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Research

# Mechanical Diagnosis and Therapy has similar effects on pain and disability as 'wait and see' and other approaches in people with neck pain: a systematic review

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KEYWORDS

Exercise
Neck pain
Physiotherapy
Systematic review
Randomised controlled trials

ABSTRACT

**Questions:** In people with neck pain, does Mechanical Diagnosis and Therapy (MDT) reduce pain and disability more than 'wait and see'? Does MDT reduce pain and disability more than other interventions? Are any differences in effect clinically important? **Design:** Systematic review of randomised trials with meta-analysis. **Participants:** People with neck pain. **Intervention:** MDT. **Outcome measures:** Pain intensity and disability due to neck pain in the short (< 3 months), intermediate (< 1 year) and long term (≥ 1 year). **Results:** Five trials were included. Most comparisons demonstrated mean differences in effect that favoured MDT over wait-and-see controls or other interventions, although most were statistically non-significant. For pain, all comparisons had a 95% confidence interval (CI) with lower limits that were less than 20 on a scale of 0 to 100, which suggests that the difference may not be clinically important. For disability, even the upper limits of the 95% CI were below this threshold, confirming that the differences are not clinically important. In all of the trials, some or all of the treating therapists did not have the highest level of MDT training. **Conclusion:** The additional benefit of MDT compared with the wait-and-see approach or other therapeutic approaches may not be clinically important in terms of pain intensity and is not clinically important in terms of disability. However, these estimates of the effect of MDT may reflect suboptimal training of the treating therapists. Further research could improve the precision of the estimates and assess whether the extent of training in MDT influences its effect. [**Takasaki H, May S (2014) Mechanical Diagnosis and Therapy has similar effects on pain and disability as 'wait and see' and other approaches in people with neck pain: a systematic review. *Journal of Physiotherapy* 60: 78–84**].



## Introduction

Neck pain and disability due to neck pain are major problems in public health. A systematic review identified reports of the one-year prevalence of neck pain in general populations ranging from 4.8% to 79.5%.[1] Neck pain that limits daily activities is not uncommon (17% to 70%)[2–5] and the economic impact of neck pain is immense.[6–10] Therefore, effective self-management strategies for neck pain are important. One proposed strategy is Mechanical Diagnosis and Therapy (MDT) or the McKenzie approach.

Mechanical Diagnosis and Therapy is one of the common conservative treatments for back pain[11–13] and the principle can be applied to neck problems also.[14] It is a treatment-based approach that classifies the patient's symptoms into subgroups based on findings through: systematic history taking, assessment of neurological tests and motion loss, and symptomatic and mechanical changes in response to repeated motion assessment. Treatment principles are designed for each subgroup and each patient is provided with individualised treatment. There are four primary subgroups in MDT: Derangement Syndrome, Dysfunction Syndrome, Posture Syndrome and 'Other' (eg, the acute phase of whiplash injury). Features of the four subgroups are summarised in Box 1. When necessary, the mechanical loading is progressed from patient-generated force to therapist-generated force, but if patient-generated forces are adequate, only these are used to minimise the risk of worsening the problem through evaluation with mechanical loading, to minimise the chance of the patient's dependency on therapist intervention and to maximise the patient's independence in self-management strategies.

Although approximately 30% to 70% of people with neck pain improve spontaneously over time,[1,15,16] neck pain can be a persistent or a recurrent disorder.[1,17] Thus, it is important to investigate if MDT provides additional benefit in comparison to natural resolution of neck pain and other therapeutic approaches. The approach of MDT emphasises patient education throughout the treatment so that patients can obtain skills to both manage

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**Box 1.** Features of four subgroups in Mechanical Diagnosis and Therapy for spinal problems

**Derangement Syndrome**
- Rapid change of pain or range of motion (ROM) in response to repeated movements or sustained posture, including centralisation or peripheralisation.
- In particular, reducible Derangement Syndrome has a Directional Preference (DP), which is a direction of movement where pain is reduced or ROM is increased with or without centralisation.
- In contrast, maintenance of activity and general exercise with and without medications are instructed for irreducible Derangement Syndrome, where any movements and postures aggravate pain intensity, cause peripheralisation and reduce ROM.

