Conservative Management of Mechanical Neck Disorders: A Systematic Review

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ABSTRACT. ***Objective.*** To determine if conservative treatments (manual therapies, physical medicine methods, medication, and patient education) relieved pain or improved function/disability, patient satisfaction, and global perceived effect in adults with acute, subacute, and chronic mechanical neck disorders (MND) by updating 11 systematic reviews of randomized controlled trials (RCT).

Methods. Two independent authors selected studies, abstracted data, and assessed methodological quality from computerized databases. We calculated relative risks and standardized mean differences (SMD) when possible. In the absence of heterogeneity, we calculated pooled effect sizes.

Results. We studied 88 unique RCT. The mean methodological quality scores were acceptable in 59% of the trials. We noted strong evidence of benefit for maintained pain reduction [pooled SMD –0.85 (95% CI –1.20, –0.50)], improvement in function, and positive global perceived effect favoring exercise plus mobilization/manipulation versus control for subacute/chronic MND. We found moderate evidence of longterm benefit for improved function favoring direct neck strengthening and stretching for chronic MND, and for high global perceived effect favoring vertigo exercises. We noted moderate evidence of no benefit for botulinium-A injection [pooled SMD –0.39 (95% CI –01.25, 0.47)]. We found many treatments demonstrating short-term effects.

Conclusion. Exercise combined with mobilization/manipulation, exercise alone, and intramuscular lidocaine for chronic MND; intravenous glucocorticoid for acute whiplash associated disorders; and low-level laser therapy demonstrated either intermediate or longterm benefits. Optimal dosage of effective techniques and prognostic indicators for responders to care should be explored in future research. (First Release Jan 15 2007; J Rheumatol 2007;34:1083–102)

Key Indexing Terms:

NECK	WHIPLASH	DEGENERATIVE
RADICULAR	TREATMENTS	SYSTEMATIC REVIEW

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Supported by a Problem-based Research Grant from Sunnybrook and Women's Health Sciences Centre, Toronto, Canada.

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Accepted for publication October 13, 2006.

Neck pain is still a major contributor to disability worldwide[1-4], with about 70% of the population experiencing an episode of neck pain at some point in their lives[1,5] and 15% experiencing chronic neck pain[6]. Chronic pain accounts for $150 to $215 billion US each year in economic loss (i.e., lost workdays, therapy, disability)[7,8], yet very little is known about the effectiveness of many of the available treatments. In this report, we update our previous systematic reviews from the Cervical Overview Group on conservative management for mechanical neck disorders[9-19].

MATERIALS AND METHODS

The medical and alternative-medicine literature was searched from 1997 to September 2004 with no language restrictions using a sensitive search strategy[20]. It included computerized bibliographic databases: Cochrane Register of Controlled Trials (Central), Medline, Embase, Manual Alternative and Natural Therapy, Cumulative Index to Nursing and Allied Health Literature, Index to Chiropractic Literature, an acupuncture database in China (root to September 2005). Medical Subject Headings key words included terms related to anatomic, disorder/syndrome, treatment, and methodology. Figure 1 depicts the review retrieval flow from selection to metaanalyses. Two independent reviewers conducted study selection using pilot-tested forms (qw kappa 0.82, SD 0.05)[21].

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Selection criteria

Type of study. Published or unpublished (quasi-) randomized controlled trials.

Type of participant. Adults with acute (< 30 days), subacute (30–90 days), or chronic (> 90 days) neck disorders categorized as: (1) mechanical neck disorders (MND), including whiplash associated disorders (WAD I/II)[22,23], myofascial neck pain, and degenerative changes or OA[24]; (2) neck disorder with headache (NDH)[25-27]; and (3) neck disorder with radicular findings (NDR), including WAD III[22,23].

Type of intervention. Medication, medical injections[18], acupuncture[19], electrotherapy[17], exercise[16], low-level laser therapy[11], orthosis, thermal agents[12], traction[13], massage[15], mobilization, manipulation[10], and patient education[14].

