased in both training groups. This change was not significantly different between the 2 training groups. SMD (2 min): -0.66 (95% CI: -1.02 to -0.30) SMD (12 min): -0.59 (95% CI: -0.94 to -0.23) REASON FOR DROP-OUTS: 3 in 2 min group, 1 in 12 min group, 2 in Control group, reasons reported SIDE EFFECTS: Reported worsening of neck muscle tension during and/or in the days after training (2-minute n = 1, 12-minute n = 4), shoulder joint pain during training (2-minute n = 1, 12-minute n = 4), pain in the upper arm during training (2-minute n = 1, 12-minute n = 1), pain of the forearm/wrist during training (12-minute n = 2), worsening of headache after training (2-minute n = 1, 12-minute n = 1). No long-lasting or major complications resulted from the training program. COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	pg 444 second column/ pg 442 first column
Allocation concealment (selection bias)	Low risk	Described pg 444
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to intervention
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to intervention
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible self assessment evaluation NPRS

Andersen 2011 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	p 443 second column
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	Figure 1 p 441 - not all participants randomized were analyzed
Selective reporting (reporting bias)	Unclear risk	No protocol
Similarity of baseline characteristics?	Low risk	
Co-interventions avoided or similar?	Low risk	Co-interventions similar p 443 section 2.5
Compliance acceptable?	Low risk	p 443 second column
Timing outcome assessments similar?	Low risk	p 443 top of 1st/p 441 under methods

Ang 2009

Methods	Type of Trial: RCT Number Analysed/Randomized: 56/68 Intension-to-treat Analysis: Calculated Power Analysis: Calculated
Participants	Chronic MND (Mechanical Neck Pain & Myofascial Pain Syndrome) Radicular signs/symptoms: Absent Setting: 2 air force helicopter bases Country: Sweden
Interventions	INDEX TREATMENT Exercise Group: Progression from nonpostural (low-load active craniocervical flexion at 5 pressure levels (22-30 mmHg) held isomerically for 10s, repeated 10x, focusing on surface neck flexors relaxed and isometric shoulder/scapula held against gravity for 10s, repeated 10x, at a retracted (max-and midmotion range) in prone to postural (seated, isometric held at 5 pressure levels like supine, holding 10s, repeated 10x, neck rotation to end range with simultaneous scapular retraction to midmotion range and active craniocervical flexion, repeated 10-15x on each side) to endurance-strength exercises (controlled dynamic shoulder retraction following a rowing exercise movement, dynamic scapular retraction with weight load over long movement arms in "rowing"exercises in regular pulls, emphasizing shoulder retraction in the initial concentric phase and upright trunk postures in the inner range, 3 sets of 15 repetitions (elastic bands were used to replicate the exercises at home). Dynamic neck rotation exercises in upright posture against moderate resistance using elastic bands. Initiated with short craniocervical flexion, short neck extension and then neck rotation, 15 rotations to each side, repeated 3x. Initial exercises replaced with new exercises (therefore the number of exercises did not increase through intervention). Progression, assigned individually, based on observed progress towards neck/should movement quality, not sets and repetitions. In the initial stages, in those reporting ongoing pain, the procedure described by Jull 2004 was followed.

	Assigned exercises (2-4) were to be completed 2x/day lasting 10-15 minutes, supervised weekly by a physiotherapist providing instruction and manual guidance COMPARISON TREATMENT Control: No exercise, encouraged to continue with ordinary exercise activity Treatment Schedule: 6 weeks, instructed to do 2-4 exercises 2x/day, for 10-15 minutes, supervised by physiotherapist weekly. Duration of Follow-up: 12 months CO-INTERVENTION: Not specified
Outcomes	PAIN Prevelance during previous week Baseline Mean (SD): Exercise13 (38), Control 11 (32) Reported Results: In the exercise group, the prevalence of cases for the previous week and the previous 3 months decreased from 38% to 15% and 76% to 44% respectively, whereas in controls it was unchanged. Between-grop regression analyses revealed that the members of the exercising group had a 3.2 times greater chance (odds ratio) than the control group of having been pain-free during the previous 7 days and a1.9 times great chance (odds ratio) of having been pain-free during the previous 3 months, P = 0.01 REASON FOR DROP-OUTS: 6 in Exercise Group, 6 in Control, reasons reported SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Randomization technique not adequately described
Allocation concealment (selection bias)	Unclear risk	Not adequately described
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Patient is assessor
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	Described in Figure 2
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	Figure 2; P 457Lp3

Ang 2009 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	No protocol
Similarity of baseline characteristics?	Low risk	See Table 1-3
Co-interventions avoided or similar?	Unclear risk	Not reported
Compliance acceptable?	Unclear risk	Unsure of long-term compliance in exercise group; unsure what compliance data refer to
Timing outcome assessments similar?	Low risk	Baseline, 6 weeks, 1 year

Bronfort 2001

Methods	Type of Trial: RCT Number Analysed/Randomized: 158 to 160/191 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Chronic MND Radicular signs/symptoms: Absent Setting: University Centre for Clinical Studies and the Physician's Neck and Back Clinic Country: USA, Canada
Interventions	INDEX TREATMENT Gr 1: MedX Exercise (MedX): High technology exercise, medically supervised rehabilitative exercise, 20 sessions over 3 months Gr 2: Manipulation and low tech Exercise (SMT/Ex): Chiropractic manipulation, supervised low technology rehabilitative exercise comprised progressive strengthening exercises for the neck and upper body proceeded by a short aerobic warm up of the upper body and light stretching; the upper body strengthening exercises included push ups and dumb bell shoulder exercises as described by Dyrssen et al 1989, 45 minutes total, 2 sets of 15 to 30 reps, weight 2 to 10 lbs; cervical progressive resisted strengthening exercises where performed while lying on a therapy table with wearing head gear with variable weights from 1.25 lb to 10 lbs guided by a simple pulley system attached to the table; 20 sessions over 3 months COMPARISON TREATMENT Gr 3: Spinal Manipulative (SMT): Chiropractic manipulation, 20 sessions over 3 months CO-INTERVENTION: NR Treatment Schedule: 11 weeks, 20 session Duration of Follow-up: 12 months CO-INTERVENTION:
Outcomes	CUMULATIVE ADVANTAGE for six patient-oriented outcomes Reported Results: favours SMT/Ex over SMT; MONOVA value yielded a significant group difference [Wilk's Lambda = 0.85, F(12,302) = 2.2, P < 0.01] PAIN (11-box scale, 0 to 10) Baseline Mean: SMT 56.6, MedX 57.1, SMT/Ex 56.0

	Reported Results: group difference in patient-rated pain ANOVA [F(2,156) = 4.2, P = 0.02] favours the two exercise groups SMD (SMT/Ex v SMT) at LT follow-up: -0.21 (95% CI: -0.60 to 0.18) [power 28%], NNTB 10; treatment advantage 15% FUNCTION (Neck Disability Index, 0 to 50) Reported Results: no significant group differences were found ANOVA: F[2, 156] = 2. 04, p = 0.13 SMD (SMT/Ex vs SMT) at LT follow-up: -0.38 (95% CI: -0.78 to 0.01) [power 28%], NNTB 11, treatment advantage 11% PATIENT SATISFACTION (1 to 7; completely satisfied to completely dissatisfied) Reported Results: A clinically worthwhile cumulative advantage was reported favouring manipulation/exercise [low tech] group over exercise [high tech] and manipulation alone ANOVA: F[2, 158] = 6.7, P = 0.002 SMD (SMT/Ex vs SMT) at LT follow-up:-0.73 (95% CI: -1.14 to -0.33) PATIENT RATED IMPROVEMENT (1 to 9) Reported Results: substantial improvement over time, ANOVA: F[2, 174] = 1.7, p = 0. 18 SMD (SMT/Ex vs SMT) at LT follow-up: -0.23 (95% CI: -0.62 to 0.16) [power 44%] REASONS FOR DROP-OUTS: Reported SIDE EFFECTS: increase neck or headache pain 8 SMT/Ex, 9 MedX, 6 SMT; increased radicular pain 1 SMT/Ex; severe thoracic pain 1 SMT; all cases self-limiting and no permanent injuries; RR(SMT/Ex vs MedX): 0.81 (95% CI: 0.23 to 1.55) RR(SMT vs MedX): 0.61 (95% CI: 0.23 to 1.55) COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sequentially numbered, opaque envelopes, prepared using a computer-generated list prior to start of study p2384
Allocation concealment (selection bias)	Low risk	Study staff, investigators, clinicians, and patients were masked to upcoming treatment assignments p2384
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to self-report measures

Bronfort 2001 (*Continued*)

Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design.
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	High risk	93% at 11 weeks, 76% overall, but not described.
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	Only 145 out of 178 participants were analyzed according to Table 2
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	Low risk	Comparable on measured clinical and demographic characteristics, see Table 1
Co-interventions avoided or similar?	Unclear risk	Not reported
Compliance acceptable?	Unclear risk	Not reported with respect to exercise
Timing outcome assessments similar?	Low risk	5, 11 weeks of treatment, 3, 6, 12, months

Chiu 2005

Methods	Type of Trial: RCT cross-over design Number Analysed/Randomized: 109/145 Intension-to-treat Analysis: Calculated Power Analysis: 90% power
Participants	Subacute MND (Cervical Brachial Pain Syndrome) Radicular signs/symptoms: Absent Setting: Physiotherapy Outpatient Department Country: Hong Kong
Interventions	INDEX TREATMENT: Gr 1: Craniocervical Flexion and isometric neck strengthening (CCF) a. deep neck flexor-using pressure sensor @20mmhg x10 min (10 sec. on/15 sec. off) b. Strengthening using a Multi Cervical Rehabilitation Unit (MCRU). 15 reps of flexion, extension at 20% of Peak Isometric Strength(PIS) as warm up. Then dynamic flexion and extension with variable resistance x 0-12 reps c. Infrared irradiation d. 35 minutes of exercise per session COMPARISON TREATMENT: Gr 2: TENS (TENS)

	a. 30 minutes of dual channel portable TENS unit (ITO model 1302). Continuous trains of 150ms square pulse at 80 Hz. 4 Electrodes (4x4cm) CONTROL TREATMENT: Gr 3: Infrared Irradiation (IR): Control Group a. Infrared Irradiation: place on Ex 21, GB21, LI 11, intensity 2 to 3 times of participants sensory threshold b. education on neck care c. 20 minutes per session Duration of Treatment: 6 weeks, 2 sessions/wk Duration of Follow-up: 6 months CO-INTERVENTION: NS
Outcomes	PAIN (VAS, 0 to 10) Baseline Median: CCF 4.61, TENS 4.69, IR 4.26 Reported Results: NS SMD (CCF vs IR): -0.34 (95% CI: -0.72 to 0.04); NNTB 6, treatment advantage 24% FUNCTION (Chinese version of Northwick Park Questionnaire, 0 to 4) Baseline Median: CCF 1.39, TENS 1.55, IR 1.36 Reported Results: CCF vs IR was significant (p=0.02) SMD (CCF v IR): -0.33 (95% CI: -0.71 to 0.05); NNTB 6, treatment advantage 16% REASON FOR DROP-OUTS: Reported SIDE EFFECTS: No complications occurred. COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer-generated minimization method
Allocation concealment (selection bias)	Low risk	Computer-based randomization
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	

Chiu 2005 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	
Selective reporting (reporting bias)	Low risk	
Similarity of baseline characteristics?	Low risk	See Table 1
Co-interventions avoided or similar?	Low risk	
Compliance acceptable?	Low risk	
Timing outcome assessments similar?	Low risk	See Table 2

Franca 2008

Methods	Type of Trial: RCT Number Analysed/Randomized: 46/49 Intension-to-treat Analysis: Not specified Power Analysis: not calculated
Participants	Chronic MND (Myofascial Pain Syndrome) Radicular signs/symptoms: Absent Setting: University Research and Rehabilitation Department Country: Brazil
Interventions	INDEX TREATMENT: Gr 1: (1) Physiotherapy protocol performed according to Hall and Brody consisting of muscle stretching of neck and upper limbs regions; recruitment exercise of Deep Cervical Flexion Muscles; strengthening exercise of Deep Cervical Flexion Muscles and upper limbs. Duration of treatment 20 mins, 1 to 2 times per week for 10 weeks (2) Acupuncture combined with Physiotherapy (G1): Stage 1: acupuncture therapy based on the TCM theory of biao-li (symptom/root) treatment. Chinese acupuncture, as the root treatment, was performed with a selection of body points by means of the diagnostic of syndromes of TCM. Disposable stainless steel needles (0.25 mm x 30 mm) with guide-tubes (Dong-bang Acupuncture Needle, Korea) inserted bilaterally into the body points to a depth of 10-15 mm. YNSA was carried out as the symptom treatment with a selection of the kinetic and ypsilon points as the main scalp points to treat TNS. The kinetic points were stimulated bilaterally with needle measuring 0.25 mm x 5 to 15 mm (Dongbang Acupuncture Needle, Korea) to a depth of 1-2 mm, whereas the selection of the ypsilon points were ipsilateral of the scalp to the diagnosed side of the neck. All acupoints (body and scalp points) were stimulated in an uneven manner every 10 min to maintain the needling sensation. Chinese acupuncture was performed in 20 min and YNSA was maintained until 40 min. Stage 2: Physiotherapy given simultaneously with YNSA COMPARISON TREATMENTS: Gr 2: Acupuncture (G2): Same protocol of acupuncture therapy as described in the first stage of G1 for 20 mins

	Gr 3: Physiotherapy (G3): Same protocol of physiotherapy as described in the second stage of G1 for 20 mins Treatment Schedule: 10 weeks, 20 sessions Duration of Follow-up: 6 months follow-up CO-INTERVENTION: avoided in trial
Outcomes	PAIN (VAS, 0 to 100 mm) Baseline Median: PT+Acup 85.0, Acup 80.0, PT 70.0 Reported Results: According to KWT (Kruskal-Wallis test), the statistical analysis of the inter-groups demonstrated significant ($p<0.05$) differences among the groups. The DMCT (Dunn's Multiple Comparison test) showed that G1 was superior to G3 in pain improvement ($P < 0.05$) SMD (PT+ Acup vs Acup) at immediate post treatment: -0.73 (95% CI: -1.46 to -0.00], NNTB not calculated due to data type, treatment advantage 11% FUNCTION (Neck Disability Index - Brazilian//Portuguese version) Baseline Median: PT+Acup 24.0, Acup 30.0, PT 28.0 Reported Results: The DMCT (Dunn's Multiple Comparison test) showed that G1 was superior to G3 in reducing functional disability ($P < 0.0001$) SMD (PT + Acup vs Acup) at IT follow-up: -0.95 (95% CI: -1.70 to -0.20), NNTB13, treatment advantage 13% REASONS FOR DROP-OUTS: Reported (3 drop-outs, 1 in each group) SIDE EFFECTS: Reported; no record of serious complication of acupuncture or physiotherapy occurred during treatments or during the follow-up period after any of the treatments that could harm the patients during the assessment all stages of the trial COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	
Allocation concealment (selection bias)	Low risk	
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design

Franca 2008 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	1 per group
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	No ITT performed
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	VAS scores were significantly different between groups
Co-interventions avoided or similar?	Unclear risk	Not clear
Compliance acceptable?	Unclear risk	Not clear
Timing outcome assessments similar?	Low risk	10 weeks and 6 months

Goldie 1970

Methods	Type of Trial: Q-RCT Number Analysed/Randomized: 73/73 Intention-to-treat: Not applicable Power Analysis: NR
Participants	Chronic MND with possible NDR (radiation down either of the upper extremities following a segmental pattern, paresthesiae was uncommon, paresis was absent) Setting: Physiotherapy Department Country: Scandinavia [Sweden]
Interventions	INDEX TREATMENT: Gr 1: Isometric Group (ISO): Isometric exercise against therapist manual pressure to a maximum of the patients' ability under the pain threshold in cervical movement directions, patient either in sitting or supine position, rest for 10 minutes post treatment in lying position, 3 times per week for 10 sessions just over 3 weeks; analgesic; muscle relaxant; education (advice to rest) COMPARISON TREATMENTS: Gr 2: Traction Group (Txn): a. traction b. medication: Analgesic, muscle relaxant, c. education (advice to rest) Gr 3: No-treatment Group (NT): a. medication: Analgesic, muscle relaxant Treatment Schedule: 3 weeks, 10 sessions Duration Follow-up: 3 weeks (assessment), 24 week (letter) CO-INTERVENTION: avoided in trial

Goldie 1970 (*Continued*)

Outcomes	PATIENT GLOBAL PERCEIVED EFFECT (3-point scale) Baseline: NR Reported Results: A slight tendency favouring traction RR (exercise vs no treatment): 0.42 (95% CI: 0.21 to 0.83) REASONS FOR DROP-OUTS: N/A SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Patients were divided into 3 groups according to their date of birth
Allocation concealment (selection bias)	Low risk	
Blinding (performance bias and detection bias) All outcomes - patients?	Low risk	
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Provider implemented exercise program; not blind to program
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	High risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	Not all outcomes reported
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	
Co-interventions avoided or similar?	Low risk	All study participants were given a combined muscle relaxant and analgesic
Compliance acceptable?	Low risk	
Timing outcome assessments similar?	Low risk	3 weeks of treatment + 3 weeks follow-up

Hall 2007

Methods	Type of Trial: RCT Number Analysed/Randomized: 32/32 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	(sub)acute Cervicogenic headache (CGH) Radicular symptoms/signs: NS Setting: Physiotherapy Private Practice Country: USA, Canada
Interventions	INDEX TREATMENT: Gr 1: C1-2 self SNAG (SSng). Belt was used as per Mulligans detailed techniques. The participant was instructed by the PT on the proper positioning and technique of mobilization belt on 3 trials to familiarize themselves. The participant was instructed to perform technique without producing pain. (supplemental video available on line) Treatment schedule: 1 day Duration of Follow-up: 4 weeks and 12 months. CONTROL GROUP:(Mock) Gr 2: Sham mobilizations with same belt. This group did not receive instruction to rotate head towards restriction Treatment Schedule: 1 day Duration of Follow-up: 4 weeks and 12 months CO-INTERVENTION: Not avoided
Outcomes	PAIN (0 to 100) Baseline Mean: SSng 52 Mock 51 Reported Results: group difference in patient-rated pain favours the SSng exercise group SMD(SSng v Mock) at ST follow-up: -1.58 (95% CI: -2.38 to -0.77) [power 100%], NNTB 2, Treatment advantage 40% SMD(SSng v Mock) at LT follow-up: -1.74 (95% CI:-2.57 to -0.91) [power 100%], NNTB 3, treatment advantage 40% REASONS FOR DROP-OUTS: N/A SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Participans were allocated to treatment group using lottery ticket randomization chosen from a concealed container
Allocation concealment (selection bias)	High risk	
Blinding (performance bias and detection bias) All outcomes - patients?	Low risk	

Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	No drop-outs
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	Low risk	No significant differences were detected between the 2 groups in terms of age, headache history, FRT range, and headache severity index score. Gender distribution was similar. See Table 2
Co-interventions avoided or similar?	High risk	Not addressed
Compliance acceptable?	Low risk	Compliance investigated
Timing outcome assessments similar?	Low risk	4 weeks postintervention and 12 months postintervention

Helewa 2007

Methods	Type of Trial: RCT Number Analysed/Randomized: 128/151 Intention-to-treat Analysis: Calculated Power Analysis: Calculated: For factorial effects (not differences between treatment groups) and based on a change on the Northwick Park Questionnaire
Participants	Chronic MND Radicular signs/symptoms: NS Setting: University School of Physical Therapy Country: Canada
Interventions	INDEX TREATMENT Gr 1: Exercise: Standard Pillow + Exercise + Active Control Treatment Group: *Standard (regular) pillow* is assumed to be used by this group. Exercise including: Posture (Postural correction in sitting, standing or during work and leisure activities emphasizing chin in retracted position with cervical spine elongations not beyond normal curves of cervical

	spine practised with mirror feedback first, then freely using other prompts to become habitual), Relaxation Exercise Techniques designed to interrupt cycle of pain and muscle spasm (hold-relax approach repeated up to 5 times and/or rhythmic stabilization applied manually by the PT and taught to the patient), Free Active Exercise (following relaxation techniques patients freely move head and neck according to normal patterns of movement, may initially be helped by the physiotherapists, patterns are diagonal and involve head flexion and rotation to the right followed by head extension and rotation to the left, diagonal patterns are then repeated to the contralateral sides), and Strengthening Exercises (to strengthen the anterior neck muscles using manual resistance (within the limit of pain) with a combination of isometric and isotonic movements, the principle involving reversing movements of flexion and extension, using the principles of successive induction (Sherrington 1961)). 13 sessions over 10 weeks, as well as home exercises and Active Control treatment (massage and thermal modality) were administered to this group isometric rehabilitative exercise Gr 2: Neck Support (Pillow): Orthopaedic Pillow(s) + Active Control Treatment Group: Neck Support Pillows could be one of two designs: Shape of Sleep pillow (Manutex Products, Mississauga, ON, Canada) or the Sissel Design AB pillow (Sissel Design AB, Svedala, Sweden). The two types of pillows were randomly assigned equally in each arm. The pillows did not differ in shape but in the firmness of the foam. The pillow use was combined with the Active Control treatment (massage and thermal modality) COMPARISON TREATMENT Gr 3: Neck Support and Exercise (Exercise + Pillow): Orthopaedic Pillow(s) + Exercise + Active Control Treatment: Orthopaedic pillows were used and were of two types: Shape of Sleep pillow (Manutex Products, Mississauga, ON, Canada) or the SIssel Design AB pillow (Sissel Design AB, Svedala, Sweden). The two types of pillows were randomly assigned equally in each arm. The pillows did not differ in shape but in the firmness of the foam. Pillow use, plus Exercise plus Active control treatment (massage and thermal modality) were administered in this group CONTROL TREATMENT Gr 4: Massage Therapy and thermal modality (Control): Standard (regular) Pillow + Active Control Group: The *Standard (regular) pillow* is assumed to be used by this group. Active Control treatment that included massage and thermal modality: Efflurage type massage for 10 sessions in 10 weeks. Visits were 2 sessions/wk for 3 weeks, then 1 visit per week for 3 weeks, then 1 visit in 10th week. Thermal modality : 20 minutes of moist heat or ice. Treatment Schedule: 6 weeks (assume that the use of the pillow was constrained to these 6 weeks) Duration of Follow-up: 6 weeks CO-INTERVENTION: avoided in trial design
Outcomes	PAIN (VAS, 0 to 10) Baseline Mean: Exercise 2.9, Pillow 3.6, Exercise + Pillow 2.3, Control 2.5 Reported Results: Not significant at all points SMD (Exercise v Control): SMD -0.00 (95% CI: -0.52 to 0.52) SMD (Exercise + Pillow v Pillow): SMD -0.59 (95% CI: -1.09 to -0.09) [power 50. 69%] FUNCTION [Northwick Park Neck Pain Questionnaire (NPQ, 0 to 100)] Baseline: Exercise 32.3, Pillow 35.01, Exercise + Pillow 29.9, Control 27.4 Reported Results: Interaction of pillow and exercises are statistically significant and

	clinically important SMD (Exercise v Control): 0.00 (-0.52 to 0.52) [power 100%] SMD (Exercise + Pillow v Pillow): -0.61 (-1.11 to -0.12) [power 100%] QUALITY OF LIFE (SF 36, 0 to 100) Baseline Mean: Exercise 42.8, Pillow 41.1, Exercise + Pillow 43.7, Control 43.8 Reported Results: no significant difference between groups SMD (Exercise v Control): 0.15 (95% CI: -0.34 to 0.65) [power 100%] SMD (Exercise + Pillow v Pillow): -0.46 (95% CI: -0.95, to 0.04) [power 100%] REASON FOR DROP-OUTS: drop-outs noted SIDE EFFECTS: None present COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	2x2 balanced factorial design, balanced treatment-group allocation was done using randomly selected randomly ordered blocks
Allocation concealment (selection bias)	Low risk	
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	Low risk	See Table 1
Co-interventions avoided or similar?	Low risk	Reminder to participants at 12 weeks

Helewa 2007 (*Continued*)

Compliance acceptable?	Low risk	
Timing outcome assessments similar?	Low risk	Post treatment, 6 w treatment + 6 w follow-up, 6w treatment + 18w follow-up, 6w treatment + 46w follow-up

Jull 2002

Methods	Type of Trial: RCT Number Analysed/Randomized: 193/200 Intention-to-treat Analysis: calculated Power Analysis: NR
Participants	Chronic CGH Radicular signs/symptoms: NR Setting: Multiple trial centres Country: Australia
Interventions	INDEX TREATMENT Gr 1: Exercise Therapy (CCF/ISO): therapeutic low load exercise to cervical-scapular region: craniocervical flexor training with pressure biofeedback, scapular muscle training, postural correction, exercise performed throughout the day, isometric strengthening with co contraction of neck flexion and extension, stretching as needed, 30 minute session duration, two sessions/weeks, 8 to 12 sessions total Gr 2: Combined Therapy (MT/ET): a. manipulation, mobilization b. exercise c. 30 minute session duration, two sessions/weeks, 8 to 12 sessions total COMPARISON TREATMENT Gr 3: Manipulative Therapy (SMT): manipulation: high velocity, low-amplitude manipulation described by Maitland; mobilization (low velocity), 30 minute session duration, 2 sessions/week, 8 to 12 sessions total Gr 4: Control Group (NT): no treatment Treatment Schedule: 6 weeks, 8 to 12 sessions Duration of Follow-up: 52 weeks CO-INTERVENTION: NR
Outcomes	PAIN [Headache intensity change score (VAS, 0 to 10)] Baseline Mean: SMT 4.8, CCF 5.4, MT/ET 5.1, NT 5.3 Reported Results: significant favouring SMT and CCF SMD (CCF v NT) at LT follow-up:-0.59 (95% CI:-1.00 to -0.18), NNTB 6, treatment advantage 28% FUNCTION [Northwick Park neck pain questionnaire change score (NPQ, 0 to 36)] Baseline Mean: SMT 27.5, CCF 29.6, MT/ET 29.7, NT 30.7 Reported Results: significant favouring MT or MT/ET over control; no significant difference between MT, ET and MT/ET comparisons SMD (CCF v NT) at LT follow-up:-0.59 (95% CI:-1.00 to -0.18), NNTB 6, treatment advantage 32%

	GLOBAL PERCEIVED EFFECT [participant perceived effect (VAS, 0 to 100)] Reported Results: significant favouring SMT and MT/ET over NT, not significant for SMT or MT/ET when compared to CCF. SMD (CCF v NT):-2.51 (95% CI:-3.05 to -1.97) REASONS FOR DROP-OUTS: reported SIDE EFFECT: minor and temporary, 6.7% of headaches were provoked by treatment COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	2x2 factorial design, randomized permuted block design was used with stratification for length of headache history and city of residence
Allocation concealment (selection bias)	Low risk	An independent body implemented randomization by telephone contact with each trial centre
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	ITT analysis performed
Selective reporting (reporting bias)	Unclear risk	No protocol provided
Similarity of baseline characteristics?	Low risk	Baseline characteristics across the four treatment groups were similar (See Table 1) . The only exception was the distribution of females across treatment groups, subsequently included as a covariate in the analysis

Jull 2002 (*Continued*)

Co-interventions avoided or similar?	High risk	Present
Compliance acceptable?	Low risk	Reported
Timing outcome assessments similar?	Low risk	6w treatment + 1w, 3 months, 6 months and 12 months follow-up

Kjellman 2002

Methods	Type of Trial: RCT Number Analysed/Randomized: 70 to 77/77 Intention-to-treat Analysis: Calculated Power Analysis: NR
Participants	(sub)Acute to Chronic MND with or without radiation Radicular signs/symptoms: Present Setting: Primary care physical therapy and private physical therapy practices Country: Sweden
Interventions	INDEX TREATMENT Gr 1: General Exercise (ET): included neck and shoulder ROM, active neck endurance and strength exercises, 16 sessions over 2 months Gr 2: McKenzie Exercise (McK): Specific McKenzie protocol. Sessions over 2 months. Number not specified CONTROL TREATMENT Gr 3: Sham Ultrasound (SUS): Set at lowest setting for 7 minutes. Applied over the superior portion of the trapezius. 4 weeks of treatment Duration of Follow-up: 6 and 12 months CO-INTERVENTION: Comparable between index and control groups
Outcomes	PAIN (VAS, 0 to 100) Baseline Mean: ET 27.0, McK 19, SUS 21 Reported Results: no significant difference between groups SMD (ET v SUS) at LT follow-up: -0.19 (95% CI: -0.41 to 0.80) SMD (McK vs SUS) at LT follow-up: 0.04 (95% CI: -0.51 to 0.60) FUNCTION [Neck Disability Index (NDI, 0 to 50)] Baseline Mean: ET 27.0, McK 19, US 21 Reported Results: no significant difference between groups SMD (ET vs SUS) at LT follow-up: -0.19 (95% CI: -0.41 to 0.80) SMD (McK vs SUS) at LT follow-up: 0.04 (95% CI: -0.51 to 0.60) REASONS FOR DROP-OUTS: reported SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Kjellman 2002 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomization by drawing sealed envelopes out of a box
Allocation concealment (selection bias)	High risk	Not reported
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	Drop-outs noted
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	Not reported
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	Reported Table 1; no analysis
Co-interventions avoided or similar?	High risk	Table 5, higher use by control group
Compliance acceptable?	Low risk	
Timing outcome assessments similar?	Low risk	Post treatment, 8w treatment + 6 months, 8w treatment + 52w follow-up

Kuijper 2009

Methods	Type of Trial: RCT Number Analysed/Randomized: 200/205 at 6 weeks, 192/205 at 6-month follow-up Intension-to-treat Analysis: Calculated; sample size based on 90% power and to detect a 10mm difference in the VAS (primary outcome) for arm pain (not neck pain). Power Analysis: calculated
Participants	Acute MNDR Radicular signs/symptoms: Present Setting: Three Hospitals

	Country: Netherlands
Interventions	INDEX TREATMENT Physiotherapy Group (PG): Therapy was focused on mobilizing and stabilizing the neck and was characterized as "hands off". The sessions were standardized provided by a certified Physiotherapist, the patient was instructed on graded exercise activities to strengthen the superficial and deep muscle of the neck. The patients were also instructed in a home exercise program. Patients were advised to practice the exercises daily and asked to record the duration of their exercise daily. Treatment Schedule: 2 times per week for 6 weeks COMPARISON TREATMENT Wait and see list Group (WLG): Patients in the control group were advised to continue their daily activities as much as possible. As well they were asked to note in their diaries the parts of the day where they were unable to continue their normal activities. Treatment Schedule: Patients were asked to contact the investigators if they had any questions Collar Group (CG): Semi-hard collar (Cerviflex S, Bauerfeind and available in 6 sizes); The best size (to fit snugly) was selected for each patient. Treatment Schedule: Patients advised to wear the pillow during the day for 3 weeks. Over the next 3 weeks patients were weaned off the collar. After 6 weeks they were asked to no longer wear the collar Treatment Schedule: 6 weeks, 12 sessions Duration of Follow-up: 6 months CO-INTERVENTION: Comparable between index and control groups. Patients were asked to take paracetamol (usually) either with or without a non-steriodal antiinflammatory. If necessary opioids were prescribed
Outcomes	PAIN (VAS 0, to100mm) Baseline Mean: Cervical Collar 57.4, Physiotherapy 61.7, WLG 55.6 Reported Results: At 6 weeks there was a significant decrease in neck pain in the collar group 2.8 mm/week (17 mm in 6 weeks) and 2.4 mm/week in the physiotherapy group (14 mm in 6 weeks), while the control group showed only 0.9 mm reduction in pain over the 6 weeks. After 6 months the pain scores in the two treatment groups did not differ from those of the control patients. SMD (PT vs WLG) at Immediate post treatment: -0.47 (95% CI: -0.81 to -0.12); NNTB 4, treatment advantage 33% FUNCTION (Neck Disability Index, 100 pt higher score = worse) Baseline Mean: Cervical Collar 41.0, Physiotherapy 45.1, WLG 39.8 Reported Results: The collar group showed a significant difference in rate of improvement compared with the control group, the weekly change in the physiotherapy group was not significantly different from that of the control patients. SMD (PT vs WLC) at immediate post treatment: -0.11 (95% CI: -0.45 to 0.23) PATIENT SATISFACTION: Reported Results: NS RR (PT vs WLC) at immediate post treatment: 0.92 (95% CI: 0.62 to 1.37) REASONS FOR DROP-OUTS: NR SIDE EFFECT: NR COST OF CARE: NR

Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	
Allocation concealment (selection bias)	Low risk	Sealed envelopes prepared by an employee who had no other involvement with the study. The investigator assigned patients to specific groups
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Stated within text page 2
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Stated within text page 2
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Patient self-report so not blinded
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	High risk	There were 5 participants who were not available for follow-up at 6 weeks;similarly there were 13 participants lost to follow-up at 6 months. Figure one details this
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	Not all those randomized were included in the analysis (those without follow-up data were excluded). However this was a very small number and unlikely to affect the estimates. They undertook a LOCF analysis but did not state an ITT analysis within the report
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	Greater arm pain in the collar group. Also the control group had the smallest evidence for root compression based on MRI
Co-interventions avoided or similar?	Unclear risk	All groups were allowed to take analgesics and anitinflammatories.All patients received the same information about the

Kuijper 2009 (*Continued*)

		natural course of the disease
Compliance acceptable?	Low risk	Compliance was monitored for both collar use and physiotherapy. A total of 6 patients (almost 10%) did not wear the collar at all during the first 3 weeks
Timing outcome assessments similar?	Low risk	6w of treatment + 6 months and 12 months follow-up

Lundblad 1999

Methods	Type of Trial: RCT Number Analysed/Randomized: 58/97 Intention-to-treat Analysis: NR Power Analysis: NR
Participants	Chronic MND Radicular signs/symptoms: NS Setting: Factory Country: Sweden
Interventions	INDEX TREATMENT Gr 1: Feldenkrais Intervention (F) a. Education: Individualised (functional integration) teacher guides through movement sequences; Group (awareness through movement) verbally guided through exercises for neck-shoulder complaints b. home exercises c. 50 minutes per week; individually 4 times and in group (7 to 8 participants) 12 times; required 50% participation in both segments of program Gr 2: Physiotherapy Intervention (MmPT) a. Stabilisation exercises for low back and pelvis, isolated and relaxed shoulder movements b. Education: use of body emphasizing self-directed control and responsibility for body, ability to cope with pain, muscle tension, and complaints c. Awareness of body posture d. Practice work-related lift and movement techniques e. Exercise program of strength, coordination, endurance, flexibility/smoothness and rhythm f. Home exercises g. 50 minutes; 2 times/week for 16 weeks in group of 5 to 8 participants; Required 50% participation in the exercises COMPARISON GROUP Control Regimen (NT): no treatment Treatment Schedule: 16 weeks, 32 sessions Duration of Follow-up: 52 weeks CO-INTERVENTION: NR

Outcomes	PAIN (VAS, 0 to 10) Baseline Mean: VAS - usually MmPT 1.2, F 1.5, NT 2.0 VAS - worst MmPT 4.1, F 4.4, NT 5.5 Reported Results: no significant differences SMD (PT vs no Treatment): -0.14 (95% CI: -0.80 to 0.51) DISABILITY (work and leisure, 4 point scale) Baseline Mean: Disability - work MmPT 1.3, F 1.2, NT 1.3 Disability - leisure MmPT 0.6, F 0.9, NT 0.6 Sick leave (days) MmPT 12.7, F 12.0, NT 11.5 Sick leave (%) MmPT 6.5, F 5.8, NT 5.9 REPORTED RESULTS: no significant differences REASON FOR DROP-OUTS: Reported SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Randomization not described
Allocation concealment (selection bias)	High risk	Concealment not described
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	High risk	Not reported
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	No ITT analysis
Selective reporting (reporting bias)	Unclear risk	No protocol available

Lundblad 1999 (*Continued*)

Similarity of baseline characteristics?	Low risk	Table 3 no significant difference
Co-interventions avoided or similar?	Low risk	Avoided in trial design
Compliance acceptable?	Low risk	
Timing outcome assessments similar?	Low risk	16w of treatment + 6w follow-up

Martel 2011

Methods	Type of Trial: RCT Number Analysed/Randomized: 64/69 Intention-to-treat Analysis: Calculated Power Analysis: NR
Participants	Chronic MND Radicular signs/symptoms: Present Setting: Chiropractic Clinic and Human Research Laboratory of the Department of Chiropractice at the Universite du Quebec Country: Canada
Interventions	INDEX TREATMENT SMT Group: Spinal Manipulation Maximum 4 spinal manipulations to the cervical and upper thoracic areas. One treatment per month, lasted 10 to 15 minutes SMT + Exercise Group: Spinal Manipulation + Home Exercise Program Maximum 4 spinal manipulations to the cervical and upper thoracic areas (down to T4) . One treatment per month, lasted 10-15 minutes Advised to perform a home exercise program 3x/week including: range of motion exercises, followed by 4 stretching/mobilization, and 4 strengthening exercises (concentric and isometric contractions) of the cervical and upper thoracic spine (primarily flexion, extension, lateral flexion and rotation of the cervical spine). Three series of each exercises with a 30-60 second rest between series were performed during each training session. A training session lasted 20 to 30 minutes All participants were instructed in the same routine, exercise volume was tailored to each participant's strength, flexibility and ability to complete the routine with minimal neck pain. Each patient received a written copy of the program. Exercise checked every 2 months by a kinesiologist COMPARISON GROUP Control Group: Attention-control No treatment, attended clinic once every 2 months, visited lasted 20-30 minutes for data collection Treatment Schedule: 10 months, 10 sessions Duration of Follow-up: none CO-INTERVENTION: NR