**Dysfunction Syndrome**
- Neither pain nor ROM change rapidly in response to repeated movements or sustained posture.
- Pain is intermittent.
- Pain is produced only at the end range of a movement.
- A spinal movement producing mild to moderate pain is repeated for the treatment to facilitate remodelling of an injured tissue or to stretch tissue with adopted shortness, as these are considered possible biomedical models.

**Posture Syndrome**
- Pain is intermittent.
- Pain location is around the spine.
- Pain is produced and worsened only when a certain posture is sustained for a prolonged time.
- Behavioural modification is prescribed to avoid having a certain prolonged posture.

**Other**
- The symptom does not fit into any of the three subgroups.
- Other treatment approaches are discussed or referral to medical doctors for further investigation is chosen.
- One example is the acute phase of whiplash-associated disorders (WADs). Treatment includes: 1) educating patients to reduce anxiety and fear of movement; 2) exercising to gradually increase the limited ROM without worsening symptoms; 3) posture correction. When symptom reactions fit in another subgroup at follow up, the treatment principle for a corresponding subgroup is used (eg, repeated exercises in the direction of a DP in the case of Derangement Syndrome).

their current episode of neck pain and prevent or self-treat future recurrences independently. Therefore, it is also important to investigate long-term effects in addition to short-term effects.

A systematic review with meta-analysis of randomised trials is required to synthesise the evidence about the effectiveness of MDT on pain intensity and disability in the short, intermediate and long term in comparison to wait-and-see control and to other therapeutic approaches. In 2004, a systematic review was conducted to try to synthesise randomised trials of MDT for spinal pain compared to other therapeutic approaches.[18] However, only one randomised trial of MDT for neck pain was included in that review, so findings were inconclusive. In 2006, the MDT textbook for neck pain, including whiplash-associated disorders,[14] was updated considerably.[19] Research on MDT has been increasing over the past decade. Therefore, this systematic review was deemed necessary to estimate the effectiveness of MDT on neck pain and disability from unbiased evidence.

The research questions were:

1. In people with neck pain, does MDT reduce pain and disability more than a wait-and-see control?

**Box 2.** Inclusion criteria.

**Design**
- Randomised controlled trials

**Participants**
- People with neck pain

**Intervention**
- Mechanical Diagnosis and Therapy (MDT) without other treatment modalities

**Outcome measures**
- Neck pain intensity
- Overall pain intensity
- Disability due to neck pain

**Comparisons**
- MDT versus 'wait and see', act as usual, or placebo
- MDT versus other interventions

2. Does MDT reduce pain and disability more than other therapeutic approaches?
3. Are any differences in effect clinically important?

## Method

### *Identification and selection of studies*

A systematic search was performed in PubMed, SCOPUS, EMBASE, CINAHL, Physiotherapy Evidence Database (PEDro) and the Cochrane library, from inception to May 2013. The refined key search terms included: *McKenzie therapy*, *McKenzie method*, *McKenzie approach*, *McKenzie treatment* or *mechanical diagnosis*, and *neck* or *cervical*. In addition, the reference list of the McKenzie Institute website and the International Clinical Trials Registry Platform Search Portal were manually searched. Cross-referencing was undertaken through communications with experts in this field and relevant reviews. Inclusion criteria are presented in Box 2. Two assessors (HT and RN) independently inspected studies to be included. Full text was inspected after exclusion of studies by screening the title and abstract. Disagreements were resolved by consensus.

### *Assessment of characteristics of studies*

Methodological quality was assessed using the 10-point PEDro scale, excluding Item 1 (eligibility), as recommended because of its relevance to external not internal validity. This scale was developed for the assessment of methodological quality for studies in rehabilitation science[20] and is reliable and valid for assessing physiotherapy trials.[21,22] A cut-off score of six and above has been used for high-quality studies,[21] but reducing the cut-off score from six to five has not affected the overall outcome and a cut-off score of five has been used by some reviews.[23–26] Hence, in this review, high-quality research was defined as a study with a $\geq$ 5 PEDro score and was used as a criterion for meta-analysis. The score from the PEDro online database was used, as all studies included in this study were included in the PEDro database.