The control group consisted of a placebo, wait-list/no treatment control; active treatment control (e.g., exercise and ultrasound vs ultrasound); or inactive treatment control (e.g., sham transcutaneous electrical nerve stimulation). Other comparisons were excluded.

Type of outcome. Pain, disability/function including work related measures, patient satisfaction, and global perceived effect (GPE)[28]. Followup periods were defined as post-treatment (≤ 1 day), short-term (> 1 day to < 3 months), intermediate term (≥ 3 months to < 1 year), and longterm (≥ 1 year).

Two independent reviewers conducted data abstraction using pilot-tested forms. We calculated standard mean difference (SMD), relative risk (RR), number needed to treat, absolute benefit, and treatment advantage (Table 1, Figures 2 and 3). In the absence of heterogeneity ($p \geq 0.05$), data were pooled statistically (random effects model) when we judged the studies to be clinically and statistically similar by Q-test (Figure 4). We categorized our findings using levels of evidence (Table 2)[29,30].

Methodological quality. We had at least 2 authors independently assess each selected study for methodological quality, based on the validated Jadad criteria[31] (maximum score 5, high/acceptable score ≥ 3) and the van Tulder criteria[30] (maximum score 11, high/acceptable score ≥ 6; Table 2). The mean scores were 2.9 (SD 1.2) for Jadad, *et al*[31] or 6.0 (SD 2.3) for the van Tulder, *et al*[30] criteria lists. Using a cutoff value of 50% (6/11) on the van Tulder criteria list, 59% of the included studies had "acceptable" methodological quality. Table 3 shows methodological quality scores of all studies and Figure 5 the main methodological limitations of the studies by treatment category. Sensitivity analysis for methodological quality using the Jadad scale (high score ≥ 3) upheld our primary analysis. Metaregression was not possible.

RESULTS

We detailed trial findings by "level of evidence" and "treatment category" in the later sections. Table 1 details the magnitude of the effect in terms of effect size (SMD or RR), number needed to treat, and treatment advantage; Table 4 gives a summary of the level of evidence by treatment category.

Evidence of benefit

Strong evidence

We found that multimodal approaches including stretching/strengthening exercise and mobilization/manipulation for subacute/chronic MND, NDR, and NDH reduced pain (Figure 4[32-36]), improved function, and resulted in favorable GPE in the long term.

Moderate evidence

Exercise. We noted 7 trials that supported various methods of direct neck strengthening and stretching exercises for chronic NDH[35] and chronic MND[32,37-39] (Figure 4[40,41]) in the intermediate or long term for multiple outcomes. However, strengthening and stretching of only the shoulder region plus general conditioning[38,42] did not alter pain in the short or long term, but did assist in improving function in the short term for chronic MND. One study found an effect favoring active range of motion exercises for acute pain reduction of WAD in the short term[43,44]. Other studies favored cervical proprioceptive training and eye-fixation exercises to achieve pain reduction, improved function and GPE in the short term, and GPE in the long term for cases of chronic MND[45,46] (Figure 4). The effect for pain was not maintained in the long term.

Medicine. We found 2 controlled trials favoring specific medicines in the intermediate or long term, as follows: intravenous glucocorticoid for pain reduction and reduced sick leave in cases of acute WAD[47], and epidural injections for pain reduction and improved function in cases of chronic neck disorder with radiculopathy[48].

Low-level laser therapy. Using sensitivity analysis by disorder subtype, we found evidence to support the use of low-level laser therapy (830 or 904 nm) for pain reduction and functional improvement in the intermediate term for acute/subacute and chronic MND/degenerative changes[49-52]. Although the frequency and duration of treatment were similar, other aspects of dosage (radiant power, energy density, emission frequency, duration of disorder) were diverse and precluded a metaanalysis.

Electrotherapy. We found a short course of low-frequency pulsed electromagnetic field was helpful to palliate pain for acute WAD I and II, acute MND, or chronic MND with associated degenerative changes. We noted an immediate posttreatment effect; this was not maintained into the short term[53-57].

Intermittent traction. For pain, we determined that there was moderate evidence of benefit favoring intermittent traction compared to control or placebo for chronic MND, NDR, degenerative changes[58,59]. These were short-term results.