Outcomes	PAIN (VAS, 0 to 10) Baseline Mean (SD): SMT 3.1 (2.1), SMT + Ex 3.8 (2.6) Reported Results: no significant differences FUNCTION Cervical Range of Motion (F/E/Rot/SF) Reported Results: no significant differences DISABILITY [Neck Disability Index (NDI, 0-50)] Baseline Mean (SD): SMT 21.4 (8.8), SMT + Ex 22.2 (9.0) Reported Results: no significant differences HEALTH-RELATED QUALITY OF LIFE (SF-12 Questionnaire, 0-100) Baseline Mean (SD) Physical Scale: SMT 48.7 (5.6), SMT + Ex 50.0 (7.2) Baseline Mean (SD) Mental Scale: SMT 45.3 (9.9), SMT + Ex 44.8 (9.0) Reported Results: no significant differences REASON FOR DROP-OUTS: Reported SIDE EFFECTS: Reported: No serious adverse events were reported during RCT COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	
Allocation concealment (selection bias)	Low risk	Sealed, opaque envelopes
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	No ITT analysis
Selective reporting (reporting bias)	Unclear risk	No protocol available

Martel 2011 (*Continued*)

Similarity of baseline characteristics?	Low risk	Table 1
Co-interventions avoided or similar?	High risk	
Compliance acceptable?	High risk	Not Reported
Timing outcome assessments similar?	Low risk	10 months of treatment

Rendant 2011

Methods	Type of Trial: RCT Number Analysed/Randomized: 113/122 Intention-to-treat Analysis: calculated Power Analysis: calculated
Participants	Chronic MND Radicular signs/symptoms: NS Setting: Community Country: Germany
Interventions	INDEX TREATMENT: Qigong: 12 neck exercises including ROM/mobility, imagery: 9 shoulder exercises, breathing and moving exercise (Figure 1); 18 sessions 90 minute sessions over 6 months; home exercise with a manual; Qigong qualified teacher was certified by German Qigong Society Exercise (E): Warm-up included neck ROM, use of soft ball, strengthening using a theraband; flexibility exercise, home exercise with a manual, individual pain level was not exceeded; 18 sessions over 6 months; exercise is monitored by a qualified physiotherapist COMPARISON TREATMENTS: Control (NT): no intervention Treatment Schedule: 6 months, 18 sessions Duration Follow-up: 3 month, 6 month CO-INTERVENTION: not avoided
Outcomes	PAIN (VAS 0 to 100) Baseline Mean: Qigong 57.7, E 57.5, NT 53.4 Reported Results: significant differences qigong vs no treatment; no difference qigong vs exercise SMD (Exercise vs NT) at 6 month -0.48 (95% CI: -0.94 to -0.02) SMD (Qigong vs NT) at 6 month -0.51 (95% CI: -0.96 to -0.06) FUNCTION (NPDI 0 to 100) Baseline Mean: Qigong 44.0, E 39.5, NT 43.2 Reported Results: significant differences qigong vs no treatment; no difference qigong vs exercise SMD (Exercise vs NT) at 6 month -0.50 (95% CI: -0.97 to -0.04) SMD (Qigong vs NT) at 6 month -0.47 (95% CI: -0.92 to -0.02) QUALITY of LIFE (SF 36 physical component) Baseline Mean: Qigong 43.1, E 43.7, NT 43.3

	Reported Results: significant differences qigong vs no treatment; no difference qigong vs exercise SMD (Exercise vs NT) at 6 month -0.24 (95% CI: -0.69 to 0.22) SMD (Qigong vs NT) at 6 month -0.41 (95% CI: -0.86 to 0.04) REASONS FOR DROP-OUTS: detailed SIDE EFFECTS: Reported by 19 patients in qigong group including: muscle soreness (n = 15), myogelosis (n = 12), vertigo (n = 10), other pain (n = 4), headache (n = 3) , thirst (n = 1), engorged hands (n = 1), twinge in the neck (n = 1), urinary urgency (n = 1), bursitis of left shoulder (n = 1). Reported by 16 patients muscle soreness (n = 14), myogelosis (n = 11), headaches (n = 5), vertigo (n = 2), change in mood (n = 1), worsening of neck pain (n = 1), worsening of tinnitus (n = 1) COST OF CARE: NR
Notes	Additional unpublished data received from author * attrition bias may exist as ITT analysis are not presented in this overviews; ITT was performed in the RCT report

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	page 420
Allocation concealment (selection bias)	Low risk	page 420
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	The outcome assessor was the patient (i.e. VAS) therefore not blind to previous answer
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	Quigong 39/42 - acceptable; exercise 35/ 39 acceptable ; Wait list 39/41
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	ITT was stated
Selective reporting (reporting bias)	Unclear risk	No study protocol
Similarity of baseline characteristics?	Low risk	Table 1, Overall no difference noted between most variables albeit perceived effectiveness has some differences

Rendant 2011 (*Continued*)

Co-interventions avoided or similar?	Unclear risk	Not noted
Compliance acceptable?	Unclear risk	Not reported
Timing outcome assessments similar?	Low risk	Baseline, 3 months and 6 months

Revel 1994

Methods	Type of Trial: RCT Number Analysed/Randomized: 60/60 Intention-to-treat: NA Power analysis: NR
Participants	Chronic MND (osteoarthritic changes 27 of 30) Radicular signs/symptoms: Absent Setting: Outpatient Rheumatology Department Country: France
Interventions	INDEX TREATMENT Gr 1: Proprioception Rehabilitation Group (RG) a. Proprioceptive rehabilitation program: purpose to improve neck proprioception; 15 minute individualized exercise session; exercises were mainly concerned with eye-neck co-ordination including; i. slow passive motions of the head with gaze on a fixed target, ii. active movements of the head, automatic movements of the neck with passive trunk movements and head position relocation exercises, iii. exercises in a wide range of motion with free eye-head coupling [author description well detailed in Rehabilitation Procedure page 896]; 2 times per week; 30 to 40 minute sessions b. Medication: analgesics, antiinflammatory COMPARISON TREATMENT Gr 2: Control Group (CG) a. Medication: analgesic, antiinflammatory typical dosage was indomethacin 100mg; aspirin, 3000 mg; diclofenac, 150 mg; naproxen, 1000 mg Treatment Schedule: 8 weeks Duration of Follow-up: 2 weeks CO-INTERVENTION: NR
Outcomes	PAIN INTENSITY (VAS, 0 to 100) Baseline Mean: RG 50.5, CG 45.9 Reported Results: significant favouring RG SMD at ST follow-up: -0.77 (95% CI: -1.29 to -0.24), NNTB 4, treatment advantage 34% DAILY INTAKE OF NSAID / ANALGESICS Baseline Mean: RG 2.0/1.8, CG 2.3/1.6 Reported Results: not significant FUNCTIONAL IMPROVEMENT: SELF ASSESSED (5 point scale) Reported Results: significant favouring RG SMD at ST follow-up: 0.55 (95% CI: 0.33 to 0.89), NNTB 3, treatment advantage NA REASONS FOR DROP-OUTS: NR

	SIDE EFFECTS: NR COST OF CARE: NR	
Notes		

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Randomization not described
Allocation concealment (selection bias)	Low risk	
Blinding (performance bias and detection bias) All outcomes - patients?	Low risk	
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to intervention
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Patient self-report so not blinded
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	No ITT analysis
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	
Co-interventions avoided or similar?	Low risk	
Compliance acceptable?	High risk	Not reported
Timing outcome assessments similar?	Low risk	8w of treatment + 10w follow-up

Stewart 2007

Methods	Type of Trial: RCT Number Analysed/Randomized: 16/16 Intension-to-treat Analysis: NA Power Analysis: NR
Participants	Subacute and Chronic WAD Radicular signs/symptoms: Present Setting: 2 physiotherapy clinics Country: Australia
Interventions	INDEX TREATMENT Exercise and Advice: 6 week graded exercise program supervised by a physiotherapist. 1 hour of exercise per session, supervised for 30 minutes. Individualized, progressive, submaximal program designed to improve participants ability to complete functional activities specified by the participant as being difficult because of whiplash. Exercise included aerobic exercise, stretches, functional activities, activities to build speed, endurance and coordination, trunk and limb strengthening, cognitive behavioral therapy (setting goals of progressively increasing difficulty, shaping, encouraging self-monitoring of progress, self-reinforcement), home exercise program (individual specified). Regular evaluation by a physiotherapist. Encouraged to continue home exercises even after intervention was completed; 12 sessions over 6 weeks COMPARISON TREATMENT Advice Alone: Standardised education, reassurance and encouragement to resume light activity alone. One consultation and 2 follow-up phone contacts. Favorable prognosis of whiplash, addressed common inaccurate beliefs about whiplash, exploration of fear avoidance beliefs. Participants given a written report of main points of advice session. Standardized advice reinforced at 2 weeks and 4 weeks Treatment Schedule: 6 weeks, 12 sessions Duration of Follow-up: 42 weeks CO-INTERVENTION: avoided in trial design
Outcomes	PAIN Intensity (VAS 0 to 10) Baseline Mean(SD): Exercise + Advice 5.2 (2.0), Advice Alone 5.3 (2.0), Reported Results: Groups were similar at baseline. SMD post: -0.46 (95% CI: -0.81 to -0.12) SMD 12 month: -0.12 (95% CI: -0.47 to 0.23) FUNCTION [Neck Disability Index (NDI 0 to 50)] Baseline Mean(SD): Exercise + Advice 18.2 (6.3), Advice Alone 19.7 (6.9) Reported Results: Groups were similar at baseline. SMD post: -0.50 (95% CI: -0.85 to -0.15) SMD 12 month: -0.39 (95% CI: -0.74 to -0.03) GLOBAL PERCEIVED EFFECT (-5 to 5) Baseline Mean(SD): Exercise + Advice 0.6 (2.4), Advice Alone 0.3 (2.4) Reported Results: Groups were similar at baseline. SMD post: -0.46 (95% CI: -0.80 to -0.11) SMD 12 month: -0.18 (95% CI: -0.54 to 0.17) QUALITY OF LIFE (SF-36 Physical 0 to 100) Baseline Mean: Exercise + Advice 36.4 (9.9); Advice Alone 36.8 (8.6) Reported Results: Groups were similar at baseline

	SMD post: -0.35 (95% CI: -0.69 to -0.01) SMD 12 month: -0.15 (95% CI: -0.50 to 0.20) REASONS FOR DROP-OUTS: Reported but not specified SIDE EFFECTS: Reported; The main complaint in this group was muscle pain with exercise (3) followed by knee pain (2) and lumbar spine pain (2). COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	Randomized method is not described
Allocation concealment (selection bias)	Low risk	Reported p 60
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not described
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	pg 61, self-report scales therefore patient is assessor even though author reports scales being administered and scored by staff blind to group assignment
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	Although descriptions of drop-outs were not given, due to the low number of drop-outs we feel this is acceptable
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	
Selective reporting (reporting bias)	Low risk	pg 61, referenced protocol
Similarity of baseline characteristics?	Low risk	Table 1
Co-interventions avoided or similar?	High risk	Not similar at 12 months
Compliance acceptable?	Low risk	Section 3.3
Timing outcome assessments similar?	Low risk	6 weeks and 12 months

Takala 1994

Methods	Type of Trial: RCT Number Analysed/Randomized: 44/45 Intention-to-treat: NR Power Analysis: NR
Participants	MND, disorder duration NR Radicular signs/symptoms: Absent Setting: Printing Company Country: Finland
Interventions	INDEX TREATMENT Group A (ET): Group gymnastic, instructional type = group; setting = work; treatment characteristics = exercise planned to train whole body a) aerobic dynamic exercise [10 minutes walking or stepping], b) relaxation, c) stretching of muscles of the trunk and extremities and dynamic exercises [10 minutes]; schedule 10 minutes walking/stepping, 10 minutes stretch/dynamic exercises, 5 minutes walking/stepping, 10 minutes dynamic and coordination exercises, 10 minutes stretch and relaxation; duration of session = 45 minutes; frequency = 1 time per week COMPARISON TREATMENT: Group B: no treatment (NT) Treatment Schedule: 10 weeks, 10 sessions of treatment in the spring session (cross-over of placebo group occurred in autumn, the groups were reversed) Duration of Follow-up: none CO-INTERVENTION: NR
Outcomes	PAIN (VAS, 0 to 100) Baseline Median: ET 40, NT 50 Reported Results: no significant difference PRESSURE PAIN SENSITIVITY [algometer (pressure pain threshold on upper trapezius, levator scapulae, rhomboid, infraspinatus) mean score of 8 measures] Baseline Mean:ET 45.2, NT 44.8 Reported Results: no significant difference SMD at immediate post treatment: -0.06 (95% CI: -0.65 to 0.53) REASONS FOR DROP-OUTS: NR SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Matching then random allocation not described
Allocation concealment (selection bias)	Low risk	The rater was blinded with respect to the group status (treatment or control) of the participant

Blinding (performance bias and detection bias) All outcomes - patients?	Low risk	
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Patient self-report so not blinded
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	High risk	ITT not performed
Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	High risk	
Co-interventions avoided or similar?	Low risk	Similar in all groups
Compliance acceptable?	High risk	Not monitored
Timing outcome assessments similar?	Low risk	10w of treatment

Viljanen 2006

Methods	Type of Trial: RCT Number Analysed/Randomized: 340/393 Intention-to-treat Analysis: Calculated Power Analysis: Calculated
Participants	Chronic MND (NDR, NDH, WAD) Radicular signs: NS Setting: Office workers Country: USA, Canada
Interventions	INDEX TREATMENT Gr 1 (Exercise): Dynamic muscle training; dumbbells with weight of 1-3kg; activating large muscle groups in neck and shoulders; stretching followed each exercise; progression in weeks 5 and 9 Gr 2 (Relax): Relaxation training; progressive relaxation, autogenic training, functional relaxation, systematic desensitization CONTROL TREATMENT

	Gr 3 (Cntl): No treatment Treatment Schedule: 12 weeks plus 1 week reinforcement, G1: 13.6 sessions; Gr 2: 14.6 sessions Duration of Follow-up: 3 and 9 months CO-INTERVENTION: Comparable between groups
Outcomes	PAIN (VAS, 0 to 10) Baseline Mean: Exercise 4.8, Relax 4.8, Cntl 4.1 Reported Results: no group difference SMD (Exercise v Cntl): -0.04 (95% CI: -0.28 to 0.20) FUNCTION (Neck Disability Index, 0 to 50) Baseline Mean: Exercise 29, Relax 2 29, Cntl 26 Reported Results: no significant group differences were found SMD (Exercise v Cntl): -0.11 (95% CI: -0.11 to 0.38) REASONS FOR DROP-OUTS: Noted but no difference between groups SIDE EFFECTS: NR COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomization according to a random numbers table
Allocation concealment (selection bias)	Low risk	Treatment allocation was concealed in a numbered opaque envelope, which was opened by the physician after baseline measurements had been taken
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to study design
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Not possible due to study design
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	High risk	Reasons for drop-outs not described
Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	

Viljanen 2006 (*Continued*)

Selective reporting (reporting bias)	Unclear risk	No protocol available
Similarity of baseline characteristics?	Low risk	
Co-interventions avoided or similar?	Low risk	Comparable between groups
Compliance acceptable?	High risk	
Timing outcome assessments similar?	Low risk	12w of treatment + 3 and 9 month follow-up

von Trott 2009

Methods	Type of Trial: RCT Number Analysed/Randomized: 93/117 Intension-to-treat Analysis: Calculated Power Analysis: Calculated
Participants	Chronic MND in elderly adults Radicular signs/symptoms: NS Setting: Residents of residential homes for elderly people Country: Germany
Interventions	INDEX TREATMENT Gr 1: Qigong: Qigong lessons started with about 10 minutes of typical qigong "opening" exercises, continued with up to 4 exercises of Dantian Qigong, and finished with about 10 minutes of "closing" exercises. Qigong was provided by 5 approved Qigong therapists; 24 sessions (45 minutes) over 3 months (2 sessions per week) Gr 2: Exercise: Exercise therapy was based on a standardized program for computer and workplace related neck pain including repeated active cervical rotations, strength and flexibility exercises. A detailed description is provided in Weidmann 2008; 24 sessions (45 minutes) over 3 months (2 sessions per week) COMPARISON TREATMENT Gr 3: Wait List Control: Patients were free to treat their neck pain with the treatment or therapies they were using prior to randomization. Patients did not received Qigong or exercise therapy. After 6 months they were offered an intervention of their choice Treatment Schedule: 3 months, 24 sessions Duration of Follow-up: 3 months CO-INTERVENTION: Comparable between index and control groups
Outcomes	PAIN (VAS, 0 to100) Baseline Average Neck Pain: Qigong 56.4, Exercise 47.1, Wait List Control 49.9 Reported Results: After 3 months there was not significant difference for the average neck pain between the qigong and the wait list group (Δ=-11.0 mm (CI, -24.0 to 2.1; P = 0.99, ANCOVA), and no significant difference between the Qigong ane the exercise therapy group the group difference being Δ=-2.5 mm (CI,-15.4 to 10.3, P =.679). SMD (Qigong vs WLC) at ST follow-up: -0.24 (95% CI: -0.75 to 0.27)

	SMD (General Ex vs WLC) at ST follow-up: -0.43 (95% CI: -0.92 to 0.06) FUNCTION (Neck Disability Index, 0 to100) Baseline Average Neck Disability: Qigong 38.5, Exercise 41.8, Wait List Control 36.1 Reported Results: No significant difference was found between the groups after 3 and 6 months. SMD (Qigong vs WLC) at ST follow-up: -0.06 (95% CI: -0.57 to 0.45) SMD (General Ex vs WLC) at ST follow-up:-0.29 (95% CI: -0.77 to 0.20) GLOBAL PERCEIVED EFFECT SMD (Qigong vs WLC) at ST follow-up: -0.09 (95% CI: -0.60 to 0.42) SMD (General Ex vs WLC) at ST follow-up: -0.21 (95% CI: -0.69 to 0.28) QUALITY OF LIFE (SF36 physical component: 0 to100) Baseline Average Quality of Life: Qigong 30.4, Exercise 28.7, Wait List Control 30.6 Reported Results: No significant difference was found between the groups after 3 and 6 months. SMD (Qigong vs WLC) at ST follow-up: -0.20 [95% CI: -0.69 to 0.28] SMD (Qigong vs WLC) at IT follow-up: 0.01 [95% CI: -0.50 to 0.52] SMD (General Ex vs WLC) at ST follow-up: -0.19 [95% CI: -0.68 to 0.29] SMD (General Ex vs WLC) at IT follow-up: 0.25 [95% CI: -0.22 to 0.72] REASONS FOR DROP-OUTS: Reported SIDE EFFECTS: Reported; 5 side-effects were reported by 4 patients in the qigong group (2 nausea, 2 aching muscles, 1 muscle tension) and 4 side effects by 2 patients in the exercise therapy group (2 muscle tensions, 1 acing muscles, 1 nausea) COST OF CARE: NR
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	
Allocation concealment (selection bias)	Low risk	
Blinding (performance bias and detection bias) All outcomes - patients?	High risk	Perceptibly different interventions between groups
Blinding (performance bias and detection bias) All outcomes - providers?	High risk	Not possible due to intervention
Blinding (performance bias and detection bias) All outcomes - outcome assessors?	High risk	Patient is assessor
Incomplete outcome data (attrition bias) All outcomes - drop-outs?	Low risk	