### *Data analysis*

Two assessors (HT and XC) independently extracted data, with no disagreements. When data reported in a published paper were insufficient to quantitatively analyse the effect of MDT, the corresponding author was contacted and additional data were obtained if possible. Consideration of the quality of interventions is important[27] and therapists' certification/training levels could

affect outcomes with MDT treatment because treatment strategies are different in each subgroup and reliability of classification of subgroups could vary by certification/training levels. There is a consensus that classification reliability is good in the holders of the highest certification but the reliability level in other therapists is not always good.[28–30] Thus, the level of MDT certification was also analysed.

To enable comparison of outcomes between interventions and trials, data for pain intensity and disability were converted to a point scale of 0 to 100 (0 = no pain or no disability) and then a mean difference with 95% confidence interval (95% CI) was calculated for within-group change scores. A positive mean difference indicates a favourable effect of MDT in comparison to other therapeutic approaches including wait-and-see control. A value of 20 on the 0-to-100 scale was used as the threshold for clinical importance for both pain and disability. When variability data for within-group change scores were unavailable and when baseline scores were assumed to be comparable, between-group differences at follow up were used. SD was estimated as one quarter of the mean value when variability data were unavailable.[18] When the sample size at a follow-up point was not clear, the sample size before the follow-up point was used to calculate mean differences.

When pooling data was appropriate, meta-analysis was undertaken and a weighted mean difference was calculated. $I^2$ was assessed to investigate the degree of between-trial heterogeneity using a random-effects model. $I^2$ values of 25%, 50% and 75% indicate low, moderate and high heterogeneity, respectively.[31] When meta-analysis was not undertaken, a quantitative summary was tabulated.

Levels of evidence were decided according to a guideline for systematic reviews.[32] Strong evidence was defined as consistent findings among multiple high-quality randomised trials. Moderate evidence was defined as consistent findings among multiple low-quality randomised trials, and/or one high-quality randomised trial. Limited evidence was defined as a finding in one low-quality randomised trial. Conflicting evidence was defined as inconsistent findings among multiple randomised trials.

Definitions of short, intermediate and long term were as per a previous review.[18] Short term was defined as less than three months after commencement of treatments. The time point closest to six weeks was used when there were multiple eligible follow-up points. Intermediate term was defined as greater than three months and less than one year after the commencement of treatments. The time point closest to six months was chosen when there were multiple eligible follow-up points. Long term was defined as greater than or equal to one year after the commencement of treatments. The time point closest to one year was chosen if there were multiple eligible time points.

## Results

### *Flow of studies through the review*

Figure 1 presents the flow of study selection. One PhD thesis[33] was identified from manual searching and cross-referencing. However, data in the thesis were duplicate and therefore excluded from the review. Five randomised trials[34–38] were included in this review.

### *Characteristic of studies*

Table 1 summarises the five studies. A more detailed description of the studies is available in Table 2, which is available in the eAddenda. Table 3 presents the quality scores. All of the included trials had high quality. No included trials blinded subjects or therapists, although this is not feasible in most rehabilitation trials. Not all studies used therapists who had achieved the highest certification in MDT (diploma).