Acupuncture. Acupuncture was found to be effective for pain relief compared to inactive treatments either immediately posttreatment or in short-term followup for chronic MND[60-62] (Figure 4) and NDR[63]. However, we noted that the evidence suggests no benefit for pain relief in the intermediate and long term and no functional improvements in the short, intermediate, or long term[61,62]. Additionally, one high-quality study assessed the traditional Chinese medicine procedure of dry-needling to trigger points[64] and another low-quality trial on local "standard points"[65] did not relieve pain in the short term.

Limited evidence

We found limited evidence that suggested there may be benefit in the use of repetitive magnetic stimulation[66], traditional Chinese massage[67], orthopedic pillow[68], and intramuscular injection of local anesthetic (lidocaine)[69].

Evidence of no benefit

We found evidence that varied between moderate and limited, for both intermediate and longterm use, suggesting that home exercise, hot packs, electromechanical stimulation, ultra-

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sound, and combination of manipulation/mobilization/modalities do not relieve chronic pain or improve function in MND. Additionally, we found that short-term evidence suggests the following treatments do not aid pain reduction: medicines notably botulinum-A[70-75] (Figure 4), morphine added to an epidural injection, manipulation alone, various massage techniques, laser for myofascial pain, infrared light, static traction, spray and stretch[76,77] (Figure 4), electrotherapies (diadynamic current, galvanic current, iontophoresis, magnetic necklace), ultra-reiz, oral splint, neck school, and advice [to rest for acute WAD pain relief was inferior to active treatments in the short term[43,44,78] (Figure 4); advice to activate; or on pain and stress coping skills].

Conflicting evidence

We have recorded numerous trials with conflicting/unclear evidence in Table 5.

Adverse events

We found that minor, transient, and reversible side effects consisting of increased symptoms were occasionally reported. A valid estimate of clinically significant, uncommon, and rare adverse events cannot be made from these trials. Adverse effects of longterm steroid therapy[81] and manipulation[82] have been well described.

DISCUSSION

For treatment of subacute and chronic MND or NDH, our review found evidence favoring a multimodal strategy (exercise and mobilization/manipulation); exercise alone; intramuscular lidocaine injection; and low level laser therapy (for OA) for pain, function, and GPE in the short and long term. Acupuncture, low-frequency pulse electromagnetic field, repetitive magnetic stimulation, cervical orthopedic pillow, and traditional Chinese massage are favored for either immediate or short-term pain management. For acute WAD, we found that studies of intravenous glucocorticoid show reduction of work disability at 1 year, while stretching exercises and low-frequency pulse electromagnetic field reduce pain. For chronic NDR, we determined that epidural methylprednisolone and lidocaine improved function and pain in the short and long term, while intermittent traction improved pain in the short term. Other commonly used interventions were either not studied, were unclear, or were not compatible with any evidence of benefit.

Interpretation of the magnitude of these treatment effects can benefit communication with our patients, third-party payers, and policy-makers in terms of treatment advantage, expected absolute benefit, and number needed to treat. For example, as shown in Table 1, a multimodal management approach (exercise, mobilization, and manipulation) is compatible with a 28% to 70% treatment advantage over a control, and with a longterm absolute benefit in pain reduction of 25 mm on a numeric rating scale (0-100 mm) from baseline for 1 in 2 to 5 patients with subacute or chronic MND/NDH. Similarly, intramuscular lidocaine injection for chronic myofascial neck pain is associated with a 45% treatment advantage, 40 mm absolute benefit, and a number needed to treat of 3. Table 1 provides corresponding data for treatment types shown to be beneficial.

Despite a large increase in the number of trials since our 1996 review, the advances in our understanding of the effectiveness of treatments are modest. No substantive change in methodological quality has occurred since the 1980s. The main flaws were in concealment of allocation; blinding of patients, caregivers, and outcome assessors; avoidance of cointervention; and compliance. There continues to be ample room for improving the methodological quality of trials, as proposed in the Consolidated Standards of Reporting Trials (CONSORT) statement[83].