Incomplete outcome data (attrition bias) All outcomes - ITT analysis?	Low risk	
Selective reporting (reporting bias)	Low risk	Wiedmann 2008
Similarity of baseline characteristics?	Low risk	Table 1
Co-interventions avoided or similar?	Unclear risk	Unclear about the wait list group
Compliance acceptable?	Unclear risk	Compliance of home based exercises was not measured
Timing outcome assessments similar?	Low risk	3 months, 6 months

1.0 Definitions of terms
1.1 Acute = <30 days [1 month, 4 weeks]
Subacute = 30 days [1 month, 4 weeks] to 90 days [3 months, 12 weeks]
Chronic = > 90 days [3 months, 12 weeks]
1.2 short-term follow-up < 6 months
longer-term follow-up > or = 6 months
2.0 Short forms commonly used in text and tables:
2.1 Clinical terms
AE=Active ex group
AROM = active range of motion
BM=ET +CBT
BPT=Physiotherapy with Behavioral Therapy
CBT=Cognitive Behavioral Therapy
CCF=Craniocervical Flexion
CEFL=Cervical Endurance flexion
Clr=collar
Co-Ord=Co-ordination
D=Delayed treatment
DEx=Delayed Exercise
DEd=Delayed Education
DT = drug therapy
EEx=Early exercise
EEd=Early education
ED = education
ET= Exercise Therapy
F=Feldenkrais
GP=General Practitioner
HT=home training
IR= infrared Radiation
ISO=Isometric neck ex
ISOSh=Isometric shoulder ex
ISOShEn=Isometric Shoulder endurance
ISOShST=Isometric shoulder Strength

McK=McKenzie
MmPT=Multimodal Phyical Therapy
Mock=Mock therapy
MT = manual therapy
NaMT=Napropathic Manual Therapy
NoEG=No Exercise Group
NSET=New sling Exerise therapy
NeuT=Neural Mobilizations
NT=No treatment
PE=Passive exercise group
PEMT = pulsed electromagnetic therapy
PhEx= Phasic exercise
Pil=Pillow
PMM = physical medicine methods
PROM = passive range of motion
PRT= Proprioceptive rehab training
REL=Relaxation
ROM = range of motion
RMT=Massage Therapy
SMP=Self Management Prog
SMT=Manipulation
SMT/ET=Manipulation and exercise
SpvT=supervised training of CSP/Scap
SSng=Self Snag
SSET=Specific exercise therapy
SSETUBE=Specific tubing exercise
StEx= Standard exercise
SUS=Sham Ultra Sound
Sx=Surgery
TBS=Traditional Bone Setting
TENS = transcutaneous electrical nerve stimulation
Txn=Traction
US = ultrasound
WAD = whiplash-associated disorders
2.2 Outcome measures
WHYMPI = West Haven-Yale Multidimensional Pain Inventory [sub scale pain severity]
SF-36 = short-form 36 [short-form with 36 questions yielding an 8-scale health profile]
NDI = neck disability index
VAS = visual analogue scale
NRS-101 = numeric rating scale 101 [0 to 100 point scale]
PPT = pain pressure threshold [measured by algometer]
2.3 Other
v = versus
w = weeks
m = months
y = years
ITT = intention-to-treat
NNTB = number needed to treat to benefit
RCT = randomized controlled trial
SMD = standardized mean difference

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

Study	Reason for exclusion
Allison 2002	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Andersen 2008a	Comparison: Comparison group received equal attention by forming groups which should improve workplace ergonomics, stress management, etc
Andersen 2010	Comparison: Comparison group received equal attention by forming groups which should improve workplace ergonomics, stress management, etc
Bernaards 2007	Intervention: Multimodal including exercise and cognitive behavioral training (companion paper to Bernaards 2008)
Bernaards 2008	Intervention: Multimodal including cognitive behavioral training (companion paper to Bernaards 2007)
Bissett 1985	Intervention: EMG biofeedback mediated muscle relaxation not active exercise
Blangsted 2008	Comparison: Comparison group received equal attention by forming groups which should improve workplace etc (companion paper to Andersen 2008)
Bonk 2000	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Bosmans 2011	Intervention: Multimodal approach with intervention groups without ability to differentiate each treatment techniques contribution
Brewerton 1966	Intervention: Instruction on posture is not considered an exercise. There was no exercise group outside "instruction on posture"
Brodin 1985	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Bronfort 2012	Intervention: No control group, a comparison trial
Burketorp 2006	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Carlsson 1990	Population: Chronic tension headache (either occipital, temporal and/or frontal)
Cleland 2010	Intervention: Both treatment and control received same exercise intervention
Cunha 2008	Intervention: Multimodal - manual therapy and exercise
Dellve 2011	Intervention: No control group, exercise in both treatment arms

(*Continued*)

Dusunceli 2009	Intervention: Multimodal - exercise and PT agents
Ehrenborg 2010	Intevention: Both treatment and control received same exercise intervention
Escortell-Mayor 2008	Intevention: Both treatment and control received same exercise intervention
Escortell-Mayor 2011	Intevention: Both treatment and control received same exercise intervention
Falla 2006	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Fitz-Ritson 1995	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Foley-Nolan 1992	Intervention: Not exercise
Friedrich 1996	Intervention: Education comparison, exercise is the same in all 3 groups
Gam 1998	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Giebel 1997	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Gustavsson 2006	Intervention: The control treatment was individualized care (acupuncture, massage, mobs, hot pack, TENS, US, exercise) and we were not able to elucidate the exact treatment mix for the treat as usual group
Guzel 2006	Intervention: Both groups received the same exercise intervention
Hagberg 2000	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Hamberg-van Reenen 2009	Population: Convenience sample of 22 healthy workers
Hanten 1997	Outcome Measures: Did not use any of the identified outcome measures (only pain pressure threshold as a proxy for pain)
Hanten 2000	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Henning 1997	Population: Preventional trial, although participants rated neck and shoulder discomfort this subpopulation was never identified, nor was discomfort ratings in neck and shoulders reported
Hoving 2002	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution

(*Continued*)

Hudson 2010	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Hurwitz 2002	Intervention: No active exercise
Hurwitz 2005	Intervention: Exercise was same in all groups
Jensen 2001	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Jensen 2005	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Jordan 1998	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Jull 2007 JOR	Intervention: All groups received exercise
Jull 2007 Pain	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Jull 2009	Intervention: All groups received exercise
Kamwendo 1991	Intervention: Exercises not specified
Karlberg 1996	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Kietrys 2007	Comparison: Comparison was activities
Koes 1992	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Kogstad 1978	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Lansinger 2007	Intevention: Both treatment and control received same exercise intervention
Levoska 1993	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Linton 2001a	Intervention: Unable to separate exercise group within treatment as usual comparison group
Ma 2011	Intervention: No control group, comparison group received education
Madson 2010	Intevention: Both treatment and control received same exercise intervention

(*Continued*)

Manca 2006	Intervention: Exercise prescription was not a significant component of the study (less than 10%)
McKinney 1989	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Mealy 1986	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Moffet 2006	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Murphy 2010	Intevention: Both treatment and control received same exercise intervention
Nordemar 1981	Intervention: Passive exercise
O'Leary 2007	Outcome Measures: The reported outcomes are not outcomes of interest to this review
O'Leary 2007 JoPain	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Pato 2010	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Pennie 1990	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Persson 2001	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Pool 2006	Intervention: Protocol only, multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution (Ex+graded activity+MT)
Provinciali 1996	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Randlov 1998	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Rosenfeld 2000	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Rosenfeld 2003	Intervention: Both groups received exercise
Rundcrantz 1991	Design: This was a quasi-RCT, treatment was individualized and unable to specify exercise
Ryan 2001	Intervention: Both groups received exercise (strength vs endurance)

(*Continued*)

Schnabel 2004	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Scholten-Peeters 2006	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Skargren 1997	Intervention: Unable to separate data for exercise group (unclear if McKenzie treatment mobilization or exercise)
Skillgate 2007	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Soderlund 2000	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Soderlund 2001	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Taimela 2000	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Tsauo 2004	Population: Prevention trial, between than 14.3 -58.5 % of participants had neck pain at baseline
Van den Heuvel 2003	Population: Prevention trial, greater proportion of participants non-symptomatic in past week at baseline
Van Ettekoven 2006	Population: The primary diagnosis was tension type headaches
Vasseljen 1995	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Vikne 2007	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Voerman 2007	Intervention: Relaxation therapy using myofeedback versus ergonomic intervention, no active component
von Piekartz 2011	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Waling 2002	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Wei 2007	Outcome Measure: not our primary outcomes of interest in this review
Ylinen 2003	Comparison: Control group included exercise

(*Continued*)

Ylinen 2006b	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Ylinen 2007b	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution
Ylinen 2010	Intervention: Both treatment and control received same exercise intervention
Zaproudina 2007	Intervention: Multimodal approach within intervention groups without ability to differentiate each treatment techniques contribution

EMG: electromyography
PT: physiotherapy
RCT: randomized controlled trial
TENS: transcutaneous electrical nerve stimulation
US: ultrasound

Characteristics of studies awaiting assessment *[ordered by year of study]*

Humphreys 2002

Methods	Random allocation stratified for gender and age
Participants	Chronic neck pain
Interventions	Rehabilitative exercise group v non-exercise group
Outcomes	Head repositioning accuracy, pain intensity
Notes	

Hansson 2006

Methods	Randomized control trial
Participants	WAD
Interventions	Vestibular Rehabilitation Program compared with a control group
Outcomes	Dizziness Handicap inventory
Notes	

Marangoni 2010

Methods	Pretest-post test-control group design with cluster randomization
Participants	
Interventions	Stretch every 6 mins reminded by a computer program, stretch every 6 mins reminded by a hard copy version of stretches v no intervention
Outcomes	Pain
Notes	

Zebis 2011

Methods	Cluster randomized controlled trial
Participants	
Interventions	High-intensity strength training v control group receiving advice to stay physically active
Outcomes	Pain intensity
Notes	

WAD: whiplash-associated disorders
v: versus

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

Andersen 2010a (Protocol)

Trial name or title	Protocol for work place adjusted intelligent physical exercise reducing musculoskeletal pain in shoulder and neck (VIMS): a cluster randomized controlled trial
Methods	
Participants	
Interventions	Specific strength training with supervision v specific strength training with minimal supervision v reference groups without training
Outcomes	Pain
Starting date	
Contact information	National Research Centre for the Working Environment, Copenhagen O, Denmark

Andersen 2010a (Protocol) (*Continued*)

Notes	

Andersen 2011a (Protocol)

Trial name or title	Protocol for shoulder function training reducing musculoskeletal pain in shoulder and neck: a randomized controlled trial
Methods	
Participants	Neck pain
Interventions	Shoulder function training with supervision v reference group receiving advice to stay physically active
Outcomes	Pain intensity, strength, work disability
Starting date	
Contact information	National Research Centre for the Working Environment, Copenhagen O, Denmark
Notes	Protocol

Evans 2011

Trial name or title	Supervised Exercise with and Without Spinal Manipulation Perform Similarly and Better Than Home Exercise for Chronic Neck Pain: A Randomized Controlled Trial
Methods	
Participants	Chronic neck pain
Interventions	High dose supervised strengthening exercise with spinal manipulation v high dose supervised strengthening exercise alone v low dose home mobilization exercise and advice
Outcomes	Patient-rated pain, disability, health status, global perceived effect, medication use, and satisfaction
Starting date	
Contact information	Northwestern Health Sciences University, Wolfe Harris Center for Clinical Studies, 2501 W 84th St, Bloomington, MN 55431
Notes	

Guerriero 1997

Trial name or title	Comparative effects of manipulation and physical therapy on motion in the cervical spine
Methods	
Participants	Chronic neck pain
Interventions	Cervical spine manipulation v sham treatment v cervical spine manipulation, ischemic compression of myofascial trigger points , PNF, interferential therapy
Outcomes	Cervical ROM
Starting date	
Contact information	Palmer Institute of Graduate Studies and Research, Davenport, Iowa
Notes	

Gurumoorthy 2000

Trial name or title	A prospective study of acute whiplash injury and its clinical management
Methods	
Participants	Acute neck injury (whiplash associated disorder)
Interventions	Early immobilization v early active mobilization
Outcomes	Pain, cervical ROM, neck muscle strength, time to return to normal duties
Starting date	
Contact information	Curtin University of Technology, Perth, Australia
Notes	

Hansen 2011 (Protocol)

Trial name or title	Neck exercises, physical and cognitive behavioral-graded activity as a treatment for adult whiplash patients with chronic neck pain: Design of a randomized controlled trial
Methods	
Participants	Chronic neck pain (WAD)
Interventions	Pain management (control) group v combined pain management and training (intervention) group
Outcomes	Pain, function, disability, quality of life

Hansen 2011 (Protocol) (*Continued*)

Starting date	
Contact information	Research Unit for Musculoskeletal Function and Physiotherapy, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense M, Denmark
Notes	

Karlsson 2011

Trial name or title	The effects of two different home-exercise programmes on women suffering long-term neck muscle pain
Methods	
Participants	Chronic neck pain
Interventions	Neck/shoulder stretching program + aerobic exercise v + neck/shoulder stretching program + aerobic exercise + weight training for neck/shoulder area + exercises to strengthen core and leg muscles
Outcomes	Pain intensity, mobility, strength, self-assessed function (NDI)
Starting date	
Contact information	Rehabilitation medicine, Institution of Clinical and Experimental medicine, Linkoping, Sweden
Notes	Abstract

Michaleff 2009 (Protocol)

Trial name or title	A randomized clinical trial of a comprehensive exercise program for chronic whiplash: trial protocol
Methods	
Participants	Chronic neck pain (WAD I & II)
Interventions	Education Booklet + Comprehensive Exercise Program v Education Booklet + Advice
Outcomes	Pain intensity, disability, health-related quality of life and health service utilization
Starting date	
Contact information	The George Institute for International Health, The University of Sydney, George Street, Sydney, 2000, Australia
Notes	

Reginiussen 2000

Trial name or title	Efficiency of manual therapy on patients with cervicogenic headache. A randomized single blinded controlled trial
Methods	
Participants	Cervicogenic headache
Interventions	Manual therapy (soft tissue methods, stretching/massage, mobilizing and thrust techniques) v standardized physiotherapy treatment consisting of SWD, exercises and stretching
Outcomes	Headache, neck pain, function, use of drugs, patient satisfaction
Starting date	
Contact information	Institut of Manual Therapy, Alta, Norway
Notes	

Stokke 1995

Trial name or title	A randomized comparison of chiropractic and physiotherapy treatment for neck pain of functional (mechanical) origins. A controlled clinical trial
Methods	
Participants	Neck pain, neck and head pain, neck and shoulder pain
Interventions	Chiropractic spinal manipulation v physiotherapy v medication
Outcomes	NDI, pain intensity VAS
Starting date	
Contact information	Institute of Community Medicine, School of Medicine, Uniersity of Tramso, 9037 Tromso, Norway
Notes	

Williamson 2009 (Protocol

Trial name or title	Development and delivery of a physiotherapy intervention for the early management of whiplash injuries: The Managing Injuries of Neck Trial (MINT) Intervention
Methods	
Participants	WAD I, II, & III
Interventions	Manual therapy, exercise, and psychological strategies and self-management advice

Williamson 2009 (Protocol (*Continued)*

Outcomes	
Starting date	
Contact information	Clinical Trials Unit, Medical School Building, Gibbet Hill Campus, University of Warwick, Coventry CV4 7AL, UK
Notes	

NDI: neck disability index
PNF: Proprioceptive neuromuscular facilitation
ROM: range of motion
v: versus
VAS: visual analogue scale
WAD: whiplash associated disorders

DATA AND ANALYSES

Comparison 1. (sub)Acute/Chronic MND: General Fitness Training vs CONTROL

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 10 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 General Fitness Training v Reference Intervention	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 10 weeks of treatment + 10 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 General Fitness Training v Reference Intervention	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 2. Chronic MND: Cervical Stretch/ROM Exercises + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (NRS-101): 4 weeks of treatment			Other data	No numeric data
1.1 Stretch before Manip v Manip alone			Other data	No numeric data
1.2 Stretch after Manip v Manip alone			Other data	No numeric data
2 Function (NDI): 4 weeks of treatment			Other data	No numeric data
2.1 Stretch before Manip v Manip alone			Other data	No numeric data
2.2 Stretch after Manip v Manip alone			Other data	No numeric data

Comparison 3. Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 8 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 McKenzie Treatment v Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 8 weeks of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 McKenzie Treatment v Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Pain Intensity (VAS): 8 weeks of treatment + 12 months follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 McKenzie Treatment v Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NDI): 8 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 McKenzie Treatment v Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Function (NDI): 8 weeks of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
5.1 McKenzie Treatment v Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
6 Function (NDI): 8 weeks of treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 McKenzie Treatment v Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 4. Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 6 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Isometric neck exercises +/- pillow vs control or pillow	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 6 weeks of treatment + 6 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Isometric neck exercises +/- pillow vs pillow or placebo	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Function (NPQ): 6 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected

3.1 Isometric neck exercises +/- pillow vs pillow or placebo	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NPQ): 6 weeks of treatment + 6 weeks follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 Isometric neck exercises +/- pillow vs pillow or placebo	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Global Perceived Effect Treatment (patients assessment): 3 weeks of treatment	1	Risk Ratio (M-H, Random, 95% CI)	Totals not selected
5.1 Isometric exercises vs no intervention	1	Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]
6 Quality of Life (SF-36): 6 weeks of treatment + 6 w follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 Isometric neck exercises +/- pillow vs pillow or placebo	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 5. (sub)Acute/Chronic MND: Scapulothoracic + UE Strengthening vs Control

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 10 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Strength Specific Training vs Reference Group	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 10 weeks of treatment + 10 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Strength Specific Training vs Reference Group	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 6. Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 8 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 General Exercise vs Sham US	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 8 weeks of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 General Exercise vs Sham US	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