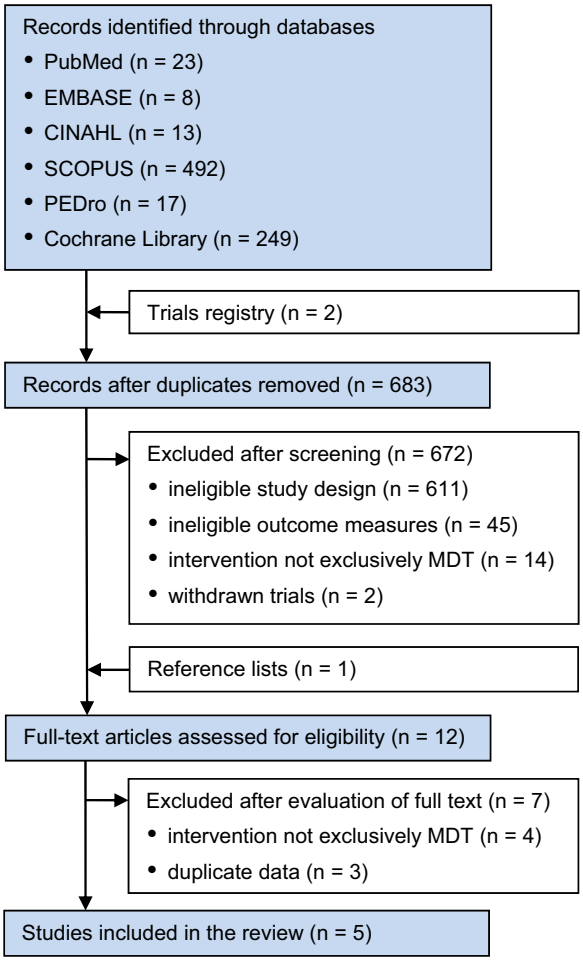


**Figure 1.** Flow of studies through the review. MDT = Mechanical Diagnosis and Therapy.

### *Effectiveness of MDT in comparison to a wait-and-see control*

Two trials[34,35] included a control condition that could be considered as 'wait and see'. As pain and disability were reported for the short, intermediate and long term in both trials, meta-analyses were performed. The corresponding author of one study[35] provided means and SDs.

*Pain*

Based on pooled data from the two trials, MDT did not significantly improve neck pain intensity in comparison to a wait-and-see control in the short, intermediate or long term, as presented in Figure 2. See Figure 3 in the eAddenda for a more detailed forest plot. Heterogeneity was low (0%) among the short-term and intermediate-term effects, and low to moderate among the long-term effects. The pooled estimates all had 95% CI that were below the threshold of clinical importance.

*Disability*

Based on pooled data from the two trials, MDT did not significantly improve disability in comparison to the wait-and-see control in the short, intermediate or long term, as presented in Figure 4. See Figure 5 in the eAddenda for a more detailed forest plot. Heterogeneity was low (0%) at all time points. The pooled

**Table 1**
Characteristics of the included studies.

| Study | Participants [a] | Intervention | Outcome measures [b] |
|---|---|---|---|
| Kjellman[34] | n = 70<br>Age (yr) = 45 (10)<br>Gender = 53 F<br>Symptom duration:<br>≤ 1 wk: n = 3<br>1-4 wk: n = 23<br>1-3 mth: n = 13<br>≥ 3 mth: n = 31 | Exp 1 (MDT) = MDT by 5 therapists who completed at least part C course of the McKenzie educational program for max 8 wks.<br>Exp 2 (exercise) = ROM exercise + endurance and strengthening exercise + standard home exercise, 2 sessions/wk x 8 wks.<br>Con = ultrasound at the lowest intensity for upper trapezius (7 mins on each side), general information about neck pain, and a limited program including arm motions, for 4 wks. | • Pain: 100-mm VAS<br>• Disability: NDI<br>Follow up: 1, 2, 3 wk; after treatment, 6, 12 mth. |
| Kongsted[35] | n = 458<br>Age (yr) = 35 (12)<br>Gender = 373 F<br>Symptom duration:<br>≤ 10 d: n = 458 | Exp 1 (MDT) = MDT by two physiotherapists, one with MDT diploma, max 2/wk x 6 wks.<br>Exp 2 (immobilisation) = semi-rigid Philadelphia neck collar in work hours for 2 wks then MDT, max 2 session/wk x 4 wks.<br>Con = staying active. | • Pain: Week average, 0-10<br>• Disability: 15-item CNFDS<br>Follow up: 3, 6, 12 mth. |
| Moffett[36] [c] | n = 96<br>Age (yr) = 47 (15)<br>Gender = 60 F<br>Symptom duration:<br>≥ 2 wk: n = 96 | Exp 1 (MDT) = MDT by 27 physiotherapists who had undertaken courses of the McKenzie educational program + The Neck Book.[48]<br>Exp 2 (MDT) = MDT by 27 physiotherapists who had undertaken McKenzie courses as above.<br>Exp 3 (CBA) = a 1 hr assessment including a physical examination, explanation about condition, reassurance and goal setting x 1 to 2 sessions + The Neck Book.[48]<br>Exp 4 (CBA) = a 1 hr assessment including a physical examination, explanation about condition, reassurance and goal setting x 1 to 2 sessions. | • Disability: Northwick Park Neck Pain Questionnaire<br>Follow up: 6 wk, 6, 12 mth. |
| Rosenfeld[37] | n = 88<br>Age (yr) = 35 (13)<br>Gender = 59 F<br>Symptom duration:<br>< 96 hr: n = 44<br>2 wk: n = 44 | Exp 1 (MDT) = MDT initiated within 96 hr of injury for max 6 wk.<br>Exp 2 (UC) = UC initiated within 96 hr of injury, including written information on injury mechanisms, advice about activity and posture, rest for 1 wk and active movement 2-3/d.<br>Exp 3 (delayed MDT) = no treatment for 14 d after injury, then MDT for max 6 wk.<br>Exp 4 (delayed UC) = UC initiated 14 d after injury, including written information on injury mechanisms, advice about activity and posture, rest for 1 wk and active movement 2-3/d. | • Pain: 100-mm VAS<br>Follow up: 6 mth, 3 yr |
| Singh[38] | n = 30<br>Age (yr) = 45 (10)<br>Gender = 53 F<br>Symptom duration:<br>≥ 3 mth: n = 31 | Exp 1 (MDT) = MDT by 5 therapists who completed at least part C course of the McKenzie educational program, 10-15 reps x 3/wk x 3wk.<br>Exp 2 (exercise) = exercises for the neck and shoulder in supine lying and prone lying including 10-12 reps for 3 sets x 2/day x 3 wk. | • Pain: 10-cm VAS<br>• Disability: NDI<br>Follow up: 3 wk |