To date, few trials on neck disorders have looked at costs[84]. However, given the lack of large treatment differences between interventions, economic evaluations are becoming increasingly important and should be performed in randomized clinical trials[85].

What are the most important unanswered questions with regard to treating mechanical neck disorders? Information on commonly used pain medications (nonsteroidal antiinflammatory drugs, acetaminophen, opioids) is needed. Glucocorticoid studies suggest reduction of work disability at 1 year; if this can be confirmed, it has important public health implications for acute whiplash injury. We need to understand the most effective treatment techniques, combinations, or approaches, and the optimal dosages. This is especially true for different forms of exercise therapy and manual therapy. Are there prognostic indicators for those who will or will not respond to care? Increased insight into compliance with treatments like exercise will help address application barriers. These are the challenging questions requiring focused attention.

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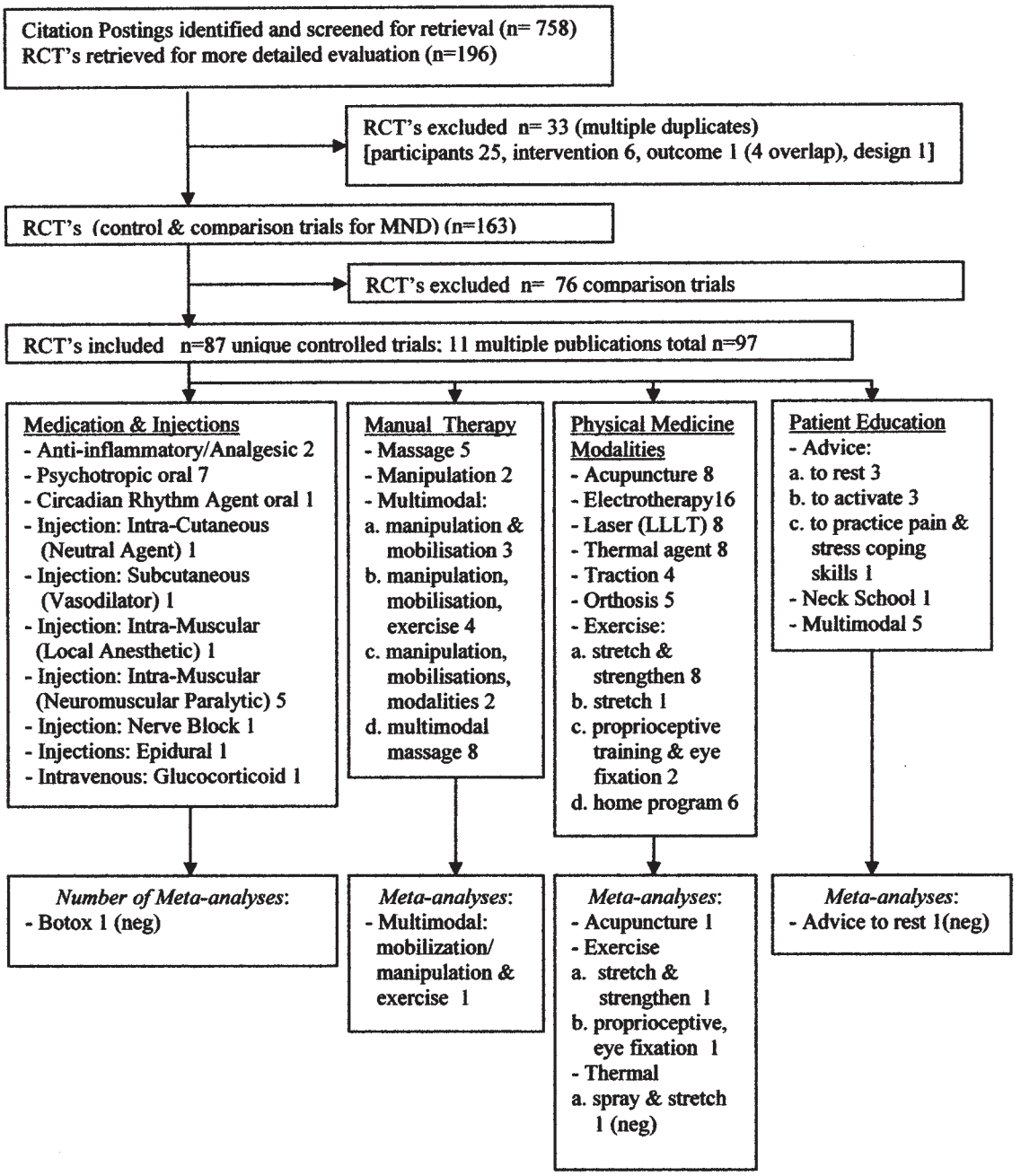