3 Pain Intensity (VAS): 8 weeks of treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 General Exercise vs Sham US	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NDI): 8 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 General Exercise vs Sham US	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Function (NDI): 8 weeks of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
5.1 General Exercise vs Sham US	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
6 Function (NDI): 8 weeks treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 General Exercise vs Sham US	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 7. Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity: Immediate Post Treatment (<11w of treatment)	4		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 Exercise +/- Infrared +/- SMT +/- Acupuncture vs Infrared or SMT or Acupuncture	4	317	Std. Mean Difference (IV, Random, 95% CI)	-0.33 [-0.55, -0.10]
2 Pain Intensity: 11 w of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 SMT + Rehab Exercises vs SMT	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Pain Intensity: Treatment + IT follow-up (11 weeks of treatment + 6 month follow-up	3		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
3.1 <11w of treatment + 6 month follow-up	3	241	Std. Mean Difference (IV, Random, 95% CI)	-0.31 [-0.56, -0.05]
4 Pain Intensity: Treatment + LT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 <11w of treatment + 24 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Function: Immediate Post treatment	4		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
5.1 <11w of treatment	4	317	Std. Mean Difference (IV, Random, 95% CI)	-0.25 [-0.48, -0.01]
6 Function: Treatment + ST follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected

6.1 <11w of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7 Function: Treatment + IT follow-up	3		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
7.1 <11w of treatment + 6 month follow-up	3	241	Std. Mean Difference (IV, Random, 95% CI)	-0.45 [-0.72, -0.18]
8 Function: Treatment + LT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
8.1 <11w of treatment + 24 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
9 Quality of Life: Immediate Post Treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
9.1 <11w of treatment	2	165	Std. Mean Difference (IV, Random, 95% CI)	-0.18 [-0.48, 0.13]
10 Quality of Life: Treatment + ST follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
10.1 11w of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
11 Quality of Life: Treatment + IT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
11.1 11w of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
12 Quality of Life: Treatment + LT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
12.1 11w of treatment + 24 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
13 Patient Satisfaction: Immediate Post Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
13.1 11>w of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
14 Patient Satisfaction: Treatment + ST follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
14.1 11w of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
15 Patient Satisfaction: Treatment + IT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
15.1 11w of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
16 Patient Satisfaction: Treatment + LT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
16.1 11w of treatment + 24 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
17 Global Perceived Effect: Immediate Post Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
17.1 11w of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
18 Global Perceived Effect: Treatment + ST follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
18.1 11w of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
19 Global Perceived Effect: Treatment + IT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
19.1 11w of treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

20 Global Perceived Effect: Treatment + LT follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
20.1 11w of treatment + 24 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 8. Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 12 weeks of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 Exercise Therapy vs No Treatment	2	147	Std. Mean Difference (IV, Random, 95% CI)	-0.61 [-1.05, -0.16]
2 Pain Intensity (VAS): 24 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Pain Intensity (VAS): 12 weeks of treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NPDS): 12 weeks of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
4.1 Exercise Therapy vs No Treatment	2	147	Std. Mean Difference (IV, Random, 95% CI)	-0.50 [-1.04, 0.03]
5 Function (NPDS): 24 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
5.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
6 Function (NPDS) 12 weeks treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7 Global Perceived Effect (General Health Perception): 12 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
7.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
8 Global Perceived Effect (General Health Perception): 12 weeks of treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
8.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

9 Quality of Life (SF-36): 12 weeks of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
9.1 Exercise Therapy vs No Treatment	2	143	Std. Mean Difference (IV, Random, 95% CI)	-0.25 [-0.58, 0.08]
10 Quality of Life (SF-36): 24 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
10.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
11 Quality of Life (SF-36): 12 weeks of treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Fixed, 95% CI)	Totals not selected
11.1 Exercise Therapy vs No Treatment	1		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 9. Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 12 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Dynamic muscle training vs control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 12 weeks of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Dynamic muscle training vs control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Pain Intensity (VAS): 12 weeks of treatment + 9 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Dynamic muscle training vs control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (Neck Disability 0-80): 12 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 Dynamic muscle training vs control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Function (Neck Disability 0-80): 12 weeks of treatment + 3 month follow-up	1		Std. Mean Difference (IV, Fixed, 95% CI)	Totals not selected
5.1 Dynamic muscle training vs control	1		Std. Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Function (Neck Disability 0-80): 12 weeks of treatment + 9 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 Dynamic muscle training vs control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 10. Chronic MND: Cervical/Scapulothoracic Strengthening + Cervical/Scapulothoracic Endurance Training

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Prevelance during previous week: 6 weeks of treatment + 46 weeks follow-up	1		Risk Ratio (M-H, Random, 95% CI)	Totals not selected
1.1 Exercise Regimen vs control group	1		Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 11. (sub)Acute/Chronic MND: Scapulothoracic/UE Endurance Training

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 10 weeks treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 2 min training group vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 12 min training group vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 12. Chronic MND: Neuromuscular Education (eye neck coordination/proprioception) + ANOTHER INTERVENTION VS THAT SAME INTERVENTION

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 8 weeks treatment + 10 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Rehabilitation Group vs Control Group	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Function (pt's assessment of functional improvement): 8 weeks treatment + 10 weeks follow-up	1		Risk Ratio (M-H, Random, 95% CI)	Totals not selected
2.1 Rehabilitation Group vs Control Group	1		Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 13. Chronic MND:Trunk/Extremity Stretch + Pattern/Synchronization: Balance and Coordination + Cardiovascular/Aerobic vs NO TREATMENT

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 10 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Group Gymnastics vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 14. Chronic MND:General Endurance Training + Dynamic/Static Lowback/pelvic Stabilization + General Stretching + Neuromuscular/body Mechanics Movement Training vs NO INTERVENTION OR WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 16 weeks treatment + 6 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Physiotherapy Group vs Control Group	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 15. Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 12 weeks of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 Qigong vs No Treatment	2	148	Std. Mean Difference (IV, Random, 95% CI)	-0.50 [-0.97, -0.03]
2 Pain Intensity (VAS): 24 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Pain Intensity (VAS): 12 weeks of treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NPDS): 12 weeks of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
4.1 Qigong vs No Treatment	2	148	Std. Mean Difference (IV, Random, 95% CI)	-0.36 [-0.68, -0.03]
5 Function (NPDAS): 24 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
5.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

6 Function (NPDS): 12 weeks of treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7 Global Perceived Effect (General Health Perception): 12 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
7.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
8 Global Perceived Effect (General Health Perception): 12 weeks of treatment + 12 weeks Follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
8.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
9 Quality of Life (SF-36 physical component): 12 weeks of treatment	2		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
9.1 Qigong vs No Treatment	2	148	Std. Mean Difference (IV, Random, 95% CI)	-0.32 [-0.64, 0.01]
10 Quality of Life (SF-36 physical component): 24 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
10.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
11 Quality of Life (SF-36 physical component): 12 weeks of treatment + 12 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
11.1 Qigong vs No Treatment	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 16. Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity: (0-10 box scale): 6 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Exercise + Advice vs Advice	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (0-10 box scale): 6 weeks treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Exercise + Advice vs Advice	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Function (NDI): 6 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Exercise + Advice vs Advice	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NDI): 6 weeks of treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected

4.1 Exercise + Advice vs Advice	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Global Perceived Effect (-5 to 5 scale): 6 weeks of treatment	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
5.1 Exercise + Advice vs Advice	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
6 Global Perceived Effect (-5 to 5 scale): 6 weeks of treatment + 12 month follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 Exercise + Advice vs Advice	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
7 Quality of Life (SF-36): 6 weeks of treatment	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
7.1 Exercise + Advice vs Advice	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
8 Quality of Life (SF-36): 6 weeks of treatment + 12 month follow-up	1	Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
8.1 Exercise + Advice vs Advice	1	Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 17. (sub)Acute CGH: Cervical Stretch/ROM vs SHAM

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (Headache Questionnaire): Treatment + 4 weeks follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 C1-C2 Self Snag vs Placebo Group	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (Headache Questionnaire): Treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 C1-C2 Self Snag vs Placebo Group	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 18. Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Headache Intensity (VAS 0-10): 6 weeks of treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Therapeutic Exercise +/- Manip vs Control Group or Manip	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Headache Intensity (VAS 0-10): 6 weeks treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Therapeutic Exercise +/- Manip vs Control Group or Manip	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Function (NPNPQ 0-36): 6 weeks treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Therapeutic Exercise +/- Manip vs Control Group or Manip	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NPNPQ 0-36): 6 weeks treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 Therapeutic Exercise +/- Manip vs Control Group or Manip	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Global Perceived Effect (VAS): 6 weeks treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
5.1 Therapeutic Exercise +/- Manip vs Control Group or Manip	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
6 Global Perceived Effect (VAS): 6 weeks treatment + 12 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
6.1 Therapeutic Exercise +/- Manip vs Control Group or Manip	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]

Comparison 19. Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain Intensity (VAS): 6 weeks treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Physiotherapy vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Pain Intensity (VAS): 6 weeks treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2.1 Physiotherapy vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
3 Function (NDI): 6 weeks treatment	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
3.1 Physiotherapy vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
4 Function (NDI): 6 weeks treatment + 6 month follow-up	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4.1 Physiotherapy vs Control	1		Std. Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
5 Satisfaction (5 point scale): 6 weeks treatment	1		Risk Ratio (M-H, Random, 95% CI)	Totals not selected
5.1 Physiotherapy vs Control	1		Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]

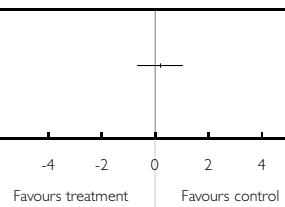
Analysis 1.1. Comparison 1 (sub)Acute/Chronic MND: General Fitness Training vs CONTROL, Outcome 1 Pain Intensity (VAS): 10 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 1 (sub)Acute/Chronic MND: General Fitness Training vs CONTROL

Outcome: 1 Pain Intensity (VAS): 10 weeks of treatment

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 General Fitness Training v Reference Intervention						
Andersen 2008 (1)	16	33 (12)	8	30 (22)		0.18 [-0.67, 1.03]



(1) GFT v REF

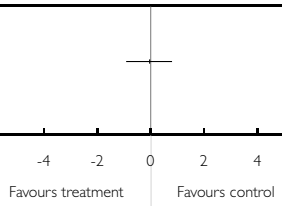
Analysis 1.2. Comparison 1 (sub)Acute/Chronic MND: General Fitness Training vs CONTROL, Outcome 2 Pain Intensity (VAS): 10 weeks of treatment + 10 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 1 (sub)Acute/Chronic MND: General Fitness Training vs CONTROL

Outcome: 2 Pain Intensity (VAS): 10 weeks of treatment + 10 weeks follow-up

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 General Fitness Training v Reference Intervention						
Andersen 2008	16	29 (15)	8	30 (18)		-0.06 [-0.91, 0.79]



Analysis 2.1. Comparison 2 Chronic MND: Cervical Stretch/ROM Exercises + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 1 Pain Intensity (NRS-101): 4 weeks of treatment.

Pain Intensity (NRS-101): 4 weeks of treatment

Study	
Stretch before Manip v Manip alone	
Allan 2003	Although the stretch before manipulation group had 30% (n=2) greater decrease in intra-group pain by the end of the study than those who received maniplation alone, inter-group analysis using the Kruskal-Wallis test found no statistical signifance between the groups (X2=2.447, d.f.=2, P=0.294) There was no statistically significant difference in pain between the stretch before manipulation group and the control group of manipulation alone There was no statistically significant difference between the stretch before manipulation vs stretch after manipulation
Stretch after Manip v Manip alone	
Allan 2003	Although the manipulation then stretch group had 26% (n=2) greater decrease in intra-group pain by the end of the study than those who received maniplation alone, inter-group analysis using the Kruskal-Wallis test found no statistical signifance between the groups (X2=2.447, d.f.=2, P=0.294) There was no statistically significant difference in pain between the stretch after manipulation group from the control group of manipulation alone There was no statistically significant difference between the stretch before manipulation vs stretch after manipulation

Analysis 2.2. Comparison 2 Chronic MND: Cervical Stretch/ROM Exercises + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 2 Function (NDI): 4 weeks of treatment.

Function (NDI): 4 weeks of treatment

Study	
Stretch before Manip v Manip alone	
Allan 2003	There was no statistically significant difference in function between the stretch before manipulation and the control group of manipulation alone There was no statistically significant difference in function between stretch before manipulation vs stretch after manipulation
Stretch after Manip v Manip alone	
Allan 2003	no statistically significant difference in function between stretch after manipulation groups from control group of manipulation alone no statistically significant difference in function between stretch before manipulation vs stretch after manipulation

Analysis 3.1. Comparison 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM, Outcome 1 Pain Intensity (VAS): 8 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome: 1 Pain Intensity (VAS): 8 weeks of treatment

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 McKenzie Treatment v Control						
Kjellman 2002 (1)	25	19 (18)	25	21 (20)		-0.10 [-0.66, 0.45]

(1) MCKENZIE treatment vs Sham US

Analysis 3.2. Comparison 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM, Outcome 2 Pain Intensity (VAS): 8 weeks of treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome: 2 Pain Intensity (VAS): 8 weeks of treatment + 6 month follow-up

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 McKenzie Treatment v Control						
Kjellman 2002 (1)	25	21 (17)	25	27 (23)		-0.29 [-0.85, 0.27]

(1) MCKENZIE Treatment vs Sham US

Analysis 3.3. Comparison 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM, Outcome 3 Pain Intensity (VAS): 8 weeks of treatment + 12 months follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome: 3 Pain Intensity (VAS): 8 weeks of treatment + 12 months follow-up

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 McKenzie Treatment v Control						
Kjellman 2002 (1)	25	26 (23)	25	25 (24)		0.04 [-0.51, 0.60]

(1) MCKENZIE Treatment vs Sham US

Analysis 3.4. Comparison 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM, Outcome 4 Function (NDI): 8 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome: 4 Function (NDI): 8 weeks of treatment

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 McKenzie Treatment v Control						
Kjellman 2002 (1)	25	16 (12)	25	19 (13)		-0.24 [-0.79, 0.32]

(1) MCKENZIE Treatment vs Sham US

Analysis 3.5. Comparison 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM, Outcome 5 Function (NDI): 8 weeks of treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome: 5 Function (NDI): 8 weeks of treatment + 6 month follow-up

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 McKenzie Treatment v Control						
Kjellman 2002 (1)	23	15 (12)	24	18 (15)		-0.22 [-0.79, 0.36]

(1) MCKENZIE Treatment vs Sham US

Analysis 3.6. Comparison 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM, Outcome 6 Function (NDI): 8 weeks of treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 3 Chronic MND: Cervical Stretch/ROM Exercises + Dynamic Cervical Stabilization vs SHAM

Outcome: 6 Function (NDI): 8 weeks of treatment + 12 month follow-up

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 McKenzie Treatment v Control						
Kjellman 2002 (1)	23	18 (14)	24	16 (15)		0.14 [-0.44, 0.71]

(1) MCKENZIE Treatment vs Sham US

Analysis 4.1. Comparison 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST, Outcome 1 Pain Intensity (VAS): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome: 1 Pain Intensity (VAS): 6 weeks of treatment

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 Isometric neck exercises +/- pillow vs control or pillow						
Helewa 2007 (1)	31	1.3 (1.2)	31	2.3 (1.7)		-0.67 [-1.18, -0.16]
Helewa 2007 (2)	28	1.9 (1.8)	33	1.7 (1.7)		0.11 [-0.39, 0.62]

(1) Exercise + Pillow vs Pillow

(2) Exercise vs Control

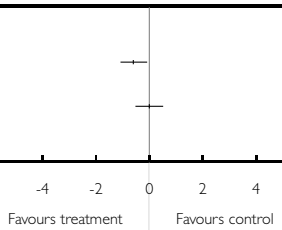
Analysis 4.2. Comparison 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST, Outcome 2 Pain Intensity (VAS): 6 weeks of treatment + 6 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome: 2 Pain Intensity (VAS): 6 weeks of treatment + 6 weeks follow-up

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 Isometric neck exercises +/- pillow vs pillow or placebo						
Helewa 2007 (1)	32	1 (1.3)	32	1.9 (1.7)		-0.59 [-1.09, -0.09]
Helewa 2007 (2)	25	1.7 (1.4)	33	1.7 (1.6)		0.0 [-0.52, 0.52]



(1) Exercise + Pillow vs Pillow

(2) Exercise vs Control

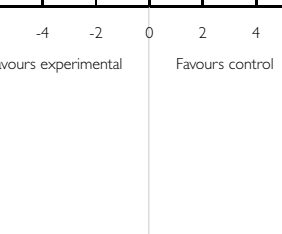
Analysis 4.3. Comparison 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST, Outcome 3 Function (NPQ): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome: 3 Function (NPQ): 6 weeks of treatment

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 Isometric neck exercises +/- pillow vs pillow or placebo						
Helewa 2007 (1)	31	17.7 (11.6)	31	26.1 (13.5)		-0.66 [-1.17, -0.15]
Helewa 2007 (2)	28	21.1 (13.3)	33	18.8 (9.4)		0.20 [-0.30, 0.70]



(1) Exercise + Pillow vs Pillow

(2) Exercise vs Control

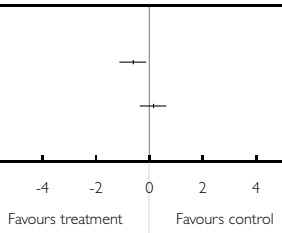
Analysis 4.4. Comparison 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST, Outcome 4 Function (NPQ): 6 weeks of treatment + 6 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome: 4 Function (NPQ): 6 weeks of treatment + 6 weeks follow-up

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 Isometric neck exercises +/- pillow vs pillow or placebo						
Helewa 2007 (1)	33	14.1 (10.6)	32	21.5 (13.1)		-0.61 [-1.11, -0.12]
Helewa 2007 (2)	29	20.1 (11.6)	34	18.6 (10)		0.14 [-0.36, 0.63]



(1) Exercise + Pillow vs Pillow

(2) Exercise vs Control

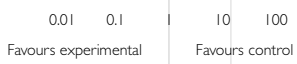
Analysis 4.5. Comparison 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST, Outcome 5 Global Perceived Effect Treatment (patients assessment): 3 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome: 5 Global Perceived Effect Treatment (patients assessment): 3 weeks of treatment

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Risk Ratio M-H,Random,95% CI
1 Isometric exercises vs no intervention				
Goldie 1970	7/24	16/23		0.42 [0.21, 0.83]