Exp = experimental group, CBA = cognitive behavioural approach, CNFDS = Copenhagen Neck Functional Disability Scale, Con = control group, F = female, MDT = Mechanical Diagnosis and Therapy, NDI = Neck Disability Index, ROM = range of motion, UC = usual care, VAS = visual analog scale.
[a] Age data are mean (SD).
[b] Pain and disability data were converted to scale of 0 to 100.
[c] Only data for participants with neck pain (not back pain) were extracted. Exp 1 and 2 were pooled and Exp 3 and 4 were pooled for meta-analysis.

**Table 3**
PEDro scores of included studies.

| Study | Random allocation | Concealed allocation | Groups similar at baseline | Participant blinding | Therapist blinding | Assessor blinding | < 15% dropouts | Intention-to-treat analysis | Between-group difference reported | Point estimate and variability reported | Total (0 to 10) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Kjellman[34] | Y | Y | Y | N | N | N | Y | N | Y | Y | 6 |
| Kongsted[35] | Y | Y | Y | N | N | Y | N | Y | Y | Y | 7 |
| Moffett[36] | Y | Y | Y | N | N | N | N | Y | Y | Y | 6 |
| Rosenfeld[37] | Y | Y | Y | N | N | Y | Y | Y | Y | Y | 8 |
| Singh[38] | Y | N | Y | N | N | N | Y | N | Y | Y | 5 |

estimates all had 95% CI that were below the threshold of clinical importance.

### *Effectiveness of MDT in comparison to other therapeutic approaches*

Meta-analysis was not undertaken due to heterogeneity of the therapeutic approaches to which MDT was compared: immobilisation, exercise, usual care, a cognitive behavioural approach, and delayed initiation of treatment. Data were extracted from all trials[34–38] and tabulated. Means and SDs were provided by the corresponding author of one trial.[35] Mean differences for disability were calculated using estimated SDs at each follow-up point for one trial.[36] Only one trial[37] reported means and SDs of within-group change and therefore between-group differences at each follow-up point were used to calculate mean differences.

*Pain*

Table 4 presents the effect of MDT on pain intensity in comparison to other therapeutic approaches. The between-group comparisons had 95% CI with lower limits that were less than 20 on a scale of 0 to 100.

*Disability*

Table 5 presents the effect of MDT on disability in comparison to other therapeutic approaches. The between-group comparisons for disability had 95% CI with upper limits that were less than 20 on a scale of 0 to 100.