Figure 1. Study selection and metaanalysis for the 2004 Cervical Overview Group update. RCT: randomized controlled trial, MND: mechanical neck disorders, LLLT: low-level laser therapy, neg: negative metaanalysis.

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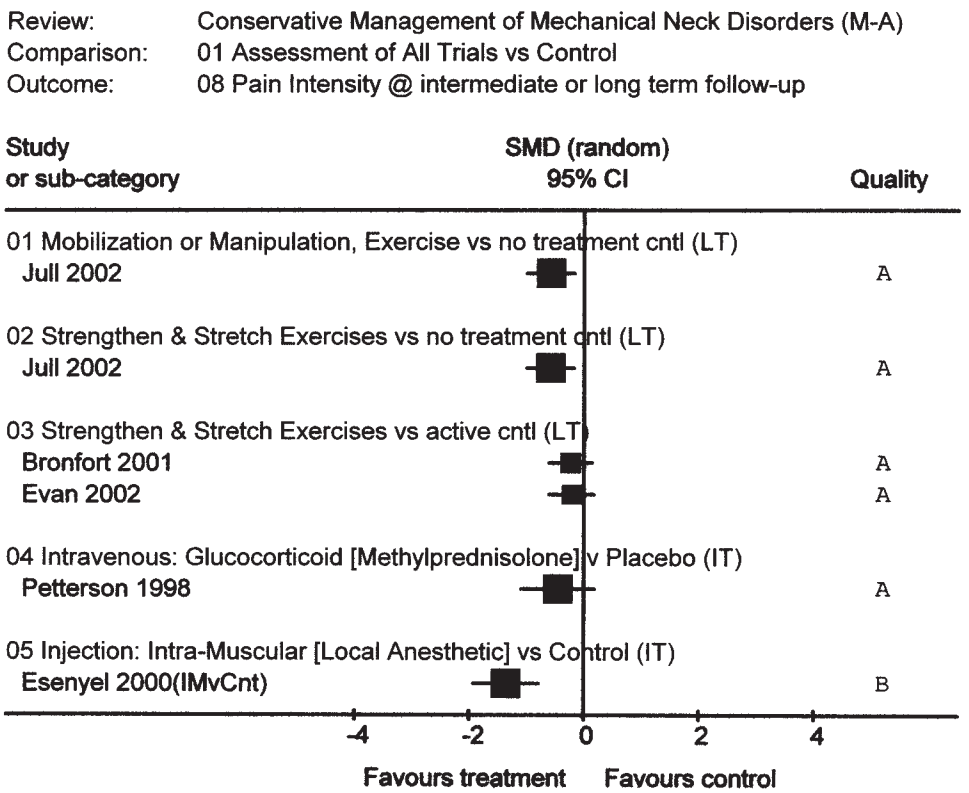

Figure 2. Intermediate (IT) and longterm (LT) results for continuous data, reported in standard mean difference (SMD), show evidence of benefit favoring pain reduction. In Pettersson's 1998 trial[47], although there was no significant effect on pain reduction, there was a clinically important effect on return to work. Direct comparison across all data is hampered by the various forms of controls (cntl) and would require a head-to-head trial comparing the various treatments. "A": high/acceptable methodological quality (≥ 3), "B": low quality on the Jadad scale[31].