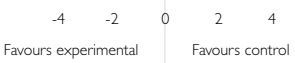
Analysis 4.6. Comparison 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST, Outcome 6 Quality of Life (SF-36): 6 weeks of treatment + 6 w follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 4 Chronic MND: Static Cervical Strengthening + Static Stabilization vs NO INTERVENTION OR WAIT LIST

Outcome: 6 Quality of Life (SF-36): 6 weeks of treatment + 6 w follow-up

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 Isometric neck exercises +/- pillow vs pillow or placebo						
Helewa 2007 (1)	33	-52.1 (6.5)	32	-48.5 (8.9)		-0.46 [-0.95, 0.04]
Helewa 2007 (2)	29	-48.7 (9.6)	34	-50 (7)		0.15 [-0.34, 0.65]



(1) Exercise + Pillow vs Pillow

(2) Exercise vs Control

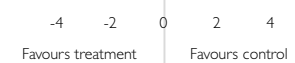
Analysis 5.1. Comparison 5 (sub)Acute/Chronic MND: Scapulothoracic + UE Strengthening vs Control, Outcome 1 Pain Intensity (VAS): 10 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 5 (sub)Acute/Chronic MND: Scapulothoracic + UE Strengthening vs Control

Outcome: 1 Pain Intensity (VAS): 10 weeks of treatment

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 Strength Specific Training vs Reference Group						
Andersen 2008	18	8 (9)	8	30 (22)		-1.51 [-2.46, -0.57]



Analysis 5.2. Comparison 5 (sub)Acute/Chronic MND: Scapulothoracic + UE Strengthening vs Control, Outcome 2 Pain Intensity (VAS): 10 weeks of treatment + 10 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 5 (sub)Acute/Chronic MND: Scapulothoracic + UE Strengthening vs Control

Outcome: 2 Pain Intensity (VAS): 10 weeks of treatment + 10 weeks follow-up

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 Strength Specific Training vs Reference Group						
Andersen 2008	18	16 (14)	8	30 (18)		-0.89 [-1.76, -0.01]

Analysis 6.1. Comparison 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM, Outcome 1 Pain Intensity (VAS): 8 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome: 1 Pain Intensity (VAS): 8 weeks of treatment

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 General Exercise vs Sham US						
Kjellman 2002 (1)	20	27 (26)	25	21 (20)		0.26 [-0.33, 0.85]

(1) GENERAL EXERCISE vs Sham US

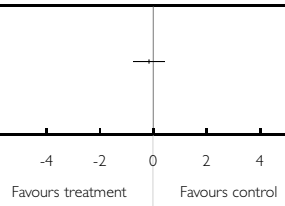
Analysis 6.2. Comparison 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM, Outcome 2 Pain Intensity (VAS): 8 weeks of treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome: 2 Pain Intensity (VAS): 8 weeks of treatment + 6 month follow-up

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 General Exercise vs Sham US						
Kjellman 2002 (1)	20	23 (26)	25	27 (23)		-0.16 [-0.75, 0.43]



(1) GENERAL EX vs Sham US

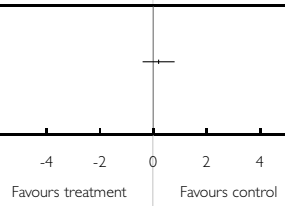
Analysis 6.3. Comparison 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM, Outcome 3 Pain Intensity (VAS): 8 weeks of treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome: 3 Pain Intensity (VAS): 8 weeks of treatment + 12 month follow-up

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 General Exercise vs Sham US						
Kjellman 2002 (1)	20	30 (27)	25	25 (24)		0.19 [-0.40, 0.78]



(1) GENERAL EX vs Sham US

Analysis 6.4. Comparison 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM, Outcome 4 Function (NDI): 8 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome: 4 Function (NDI): 8 weeks of treatment

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 General Exercise vs Sham US						
Kjellman 2002 (1)	20	21 (16)	25	19 (13)		0.14 [-0.45, 0.73]

(1) GENERAL EX vs Sham US

Analysis 6.5. Comparison 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM, Outcome 5 Function (NDI): 8 weeks of treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome: 5 Function (NDI): 8 weeks of treatment + 6 month follow-up

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 General Exercise vs Sham US						
Kjellman 2002 (1)	20	17 (17)	24	18 (15)		-0.06 [-0.66, 0.53]

(1) General EX vs Sham US

Analysis 6.6. Comparison 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM, Outcome 6 Function (NDI): 8 weeks treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 6 Chronic MND: Cervical/UE Stretch/ROM Exercise + Cervical/UE Strengthening + Dynamic Cervical Stabilization vs PLACEBO or SHAM

Outcome: 6 Function (NDI): 8 weeks treatment + 12 month follow-up

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 General Exercise vs Sham US						
Kjellman 2002 (1)	20	18 (17)	24	16 (15)		0.12 [-0.47, 0.72]

(1) General EX vs Sham US

Analysis 7.1. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 1 Pain Intensity: Immediate Post Treatment (<11w of treatment).

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 1 Pain Intensity: Immediate Post Treatment (<11w of treatment)

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Exercise +/- Infrared +/- SMT +/- Acupuncture vs Infrared or SMT or Acupuncture							
Bronfort 2001 (1)	51	2.4 (1.8)	50	2.9 (2.1)		32.1 %	-0.25 [-0.65, 0.14]
Chiu 2005	59	3 (2.3)	62	3.8 (2.3)		38.2 %	-0.35 [-0.70, 0.01]
Franca 2008	16	6.8 (9.4)	15	15.3 (13)		9.2 %	-0.73 [-1.46, 0.00]
Martel 2011	32	1.6 (2.3)	32	2.1 (2.3)		20.4 %	-0.21 [-0.71, 0.28]
Subtotal (95% CI)	**158**		**159**			**100.0 %**	**-0.33 [-0.55, -0.10]**
Heterogeneity: Tau² = 0.0; Chi² = 1.53, df = 3 (P = 0.67); I² =0.0%							
Test for overall effect: Z = 2.87 (P = 0.0041)							

(1) G2: low technology exercise

Analysis 7.2. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 2 Pain Intensity: 11 w of treatment + 3 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 2 Pain Intensity: 11 w of treatment + 3 month follow-up

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 SMT + Rehab Exercises vs SMT						
Bronfort 2001 (1)	51	2.9 (2.1)	50	3.7 (2.3)		-0.36 [-0.75, 0.03]

(1) G2: low technology exercise

Analysis 7.3. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 3 Pain Intensity: Treatment + IT follow-up (11 weeks of treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

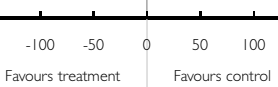
Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 3 Pain Intensity: Treatment + IT follow-up (11 weeks of treatment + 6 month follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 <11w of treatment + 6 month follow-up							
Bronfort 2001 (1)	51	3 (2.1)	50	3.5 (2.5)		42.5 %	-0.22 [-0.61, 0.18]
Chiu 2005	48	3.1 (2.4)	61	3.9 (2.4)		44.9 %	-0.33 [-0.71, 0.05]
Franca 2008	16	10.06 (12.3)	15	19.3 (21.5)		12.6 %	-0.52 [-1.24, 0.20]
Subtotal (95% CI)	**115**		**126**			**100.0 %**	**-0.31 [-0.56, -0.05]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.56$, df = 2 (P = 0.76); $I^2 = 0.0\%$

Test for overall effect: Z = 2.35 (P = 0.019)



(1) G2: low technology excercise (SMT/Ex vs SMT)

Analysis 7.4. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 4 Pain Intensity: Treatment + LT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 4 Pain Intensity: Treatment + LT follow-up

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 <11w of treatment + 24 month follow-up						
Bronfort 2001 (1)	51	3.4 (2.4)	50	3.9 (2.3)		-0.21 [-0.60, 0.18]

(1) G2: low technology exercise (SMT/Ex vs SMT)

Analysis 7.5. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 5 Function: Immediate Post treatment.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 5 Function: Immediate Post treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 <11w of treatment							
Bronfort 2001 (1)	51	13.8 (8.6)	50	15.4 (11.7)		31.9 %	-0.15 [-0.55, 0.24]
Chiu 2005	59	1 (0.5)	62	1.1 (0.6)		37.1 %	-0.18 [-0.54, 0.18]
Franca 2008	16	7.3 (3.7)	15	14 (9.7)		9.8 %	-0.90 [-1.64, -0.16]
Martel 2011	32	11.3 (11.8)	32	13.7 (12.1)		21.2 %	-0.20 [-0.69, 0.29]
Subtotal (95% CI)	**158**		**159**			**100.0 %**	**-0.25 [-0.48, -0.01]**

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 3.35$, df = 3 (P = 0.34); $I^2 = 10\%$

Test for overall effect: Z = 2.03 (P = 0.042)

(1) SMT/Ex vs SMT

Analysis 7.6. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 6 Function: Treatment + ST follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 6 Function: Treatment + ST follow-up

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 <11w of treatment + 3 month follow-up						
Bronfort 2001 (1)	51	13.6 (10.2)	50	18.7 (13)		-0.43 [-0.83, -0.04]

(1) G2: low technology exercise (SMT/Ex vs SMT)

Analysis 7.7. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 7 Function: Treatment + IT follow-up.

Review: Exercises for mechanical neck disorders

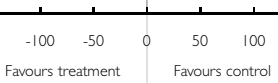
Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 7 Function: Treatment + IT follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 <11w of treatment + 6 month follow-up							
Franca 2008	16	10.2 (6.4)	15	17.6 (8.7)		12.7 %	-0.95 [-1.70, -0.20]
Bronfort 2001 (1)	51	14.3 (10.2)	50	17.5 (2.1)		42.2 %	-0.43 [-0.82, -0.03]
Chiu 2005	48	1 (0.5)	61	1.2 (0.7)		45.1 %	-0.32 [-0.70, 0.06]
Subtotal (95% CI)	**115**		**126**			**100.0 %**	**-0.45 [-0.72, -0.18]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 2.16$, df = 2 (P = 0.34); $I^2 = 7\%$

Test for overall effect: Z = 3.23 (P = 0.0012)



(1) G2: low technology exercise

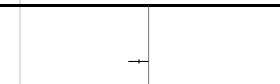
Analysis 7.8. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 8 Function: Treatment + LT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 8 Function: Treatment + LT follow-up

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 <11w of treatment + 24 month follow-up						
Bronfort 2001 (1)	51	15.6 (11.8)	50	20.5 (13.5)		-0.38 [-0.78, 0.01]



(1) SMT/Ex vs SMT

Analysis 7.9. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 9 Quality of Life: Immediate Post Treatment.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

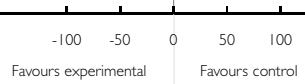
Outcome: 9 Quality of Life: Immediate Post Treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 <11w of treatment							
Bronfort 2001 (1)	51	-81.7 (12)	50	-78.8 (16.1)		61.1 %	-0.20 [-0.59, 0.19]
Martel 2011	32	-54.1 (7.2)	32	-53.1 (6.9)		38.9 %	-0.14 [-0.63, 0.35]
Subtotal (95% CI)	**83**		**82**			**100.0 %**	**-0.18 [-0.48, 0.13]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.04$, df = 1 (P = 0.84); $I^2 = 0.0\%$

Test for overall effect: Z = 1.14 (P = 0.25)

Test for subgroup differences: Not applicable



(1) G2: low technology exercise (SMT/Ex vs SMT)

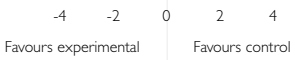
Analysis 7.10. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 10 Quality of Life: Treatment + ST follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 10 Quality of Life: Treatment + ST follow-up

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
11w of treatment + 3 month follow-up						
Bronfort 2001 (1)	51	-78.4 (14.2)	50	-74.9 (17.8)		-0.22 [-0.61, 0.18]



(1) G2: low technology exercise (SMT/Ex vs SMT)

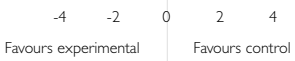
Analysis 7.11. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 11 Quality of Life: Treatment + IT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 11 Quality of Life: Treatment + IT follow-up

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
11w of treatment + 6 month follow-up						
Bronfort 2001 (1)	51	-79.8 (12.4)	50	-74.9 (17.8)		-0.32 [-0.71, 0.08]



(1) G2: low technology exercise (SMT/Ex vs SMT)

Analysis 7.12. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 12 Quality of Life: Treatment + LT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 12 Quality of Life: Treatment + LT follow-up

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 11w of treatment + 24 month follow-up						
Bronfort 2001 (1)	51	-76.2 (15.3)	50	-70.8 (20.4)		-0.30 [-0.69, 0.09]

(1) G2: low technology exercise (SMT/Ex vs SMT)

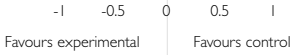
Analysis 7.13. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 13 Patient Satisfaction: Immediate Post Treatment.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 13 Patient Satisfaction: Immediate Post Treatment

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 11>w of treatment						
Bronfort 2001 (1)	51	76.9 (41.8)	50	95.2 (48.6)		-0.40 [-0.80, -0.01]



(1) G2: low technology exercise (SMT/Ex vs SMT)

Analysis 7.14. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 14 Patient Satisfaction: Treatment + ST follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 14 Patient Satisfaction: Treatment + ST follow-up

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 11w of treatment + 3 month follow-up						
Bronfort 2001 (1)	51	70.8 (41)	50	91.7 (44.9)		-0.48 [-0.88, -0.09]

(1) G2: low technology exercise (SMT/Ex vs SMT)

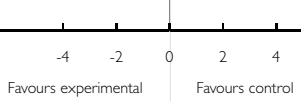
Analysis 7.15. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 15 Patient Satisfaction: Treatment + IT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 15 Patient Satisfaction: Treatment + IT follow-up

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 11w of treatment + 6 month follow-up						
Bronfort 2001 (1)	51	67.7 (39.6)	50	91.9 (48.5)		-0.54 [-0.94, -0.15]



(1) G2: low technology exercise (SMT/Ex vs SMT)

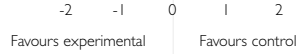
Analysis 7.16. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 16 Patient Satisfaction: Treatment + LT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 16 Patient Satisfaction: Treatment + LT follow-up

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 11w of treatment + 24 month follow-up						
Bronfort 2001 (1)	51	54.4 (34.6)	50	88.3 (37.4)		-0.93 [-1.35, -0.52]



(1) G2: low technology exercise (SMT/Ex vs SMT)

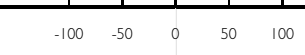
Analysis 7.17. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 17 Global Perceived Effect: Immediate Post Treatment.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 17 Global Perceived Effect: Immediate Post Treatment

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 11w of treatment						
Bronfort 2001 (1)	51	76.6 (43.3)	50	95.6 (46.8)		-0.42 [-0.81, -0.02]



(1) G2: low technology exercise (SMT/Ex vs SMT)

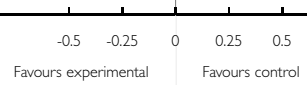
Analysis 7.18. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 18 Global Perceived Effect: Treatment + ST follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 18 Global Perceived Effect: Treatment + ST follow-up

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 11w of treatment + 3 month follow-up						
Bronfort 2001 (1)	51	77.5 (41.9)	50	91.3 (44.6)		-0.32 [-0.71, 0.08]



(1) G2: low technology exercise (SMT/Ex vs SMT)

Analysis 7.19. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 19 Global Perceived Effect: Treatment + IT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 19 Global Perceived Effect: Treatment + IT follow-up

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 11w of treatment + 6 month follow-up						
Bronfort 2001 (1)	51	75.7 (43.5)	50	90.9 (45.7)		-0.34 [-0.73, 0.05]

(1) G2: low technology exercise (SMT/Ex vs SMT)

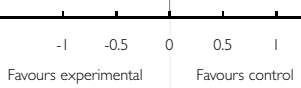
Analysis 7.20. Comparison 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION, Outcome 20 Global Perceived Effect: Treatment + LT follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 7 Chronic MND: Cervical/UE Stretch/ROM Exercises + Cervical/Scapulothoracic+/-UE Strengthening + Dynamic/Static Cervical Stabilization + ANOTHER INTERVENTION vs THAT SAME INTERVENTION

Outcome: 20 Global Perceived Effect: Treatment + LT follow-up

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 11w of treatment + 24 month follow-up						
Bronfort 2001 (1)	51	65.7 (40.6)	50	83.1 (41.7)		-0.42 [-0.81, -0.03]



(1) G2: low technology exercise (SMT/Ex vs SMT)

Analysis 8.1. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 1 Pain Intensity (VAS): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

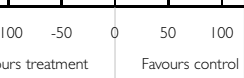
Outcome: 1 Pain Intensity (VAS): 12 weeks of treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Exercise Therapy vs No Treatment							
Rendant 2011	36	28.2 (21.9)	41	45.5 (19.4)		50.3 %	-0.83 [-1.30, -0.36]
von Trott 2009 (1)	35	44.5 (25.7)	35	54.9 (28.5)		49.7 %	-0.38 [-0.85, 0.09]
Subtotal (95% CI)	**71**		**76**			**100.0 %**	**-0.61 [-1.05, -0.16]**

Heterogeneity: $Tau^2 = 0.04$; $Chi^2 = 1.78$, df = 1 (P = 0.18); $I^2 = 44\%$

Test for overall effect: Z = 2.68 (P = 0.0073)

Test for subgroup differences: Not applicable



(1) PT vs wait

Analysis 8.2. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 2 Pain Intensity (VAS): 24 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 2 Pain Intensity (VAS): 24 weeks of treatment

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 Exercise Therapy vs No Treatment						
Rendant 2011	35	28.5 (20.8)	39	38.8 (21.6)		-0.48 [-0.94, -0.02]

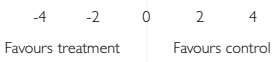
Analysis 8.3. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 3 Pain Intensity (VAS): 12 weeks of treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 3 Pain Intensity (VAS): 12 weeks of treatment + 12 weeks follow-up

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 Exercise Therapy vs No Treatment						
von Trott 2009 (1)	34	47.7 (30.5)	32	59.9 (25.5)		-0.43 [-0.92, 0.06]



(1) PT vs wait list

Analysis 8.4. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 4 Function (NPDS): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

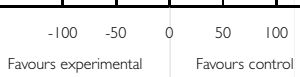
Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 4 Function (NPDS): 12 weeks of treatment

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Exercise Therapy vs No Treatment							
Rendant 2011	36	29.2 (17.5)	41	42 (15.2)		50.2 %	-0.78 [-1.24, -0.31]
von Trott 2009 (1)	35	33.6 (25.5)	35	39.1 (21.7)		49.8 %	-0.23 [-0.70, 0.24]
Subtotal (95% CI)	**71**		**76**			**100.0 %**	**-0.50 [-1.04, 0.03]**

Heterogeneity: $Tau^2 = 0.09$; $Chi^2 = 2.63$, df = 1 (P = 0.10); I^2 =62%

Test for overall effect: Z = 1.84 (P = 0.065)