**Table 4**
Mean difference (95% CI) in pain intensity between MDT and other therapeutic approaches in the short, intermediate and long term.

| Assessment time comparisons | Mean difference (95% CI) 0–100 scale |
|---|---|
| Short term | |
| MDT versus general exercise[34]–overall | 8 (-6 to 22) |
| MDT versus immobilisation with neck collar and late start of MDT[35]–neck | |
| MDT versus progressive exercise[38]–overall | 11 (-2 to 23) |
| Intermediate term | |
| MDT versus general exercise[34]–overall | 2 (-11 to 15) |
| MDT versus standard intervention initiated within 96 hr[37]–overall | 30 (14 to 46) |
| MDT versus late start of MDT after 2 wk[37]–overall | 15 (2 to 28) |
| MDT versus late start of standard intervention after 2 wk[37]–overall | 23 (9 to 36) |
| MDT versus immobilisation with neck collar and late start of MDT[35]–neck | 7 (-1 to 15) |
| Long term | |
| MDT versus general exercise[34]–overall | 4 (-11 to 19) |
| MDT versus standard intervention initiated within 96 hr[37]–overall | 19 (1 to 37) |
| MDT versus late start of MDT after 2 wk[37]–overall | 5 (-11 to 22) |
| MDT versus late start of standard intervention after 2 wk[37]–overall | 16 (-3 to 34) |
| MDT versus immobilisation with neck collar and late start of MDT[35]–neck | 4 (-3 to 11) |

MDT = Mechanical Diagnosis and Therapy.
Positive scores favour MDT.
Short term: < 3 mth after start of treatment, or time point closest to 6 wk if multiple assessments.
Intermediate term: >3 mth and <1 yr after start of treatment, or time point closest to 6 mth if multiple assessments.
Long term: ≥1 yr after start of treatment, or time point closest to 1 yr if multiple assessments.

**Table 5**
Mean difference (95% CI) in disability due to neck pain between MDT and other therapeutic approaches in the short, intermediate and long term.

| Assessment time comparisons | Mean difference (95% CI) 0–100 scale |
|---|---|
| Short term | |
| MDT versus general exercise[34] | 5 (-3 to 13) |
| MDT versus cognitive behaviour approach[36] | 1 (0 to 1) |
| MDT versus immobilisation with neck collar and late start of MDT[35] | 3 (-3 to 9) |
| MDT versus progressive exercise[38] | 2 (-4 to 8) |
| Intermediate term | |
| MDT versus general exercise[34] | 2 (-7 to 11) |
| MDT versus cognitive behaviour approach[36] | 0 (-1 to 1) |
| MDT versus immobilisation with neck collar and late start of MDT[35] | 5 (-2 to 11) |
| Long term | |
| MDT versus general exercise[34] | 0 (-9 to 9) |
| MDT versus cognitive behaviour approach[36] | 1 (0 to 2) |
| MDT versus immobilisation with neck collar and late start of MDT[35] | 7 (0 to 14) |

MDT = Mechanical Diagnosis and Therapy.
Positive scores favour MDT.
Short term: < 3 mth after start of treatment, or time point closest to 6 wk if multiple assessments.
Intermediate term: >3 mth and <1 yr after start of treatment, or time point closest to 6 mth if multiple assessments.
Long term: ≥1 yr after start of treatment, or time point closest to 1 yr if multiple assessments.

## Discussion

This review investigated the effectiveness of MDT for pain intensity and disability in comparison to other therapeutic approaches including 'wait and see'. Five studies were included in this review. Meta-analysis was undertaken in comparisons