(1) PT vs wait list

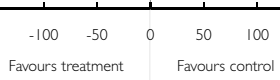
Analysis 8.5. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 5 Function (NPDS): 24 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 5 Function (NPDS): 24 weeks of treatment

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 Exercise Therapy vs No Treatment						
Rendant 2011	35	29.7 (18.1)	39	38.9 (18.1)		-0.50 [-0.97, -0.04]



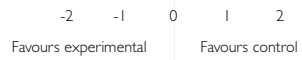
Analysis 8.6. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 6 Function (NPDS) 12 weeks treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 6 Function (NPDS) 12 weeks treatment + 12 weeks follow-up

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 Exercise Therapy vs No Treatment						
von Trott 2009 (1)	34	34.3 (24.8)	32	41.3 (23.4)		-0.29 [-0.77, 0.20]



(1) PT vs wait list

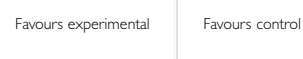
Analysis 8.7. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 7 Global Perceived Effect (General Health Perception): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 7 Global Perceived Effect (General Health Perception): 12 weeks of treatment

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 Exercise Therapy vs No Treatment						
von Trott 2009 (1)	35	37.2 (7.2)	35	36.4 (9.8)		0.09 [-0.38, 0.56]



(1) PRT vs wait list

Analysis 8.8. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 8 Global Perceived Effect (General Health Perception): 12 weeks of treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 8 Global Perceived Effect (General Health Perception): 12 weeks of treatment + 12 weeks follow-up

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 Exercise Therapy vs No Treatment						
von Trott 2009 (1)	34	34.8 (10.6)	32	36.9 (9.2)		-0.21 [-0.69, 0.28]

(1) PT vs wait list

Analysis 8.9. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 9 Quality of Life (SF-36): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

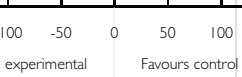
Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 9 Quality of Life (SF-36): 12 weeks of treatment

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Exercise Therapy vs No Treatment							
Rendant 2011	36	-45.7 (9.4)	41	-43 (8.7)		53.6 %	-0.30 [-0.75, 0.15]
von Trott 2009 (1)	34	-30.3 (7.8)	32	-28.6 (9.7)		46.4 %	-0.19 [-0.68, 0.29]
Subtotal (95% CI)	**70**		**73**			**100.0 %**	**-0.25 [-0.58, 0.08]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.10$, df = 1 (P = 0.76); $I^2 = 0.0\%$

Test for overall effect: Z = 1.47 (P = 0.14)



(1) PT vs wait list

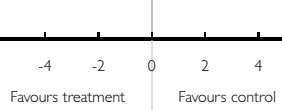
Analysis 8.10. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 10 Quality of Life (SF-36): 24 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 10 Quality of Life (SF-36): 24 weeks of treatment

Study or subgroup	Treatement N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 Exercise Therapy vs No Treatment						
Rendant 2011	35	-45 (8.3)	39	-43 (8.5)		-0.24 [-0.69, 0.22]



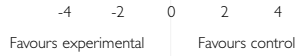
Analysis 8.11. Comparison 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST, Outcome 11 Quality of Life (SF-36): 12 weeks of treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 8 Chronic MND: Cervical Stretch/ROM Exercises + Cervical/Scapulothoracic Strengthening + Static/Dynamic Cervical/Shoulder Stabilization vs WAIT LIST

Outcome: 11 Quality of Life (SF-36): 12 weeks of treatment + 12 weeks follow-up

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Std. Mean Difference IV,Fixed,95% CI
1 Exercise Therapy vs No Treatment						
von Trott 2009 (1)	35	-29.3 (8.8)	35	-31.5 (8.3)		0.25 [-0.22, 0.72]



(1) PRT vs wait list

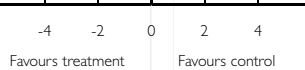
Analysis 9.1. Comparison 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST, Outcome 1 Pain Intensity (VAS): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome: 1 Pain Intensity (VAS): 12 weeks of treatment

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 Dynamic muscle training vs control						
Viljanen 2006	135	2.9 (2.6)	130	2.7 (2.5)		0.08 [-0.16, 0.32]



Analysis 9.2. Comparison 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST, Outcome 2 Pain Intensity (VAS): 12 weeks of treatment + 3 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome: 2 Pain Intensity (VAS): 12 weeks of treatment + 3 month follow-up

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 Dynamic muscle training vs control						
Viljanen 2006	135	2.9 (2.8)	130	2.9 (2.8)		0.0 [-0.24, 0.24]

Analysis 9.3. Comparison 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST, Outcome 3 Pain Intensity (VAS): 12 weeks of treatment + 9 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome: 3 Pain Intensity (VAS): 12 weeks of treatment + 9 month follow-up

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 Dynamic muscle training vs control						
Viljanen 2006	135	3.1 (2.5)	130	3.2 (2.5)		-0.04 [-0.28, 0.20]

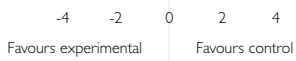
Analysis 9.4. Comparison 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST, Outcome 4 Function (Neck Disability 0-80): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome: 4 Function (Neck Disability 0-80): 12 weeks of treatment

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 Dynamic muscle training vs control						
Viljanen 2006	135	15 (14.6)	130	14 (13.8)		0.07 [-0.17, 0.31]



Analysis 9.5. Comparison 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST, Outcome 5 Function (Neck Disability 0-80): 12 weeks of treatment + 3 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome: 5 Function (Neck Disability 0-80): 12 weeks of treatment + 3 month follow-up

Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Fixed,95% CI	Std. Mean Difference IV,Fixed,95% CI
1 Dynamic muscle training vs control						
Viljanen 2006	135	15 (15.4)	130	14 (13.8)		0.07 [-0.17, 0.31]

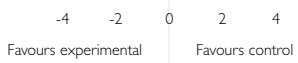
Analysis 9.6. Comparison 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST, Outcome 6 Function (Neck Disability 0-80): 12 weeks of treatment + 9 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 9 Chronic MND: Cervical/Scapulothoracic/UE Stretch + UE Endurance Training vs NO INTERVENTION or WAIT LIST

Outcome: 6 Function (Neck Disability 0-80): 12 weeks of treatment + 9 month follow-up

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 Dynamic muscle training vs control						
Viljanen 2006	135	19 (15.5)	128	17 (13.7)		0.14 [-0.11, 0.38]



Analysis 10.1. Comparison 10 Chronic MND: Cervical/Scapulothoracic Strengthening + Cervical/Scapulothoracic Endurance Training, Outcome 1 Pain Prevelance during previous week: 6 weeks of treatment + 46 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 10 Chronic MND: Cervical/Scapulothoracic Strengthening + Cervical/Scapulothoracic Endurance Training

Outcome: 1 Pain Prevelance during previous week: 6 weeks of treatment + 46 weeks follow-up

Study or subgroup	Exercise n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Risk Ratio M-H,Random,95% CI
1 Exercise Regimen vs control group				
Ang 2009	5/28	11/28		0.45 [0.18, 1.14]

Analysis 11.1. Comparison 11 (sub)Acute/Chronic MND: Scapulothoracic/UE Endurance Training, Outcome 1 Pain Intensity (VAS): 10 weeks treatment.

Review: Exercises for mechanical neck disorders

Comparison: 11 (sub)Acute/Chronic MND: Scapulothoracic/UE Endurance Training

Outcome: 1 Pain Intensity (VAS): 10 weeks treatment

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 2 min training group vs Control						
Andersen 2011 (1)	63	2.2 (1.8)	64	3.5 (2.1)		-0.66 [-1.02, -0.30]
2 12 min training group vs Control						
Andersen 2011 (2)	65	2.2 (2.3)	64	3.5 (2.1)		-0.59 [-0.94, -0.23]

(1) 2 min vs Control

(2) 12 min vs Control

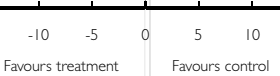
Analysis 12.1. Comparison 12 Chronic MND: Neuromuscular Education (eye neck coordination/proprioception) + ANOTHER INTERVENTION VS THAT SAME INTERVENTION, Outcome 1 Pain Intensity (VAS): 8 weeks treatment + 10 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 12 Chronic MND: Neuromuscular Education (eye neck coordination/proprioception) + ANOTHER INTERVENTION VS THAT SAME INTERVENTION

Outcome: 1 Pain Intensity (VAS): 8 weeks treatment + 10 weeks follow-up

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 Rehabilitation Group vs Control Group						
Revel 1994	30	-21.8 (25.2)	30	-4.3 (19.6)		-0.77 [-1.29, -0.24]



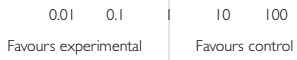
Analysis 12.2. Comparison 12 Chronic MND: Neuromuscular Education (eye neck coordination/proprioception) + ANOTHER INTERVENTION VS THAT SAME INTERVENTION, Outcome 2 Function (pt's assessment of functional improvement): 8 weeks treatment + 10 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 12 Chronic MND: Neuromuscular Education (eye neck coordination/proprioception) + ANOTHER INTERVENTION VS THAT SAME INTERVENTION

Outcome: 2 Function (pt's assessment of functional improvement): 8 weeks treatment + 10 weeks follow-up

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Risk Ratio M-H,Random,95% CI
1 Rehabilitation Group vs Control Group				
Revel 1994	12/30	22/30		0.55 [0.33, 0.89]



Analysis 13.1. Comparison 13 Chronic MND:Trunk/Extremity Stretch + Pattern/Synchronization: Balance and Coordination + Cardiovascular/Aerobic vs NO TREATMENT, Outcome 1 Pain Intensity (VAS): 10 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 13 Chronic MND:Trunk/Extremity Stretch + Pattern/Synchronization: Balance and Coordination + Cardiovascular/Aerobic vs NO TREATMENT

Outcome: 1 Pain Intensity (VAS): 10 weeks of treatment

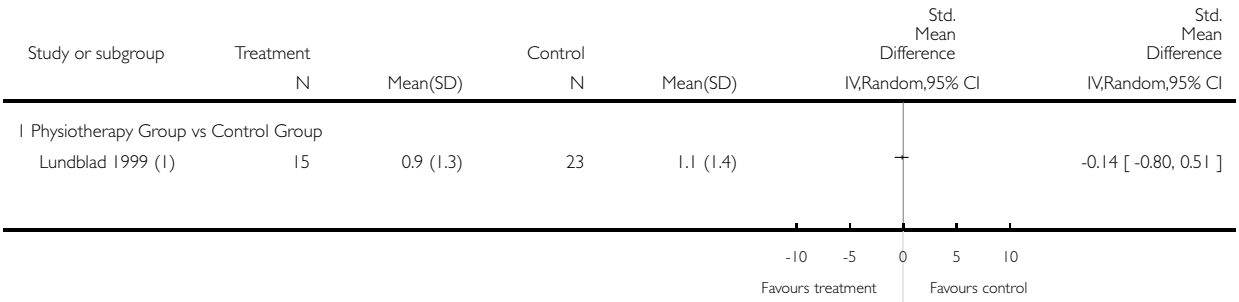
Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 Group Gymnastics vs Control						
Takala 1994	22	-9 (12)	22	-8 (18.5)		-0.06 [-0.65, 0.53]

Analysis 14.1. Comparison 14 Chronic MND:General Endurance Training + Dynamic/Static Lowback/pelvic Stabilization + General Stretching + Neuromuscular/body Mechanics Movement Training vs NO INTERVENTION OR WAIT LIST, Outcome 1 Pain Intensity (VAS): 16 weeks treatment + 6 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 14 Chronic MND:General Endurance Training + Dynamic/Static Lowback/pelvic Stabilization + General Stretching + Neuromuscular/body Mechanics Movement Training vs NO INTERVENTION OR WAIT LIST

Outcome: 1 Pain Intensity (VAS): 16 weeks treatment + 6 weeks follow-up



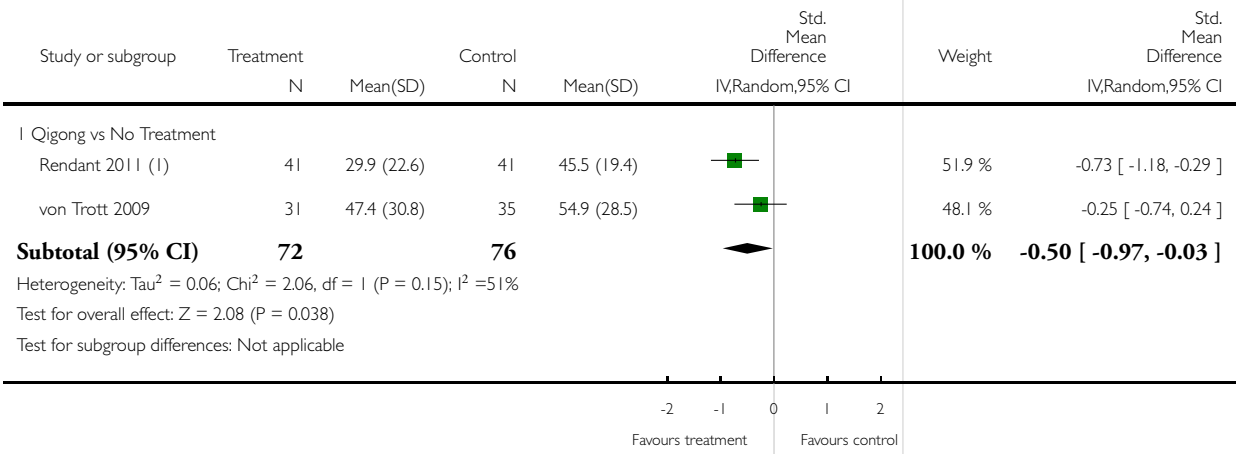
(1) PT vs no treatment

Analysis 15.1. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 1 Pain Intensity (VAS): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 1 Pain Intensity (VAS): 12 weeks of treatment



(1) Qigong vs No Treatment

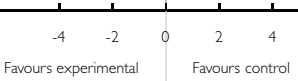
Analysis 15.2. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 2 Pain Intensity (VAS): 24 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 2 Pain Intensity (VAS): 24 weeks of treatment

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 Qigong vs No Treatment						
Rendant 2011	39	30.8 (16.2)	39	38.9 (18.1)		-0.47 [-0.92, -0.02]



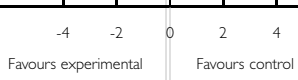
Analysis 15.3. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 3 Pain Intensity (VAS): 12 weeks of treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 3 Pain Intensity (VAS): 12 weeks of treatment + 12 weeks follow-up

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 Qigong vs No Treatment						
von Trott 2009 (1)	27	53.1 (30.6)	32	59.9 (25.5)		-0.24 [-0.75, 0.27]



(1) Qigong vs wait list

Analysis 15.4. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 4 Function (NPDS): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

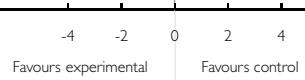
Outcome: 4 Function (NPDS): 12 weeks of treatment

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Qigong vs No Treatment							
Rendant 2011 (1)	41	34.2 (16.9)	41	42 (15.2)		54.9 %	-0.48 [-0.92, -0.04]
von Trott 2009 (2)	31	34.3 (23.6)	35	39.1 (21.7)		45.1 %	-0.21 [-0.69, 0.28]
Subtotal (95% CI)	**72**		**76**			**100.0 %**	**-0.36 [-0.68, -0.03]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.66$, df = 1 (P = 0.42); $I^2 = 0.0\%$

Test for overall effect: Z = 2.16 (P = 0.031)

Test for subgroup differences: Not applicable



(1) Quigong vs wait list

(2) Qigong vs wait list

Analysis 15.5. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 5 Function (NPDAS): 24 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 5 Function (NPDAS): 24 weeks of treatment

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 Qigong vs No Treatment						
Rendant 2011	39	30.8 (16.2)	39	38.9 (18.1)		-0.47 [-0.92, -0.02]

Analysis 15.6. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 6 Function (NPDS): 12 weeks of treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 6 Function (NPDS): 12 weeks of treatment + 12 weeks follow-up

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 Qigong vs No Treatment						
von Trott 2009	27	39.8 (25.8)	32	41.3 (23.4)		-0.06 [-0.57, 0.45]

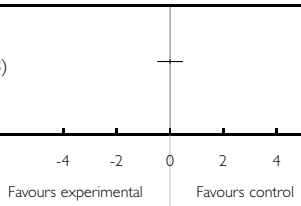
Analysis 15.7. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 7 Global Perceived Effect (General Health Perception): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 7 Global Perceived Effect (General Health Perception): 12 weeks of treatment

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 Qigong vs No Treatment						
von Trott 2009 (1)	31	36.3 (9.1)	35	36.4 (9.8)		-0.01 [-0.49, 0.47]



(1) Qigong vs wait list

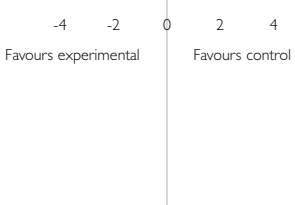
Analysis 15.8. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 8 Global Perceived Effect (General Health Perception): 12 weeks of treatment + 12 weeks Follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 8 Global Perceived Effect (General Health Perception): 12 weeks of treatment + 12 weeks Follow-up

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 Qigong vs No Treatment						
von Trott 2009 (1)	27	36.1 (8.4)	32	36.9 (9.2)		-0.09 [-0.60, 0.42]



(1) Qigong vs wait list

Analysis 15.9. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 9 Quality of Life (SF-36 physical component): 12 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

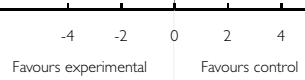
Outcome: 9 Quality of Life (SF-36 physical component): 12 weeks of treatment

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 Qigong vs No Treatment							
Rendant 2011 (1)	41	-46.6 (8.3)	41	-43.2 (8.2)		55.1 %	-0.41 [-0.85, 0.03]
von Trott 2009 (2)	31	-30.4 (7.4)	35	-28.6 (9.7)		44.9 %	-0.20 [-0.69, 0.28]
Subtotal (95% CI)	**72**		**76**			**100.0 %**	**-0.32 [-0.64, 0.01]**

Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.37$, df = 1 (P = 0.54); $I^2 = 0.0\%$

Test for overall effect: Z = 1.91 (P = 0.056)

Test for subgroup differences: Not applicable



(1) Quigong vs wait list

(2) Qigong vs wait list

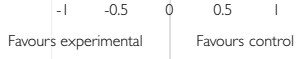
Analysis 15.10. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 10 Quality of Life (SF-36 physical component): 24 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 10 Quality of Life (SF-36 physical component): 24 weeks of treatment

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 Qigong vs No Treatment						
Rendant 2011	39	-47 (10.2)	39	-43.1 (8.5)		-0.41 [-0.86, 0.04]