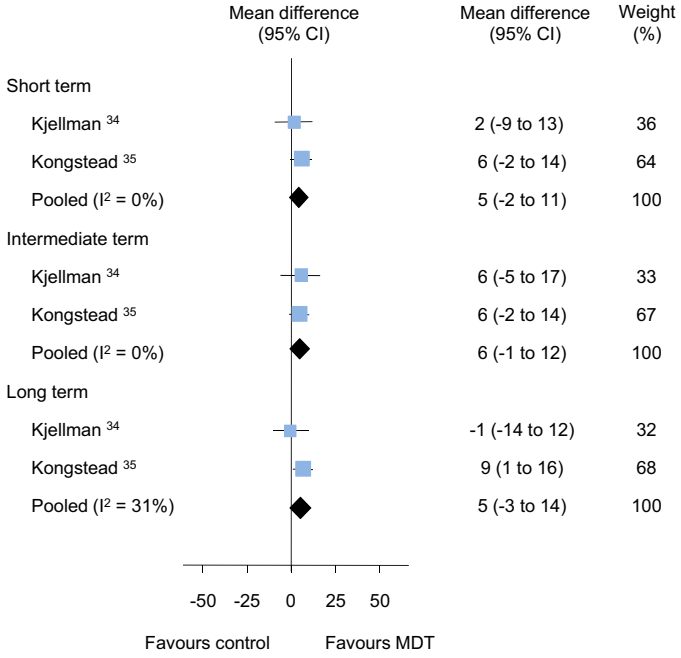


**Figure 2.** Short, intermediate and long-term mean differences (95% CI) in pain intensity with Mechanical Diagnosis and Therapy (MDT) compared to a wait-and-see control by pooling data from 2 studies.

between MDT and wait-and-see controls and other comparisons were summarised with mean difference values.

Some individual estimates of the effect of MDT in comparison to a wait-and-see control or other therapeutic approaches were statistically significant and in favour of MDT. However, in all studies at all time points, the lower limit of the 95% CI was less than 20 on a scale of 0 to 100. The between-group comparisons for disability also had 95% CI with upper limits that were less than 20 on a scale of 0 to 100. This indicates that any additional reduction in pain intensity due to MDT compared with the wait-and-see approach or other therapeutic approaches may not be clinically worthwhile. Furthermore, it confirms that any additional reduction in disability from MDT compared with the wait-and-see approach or other therapeutic approaches is not clinically worthwhile.

In several of the trials, the results may have been influenced by the use of novice MDT practitioners rather than Diploma MDT therapists. The educational program to become a credentialed MDT therapist does not include direct one-on-one clinical training as well as broader knowledge of physiotherapy evidence. It takes years of intensive MDT training to obtain the MDT Diploma, where candidates learn MDT based on a biopsychosocial framework and obtain substantial experience and skills to apply the MDT algorithm for various musculoskeletal problems. Therefore, it can be assumed that the treatment effect by therapists who only attended some of the MDT curriculum or were only credentialed MDT therapists is less than that of therapists with an MDT Diploma. Evaluation of the potential effectiveness of MDT may therefore require studies to use only therapists with an MDT Diploma. This point should be considered in future research in relation to MDT to avoid misinterpretation of its effectiveness.

A non-randomised clinical trial,[39] which was not included in this study, demonstrated different results from the strong evidence identified by this current study. The participants had centralisation, which is a feature of reducible Derangement Syndrome. In the study, MDT was compared to a rehabilitation program including infrared irradiation, massage and exercises for the neck and

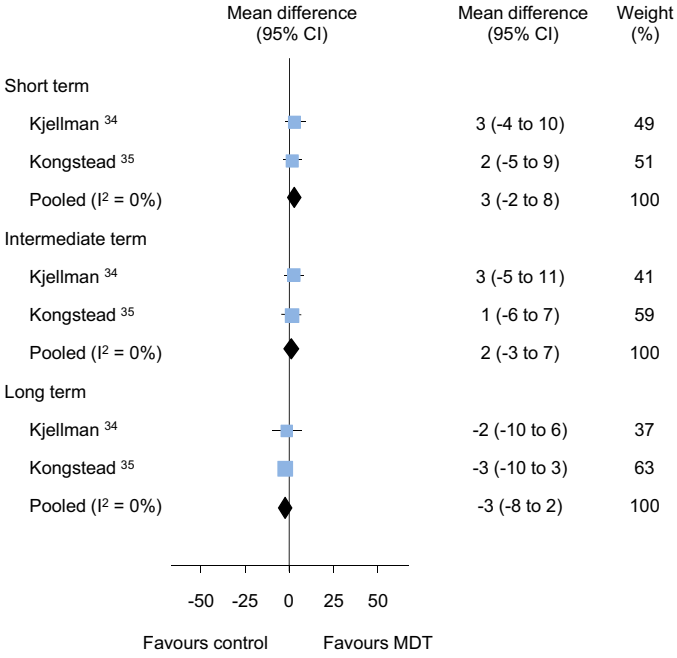


**Figure 4.** Short, intermediate and long-term mean differences (95% CI) in disability with Mechanical Diagnosis and Therapy (MDT) compared to a wait-and-see control by pooling data from 2 studies.

shoulder. The outcome measures included pain intensity at the head, neck, shoulders, upper extremities, and overall. Pain intensity on a scale of 0 to 100 favoured MDT, with mean differences (95% CI) of 28 (17 to 39) at the head, 29 (20 to 38) at the neck, 31 (21 to 41) at the shoulders, 40 (31 to 48) at the upper extremities, and 40 (32 to 48) overall. Except at the head, these confidence intervals had lower limits that were higher than 20 on a scale of 0 to 100. A recent systematic review[40] concluded that centralisation was generally a good prognostic factor and a treatment-effect modifier. The present review included studies of any participants with neck pain, not specific subgroups such as those with centralisation. The estimate of the effect of MDT may therefore have been influenced by the inclusion of less-responsive subgroups such as irreducible Derangement Syndrome, Dysfunction Syndrome, Posture Syndrome and Other. Among people with neck pain, the prevalence of irreducible Derangement Syndrome, Dysfunction Syndrome, Posture Syndrome and Other is 0.9%, 8.1%, 2.7% and 7.2%, respectively.[41] In particular, it may be difficult for non-Diploma MDT therapists to guide patients in the irreducible Derangement Syndrome and Other subgroups appropriately because the treatment for these subgroups requires a biopsychosocial approach, which is introduced in the Diploma MDT education program, rather than a simple-mechanical approach, which is introduced in the general MDT workshops.

This present review accepted all measures of disability. The Neck Disability Index[42] was used by two trials: the Northwick Park Neck Pain Questionnaire[43] by one trial, and the 15-item Copenhagen Neck Functional Disability Scale[44] by the other trial. These questionnaires are spine-specific questionnaires and therefore may not accurately reflect the most troublesome construct for each patient. The Neck Disability Index and the Copenhagen Neck Functional Disability Scale have lower responsiveness than the Patient Specific Functional Scale[45] in people with chronic whiplash-associated disorders.[46] The Neck Disability Index was also inferior to the Patient Specific Functional Scale in people with cervical radiculopathy in terms of test-retest reliability, construct validity, and responsiveness.[47] Therefore, it may be appropriate for future research to include a patient-centered questionnaire for the assessment of disability and functional performance, as well as a spine-specific disability measure.

One limitation of the present review, as discussed above, is that the overall estimate of the effect of MDT may not reflect its potential effect because therapists did not always have a MDT Diploma. Another possible limitation is omission of relevant studies – in particular non-English studies – although the review was made as inclusive as possible.

In conclusion: in people with neck pain, in the short, intermediate or long term, currently available high-quality studies provide consistent evidence that any additional benefit of MDT compared with a wait-and-see approach or other therapeutic approaches may not be clinically important in terms of pain intensity, and is not clinically important in terms of disability. However, there was no study where MDT was only performed by therapists with an MDT Diploma. In addition, certain subgroups may have better effects from MDT than others. Therefore, future trials of MDT should only use therapists with an MDT Diploma and analyse each MDT subgroup separately.

**What is already known on this topic:** Neck pain is common and disabling. Mechanical Diagnosis and Therapy (MDT, also known as the McKenzie approach) classifies the patient's symptoms into subgroups and recommends different treatments for these subgroups.
**What this study adds:** MDT may have a better effect on pain than 'wait and see' or other treatment approaches, but the difference in effect may not be clinically important. MDT does not have a greater effect on disability than 'wait and see' or other treatment approaches. Existing evidence has not examined the effect of MDT when administered by physiotherapists with the highest MDT training.

***eAddenda*:** Table 2, Figure 3 and Figure 5 can be found online at doi:10.1016/j.jphys.2014.05.006

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## Further reading

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