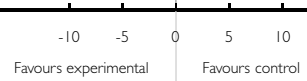
Analysis 15.11. Comparison 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness & emotional balance) vs WAIT LIST, Outcome 11 Quality of Life (SF-36 physical component): 12 weeks of treatment + 12 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 15 Chronic MND: Stretch/ROM + Endurance Training + Dynamic Stabilization + Cognitive (mindfulness % emotional balance) vs WAIT LIST

Outcome: 11 Quality of Life (SF-36 physical component): 12 weeks of treatment + 12 weeks follow-up

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 Qigong vs No Treatment						
von Trott 2009	27	-31.4 (7.7)	32	-31.5 (8.3)		0.01 [-0.50, 0.52]



Analysis 16.1. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 1 Pain Intensity: (0-10 box scale): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 1 Pain Intensity: (0-10 box scale): 6 weeks of treatment

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 Exercise + Advice vs Advice						
Stewart 2007	66	3.2 (2.2)	66	4.3 (2.5)		-0.46 [-0.81, -0.12]

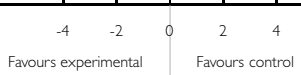
Analysis 16.2. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 2 Pain Intensity (0-10 box scale): 6 weeks treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 2 Pain Intensity (0-10 box scale): 6 weeks treatment + 12 month follow-up

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 Exercise + Advice vs Advice						
Stewart 2007	63	3.5 (2.3)	62	3.8 (2.7)		-0.12 [-0.47, 0.23]



Analysis 16.3. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 3 Function (NDI): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 3 Function (NDI): 6 weeks of treatment

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 Exercise + Advice vs Advice						
Stewart 2007	66	12 (6.8)	66	15.7 (7.9)		-0.50 [-0.85, -0.15]

Analysis 16.4. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 4 Function (NDI): 6 weeks of treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 4 Function (NDI): 6 weeks of treatment + 12 month follow-up

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 Exercise + Advice vs Advice						
Stewart 2007	63	12.1 (7.5)	62	15.5 (9.9)		-0.39 [-0.74, -0.03]

Analysis 16.5. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 5 Global Perceived Effect (-5 to 5 scale): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 5 Global Perceived Effect (-5 to 5 scale): 6 weeks of treatment

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 Exercise + Advice vs Advice						
Stewart 2007	66	-2.5 (1.8)	66	-1.5 (2.5)		-0.46 [-0.80, -0.11]

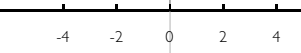
Analysis 16.6. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 6 Global Perceived Effect (-5 to 5 scale): 6 weeks of treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 6 Global Perceived Effect (-5 to 5 scale): 6 weeks of treatment + 12 month follow-up

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 Exercise + Advice vs Advice						
Stewart 2007	63	-2.3 (2)	62	-1.9 (2.3)		-0.18 [-0.54, 0.17]



Analysis 16.7. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 7 Quality of Life (SF-36): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 7 Quality of Life (SF-36): 6 weeks of treatment

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 Exercise + Advice vs Advice						
Stewart 2007	66	-42.1 (8.9)	66	-38.9 (9.3)		-0.35 [-0.69, -0.01]

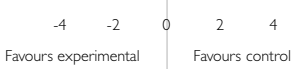
Analysis 16.8. Comparison 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT, Outcome 8 Quality of Life (SF-36): 6 weeks of treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 16 Subacute/chronic WAD: Trunk/Extremity Stretch/ROM + Trunk/Extremity Strengthening + Trunk/Extremity Endurance Training + Pattern/Synchronization: Coordination + Cardiovascular/Aerobic + Cognitive (CBT) + ANOTHER TREATMENT vs THAT SAME OTHER TREATMENT

Outcome: 8 Quality of Life (SF-36): 6 weeks of treatment + 12 month follow-up

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 Exercise + Advice vs Advice						
Stewart 2007	63	-42.3 (9.8)	62	-40.7 (11.3)		-0.15 [-0.50, 0.20]



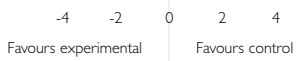
Analysis 17.1. Comparison 17 (sub)Acute CGH: Cervical Stretch/ROM vs SHAM, Outcome 1 Pain Intensity (Headache Questionnaire): Treatment + 4 weeks follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 17 (sub)Acute CGH: Cervical Stretch/ROM vs SHAM

Outcome: 1 Pain Intensity (Headache Questionnaire): Treatment + 4 weeks follow-up

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 C1-C2 Self Snag vs Placebo Group						
Hall 2007	16	31 (9)	16	51 (15)		-1.58 [-2.38, -0.77]



Analysis 17.2. Comparison 17 (sub)Acute CGH: Cervical Stretch/ROM vs SHAM, Outcome 2 Pain Intensity (Headache Questionnaire): Treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 17 (sub)Acute CGH: Cervical Stretch/ROM vs SHAM

Outcome: 2 Pain Intensity (Headache Questionnaire): Treatment + 12 month follow-up

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 C1-C2 Self Snag vs Placebo Group						
Hall 2007	16	24 (9)	16	44 (13)		-1.74 [-2.57, -0.91]

Analysis 18.1. Comparison 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST, Outcome 1 Headache Intensity (VAS 0-10): 6 weeks of treatment.

Review: Exercises for mechanical neck disorders

Comparison: 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome: 1 Headache Intensity (VAS 0-10): 6 weeks of treatment

Study or subgroup	Favours treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 Therapeutic Exercise +/- Manip vs Control Group or Manip						
Jull 2002 (1)	51	-3.26 (2.71)	46	-1.43 (2.04)		-0.75 [-1.16, -0.34]
Jull 2002 (2)	49	-3.37 (2.73)	49	-3.1 (2.24)		-0.11 [-0.50, 0.29]

(1) Exercise vs Control

(2) Ex + Manip vs Manip

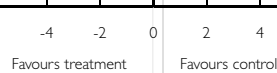
Analysis 18.2. Comparison 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST, Outcome 2 Headache Intensity (VAS 0-10): 6 weeks treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome: 2 Headache Intensity (VAS 0-10): 6 weeks treatment + 12 month follow-up

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 Therapeutic Exercise +/- Manip vs Control Group or Manip						
Jull 2002 (1)	51	-2.83 (2.64)	46	-1.32 (2.44)		-0.59 [-1.00, -0.18]
Jull 2002 (2)	48	-2.69 (2.22)	48	-2.27 (2.63)		-0.17 [-0.57, 0.23]



(1) Exercise vs Control

(2) Exercise + Manip vs Manip

Analysis 18.3. Comparison 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST, Outcome 3 Function (NPNPQ 0-36): 6 weeks treatment.

Review: Exercises for mechanical neck disorders

Comparison: 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome: 3 Function (NPNPQ 0-36): 6 weeks treatment

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 Therapeutic Exercise +/- Manip vs Control Group or Manip						
Jull 2002 (1)	51	-11.03 (15.43)	46	-3.72 (9.77)		-0.56 [-0.96, -0.15]
Jull 2002 (2)	49	-12.13 (12.6)	49	-10.69 (12.53)		-0.11 [-0.51, 0.28]

(1) Exercise vs Control

(2) Exercise + MT vs MT

Analysis 18.4. Comparison 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST, Outcome 4 Function (NPNPQ 0-36): 6 weeks treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome: 4 Function (NPNPQ 0-36): 6 weeks treatment + 12 month follow-up

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 Therapeutic Exercise +/- Manip vs Control Group or Manip						
Jull 2002 (1)	48	-14.21 (12.61)	48	-11.21 (13.03)		-0.23 [-0.63, 0.17]
Jull 2002 (2)	51	-15.66 (14.35)	46	-6.44 (11.39)		-0.70 [-1.11, -0.29]

(1) Exercise + Manip vs Manip

(2) Ex vs Control

Analysis 18.5. Comparison 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST, Outcome 5 Global Perceived Effect (VAS): 6 weeks treatment.

Review: Exercises for mechanical neck disorders

Comparison: 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome: 5 Global Perceived Effect (VAS): 6 weeks treatment

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 Therapeutic Exercise +/- Manip vs Control Group or Manip						
Jull 2002 (1)	49	-7.72 (1.96)	49	-7.09 (2.38)		-0.29 [-0.68, 0.11]
Jull 2002 (2)	51	-7.1 (2.5)	46	-0.73 (1.63)		-2.96 [-3.55, -2.38]

(1) Exercise + Manip vs Manip

(2) Exercise vs control

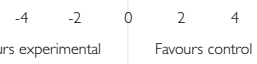
Analysis 18.6. Comparison 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST, Outcome 6 Global Perceived Effect (VAS): 6 weeks treatment + 12 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 18 Chronic CGH: Cervical/Scapulothoracic Strengthening with Endurance Training + Craniocervical Pressure Biofeedback + Dynamic Cervical Stabilization vs NO INTERVENTION or WAIT LIST

Outcome: 6 Global Perceived Effect (VAS): 6 weeks treatment + 12 month follow-up

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 Therapeutic Exercise +/- Manip vs Control Group or Manip						
Jull 2002 (1)	48	-6.89 (2.91)	48	-6.01 (2.91)		-0.30 [-0.70, 0.10]
Jull 2002 (2)	51	-6.92 (3.21)	46	-0.43 (1.56)		-2.51 [-3.05, -1.97]



(1) Exercise + Manip vs Manip

(2) Exercise vs control

Analysis 19.1. Comparison 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST, Outcome 1 Pain Intensity (VAS): 6 weeks treatment.

Review: Exercises for mechanical neck disorders

Comparison: 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST

Outcome: 1 Pain Intensity (VAS): 6 weeks treatment

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 Physiotherapy vs Control						
Kuijper 2009 (1)	68	36.2 (31)	65	51.1 (32.7)		-0.47 [-0.81, -0.12]

(1) PT vs wait list

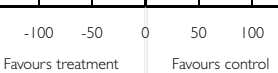
Analysis 19.2. Comparison 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST, Outcome 2 Pain Intensity (VAS): 6 weeks treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST

Outcome: 2 Pain Intensity (VAS): 6 weeks treatment + 6 month follow-up

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 Physiotherapy vs Control						
Kuijper 2009	68	20 (58.4)	61	10 (66.7)		0.16 [-0.19, 0.51]



Analysis 19.3. Comparison 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST, Outcome 3 Function (NDI): 6 weeks treatment.

Review: Exercises for mechanical neck disorders

Comparison: 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST

Outcome: 3 Function (NDI): 6 weeks treatment

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 Physiotherapy vs Control						
Kuijper 2009 (1)	68	27.8 (17.7)	65	29.9 (20)		-0.11 [-0.45, 0.23]

(1) PT vs wait list

Analysis 19.4. Comparison 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST, Outcome 4 Function (NDI): 6 weeks treatment + 6 month follow-up.

Review: Exercises for mechanical neck disorders

Comparison: 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST

Outcome: 4 Function (NDI): 6 weeks treatment + 6 month follow-up

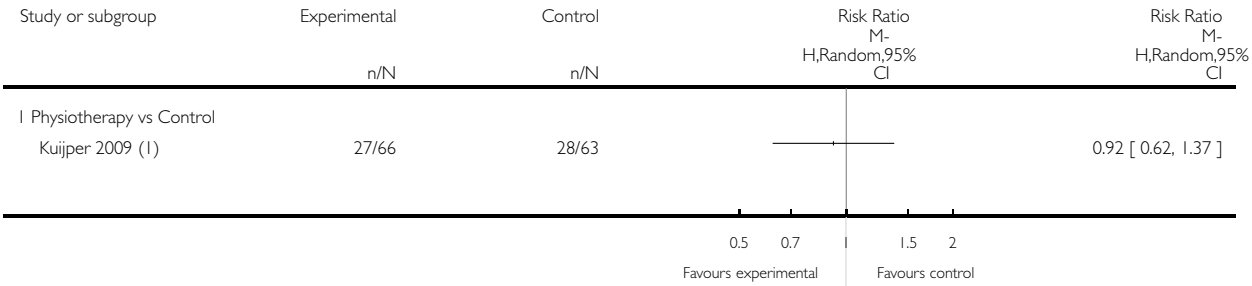
Study or subgroup	Treatment N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
1 Physiotherapy vs Control						
Kuijper 2009	68	10 (36.3)	61	8 (34.6)		0.06 [-0.29, 0.40]

Analysis 19.5. Comparison 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST, Outcome 5 Satisfaction (5 point scale): 6 weeks treatment.

Review: Exercises for mechanical neck disorders

Comparison: 19 Acute Radiculopathy: Cervical Stretch/ROM + Cervical/Scapulothoracic/UE Strengthening + Static/Dynamic Cervical Stabilization vs WAIT LIST

Outcome: 5 Satisfaction (5 point scale): 6 weeks treatment



(1) PT vs wait list

APPENDICES

Appendix 1. MEDLINE search strategy

COG Detailed Medline Search Strategies

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 [Rehabilitation]
138. exp Brachial Plexus Neuropathies/rh
139. exp neck injuries/rh or exp whiplash injuries/rh
140. thoracic outlet syndrome/rh or cervical rib syndrome/rh
141. Torticollis/rh
142. exp brachial plexus neuropathies/rh or exp brachial plexus neuritis/rh
143. 137 or 138 or 139 or 140 or 141 or 142
144. Radiculopathy/rh
145. exp temporomandibular joint disorders/rh or exp temporomandibular joint dysfunction syndrome/rh
146. myofascial pain syndromes/rh
147. exp "Sprains and Strains"/rh
148. exp Spinal Osteophytosis/rh
149. exp Neuritis/rh
150. Polyradiculopathy/rh
151. exp Arthritis/rh
152. Fibromyalgia/rh
153. spondylitis/rh or discitis/rh
154. spondylosis/rh or spondylolysis/rh or spondylolisthesis/rh
155. or/144-154
156. 59 and 155
157. exp Combined Modality Therapy/
158. Exercise/
159. Physical Exertion/
160. exp Exercise Therapy/
161. exp Rehabilitation/
162. exp Physical Therapy Modalities/
163. Hydrotherapy/
164. postur* correction.mp.
165. Feldenkrais.mp.
166. (alexander adj (technique or method)).tw.
167. Relaxation Therapy/
168. Biofeedback, Psychology/
169. or/157-168
170. 136 and 169
171. 143 or 156 or 170
172. animals/ not (animals/ and humans/)
173. 171 not 172
174. exp randomized controlled trials as topic/
175. randomized controlled trial.pt.
176. controlled clinical trial.pt.
177. (random* or sham or placebo*).tw.
178. placebos/
179. random allocation/

180. single blind method/
181. double blind method/
182. ((singl* or doubl* or trebl* or tripl*) adj25 (blind* or dumm* or mask*)).ti,ab.
183. (rct or rcts).tw.
184. (control* adj2 (study or studies or trial*)).tw.
185. or/174- 184
186. 173 and 185
187. limit 186 to yr="2006 -Current"
188. limit 186 to yr="1902 - 2005"
189. guidelines as topic/
200. practice guidelines as topic/
201. guideline.pt.
202. practice guideline.pt.
203. (guideline? or guidance or recommendations).ti.
204. consensus.ti.
205. or/189-204
206. 173 and 205
207. 136 and 205
208. 206 or 207
209. limit 208 to yr="2006 -Current"
210. limit 208 to yr="1902 - 2005"
211. meta-analysis/
212. exp meta-analysis as topic/
213. (meta analy* or metaanaly* or met analy* or metanaly*).tw.
214. review literature as topic/
215. (collaborative research or collaborative review* or collaborative overview*).tw.
216. (integrative research or integrative review* or intergrative overview*).tw.
217. (quantitative adj3 (research or review* or overview*)).tw.
218. (research integration or research overview*).tw.
219. (systematic* adj3 (review* or overview*)).tw.
220. (methodologic* adj3 (review* or overview*)).tw.
221. exp technology assessment biomedical/
222. (hta or thas or technology assessment*).tw.
223. ((hand adj2 search*) or (manual* adj search*)).tw.
224. ((electronic adj database*) or (bibliographic* adj database*)).tw.
225. ((data adj2 abstract*) or (data adj2 extract*)).tw.
226. (analys* adj3 (pool or pooled or pooling)).tw.
227. mantel haenszel.tw.
228. (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.
229. or/211-228
230. 173 and 229
231. limit 230 to yr="2006 -Current"

Appendix 2. Criteria for 'Risk of bias' Assessment

Random sequence generation (selection bias)

Selection bias (biased allocation to interventions) due to inadequate generation of a randomized 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, minimisation (minimisation 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 judgement 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 randomization); 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 standardized 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 randomized patients were reported/analysed in the group to which they were allocated by randomization.

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).

WHAT'S NEW

Last assessed as up-to-date: 29 May 2012.

Date	Event	Description
12 July 2012	New citation required but conclusions have not changed	Eligible trials were limited to those with single interventions that compared exercise with a control or comparative group. Conclusions similar
12 July 2012	New search has been performed	Updated literature search February 18 2012

HISTORY

Protocol first published: Issue 2, 2003

Review first published: Issue 3, 2005

Date	Event	Description
18 June 2008	Amended	Converted to new review format.
4 May 2008	New citation required and conclusions have changed	Substantive amendment
1 June 2005	Amended	June 2005 -- we reduced the length of the abstract; made some edits to the text for clarification; corrected the format in some of the references

CONTRIBUTIONS OF AUTHORS

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Data Abstraction, Synthesis, Manuscript Preparation, Public Responsibility, Grants, Administration - primary review authors

Final Synthesis - primary review authors

DECLARATIONS OF INTEREST

Dr. Gert Bronfort is the first author of one of the trials included in this systematic review. He was not involved in the selection of studies, quality assessment, or data extraction for the study for which he was author.

SOURCES OF SUPPORT

Internal sources

- Centric and LifeMark Health, Canada.
- McMaster University, Department of Clinical Epidemiology and Biostatistics, School of Rehabilitation Science, Occupational Health Program, Canada.
- University of Toronto, Department of Rehabilitation Medicine, Canada.

External sources

- CIHR Knowledge Synthesis Grant 2010, Canada.
- National Institutes of Health, Consortial Center for Chiropractic Research, Bethesda, MD (2002), USA.
- Hamilton Hospital Assessment Centre (2002), Canada.
- Hamilton District Research Grant (2000), Canada.
- Hamilton Health Sciences Corporation, Chedoke-McMaster Foundation (1997), Canada.
- University of Saskatchewan, Clinical Teaching and Research Award (1997), Canada.

INDEX TERMS

Medical Subject Headings (MeSH)

*Physical Therapy Modalities; Acute Pain [therapy]; Chronic Pain [therapy]; Manipulation, Chiropractic [*methods]; Neck; Neck Pain [etiology; *therapy]; Pain Management [methods]; Randomized Controlled Trials as Topic

MeSH check words

Adult; Female; Humans; Male