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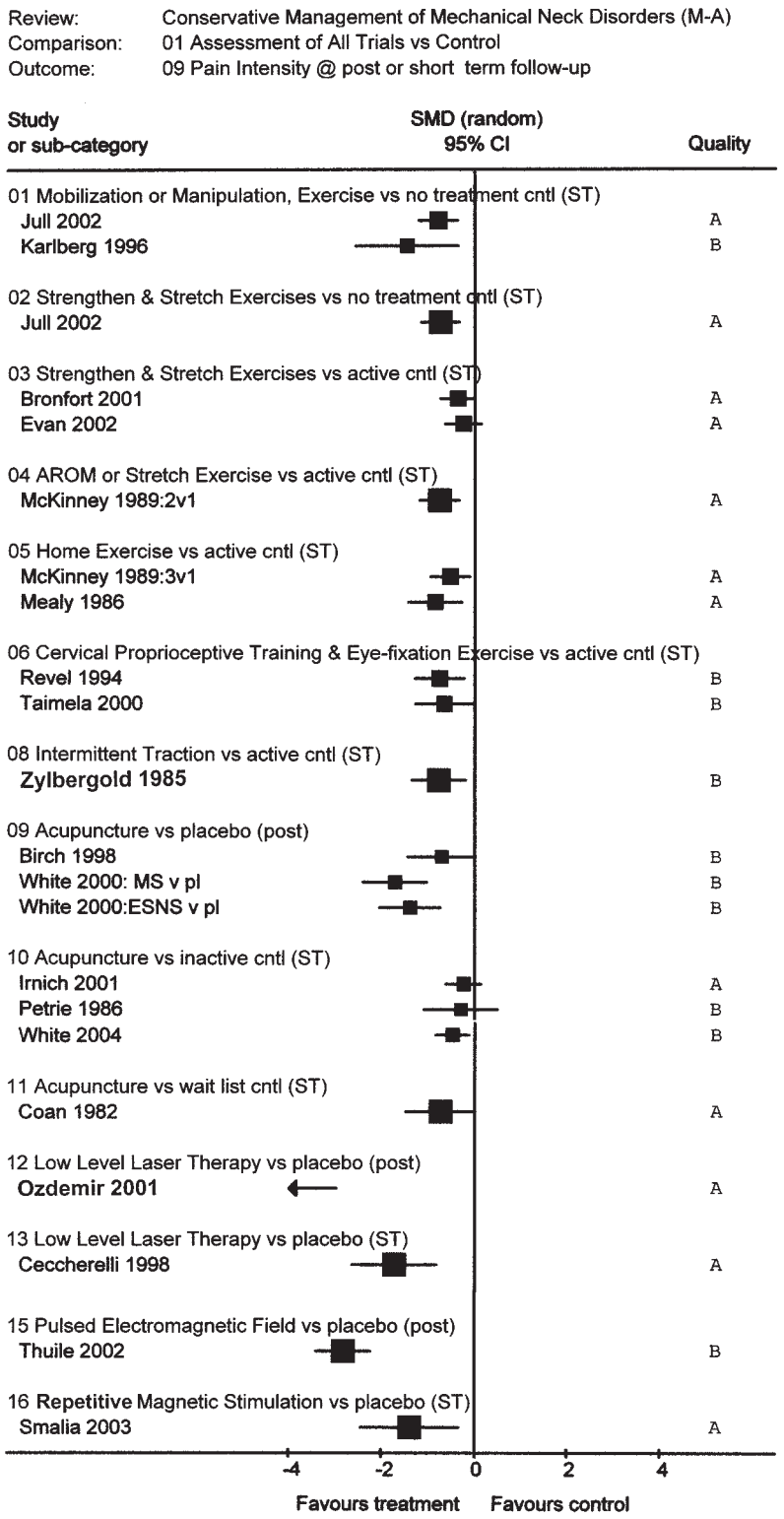

Figure 3. Short (ST) and posttreatment effects across treatment categories are depicted for continuous data on pain relief. "A": high/acceptable methodological quality (≥ 3), "B": low quality on the Jadad scale[31]. ST: short-term, AROM: active range of motion.

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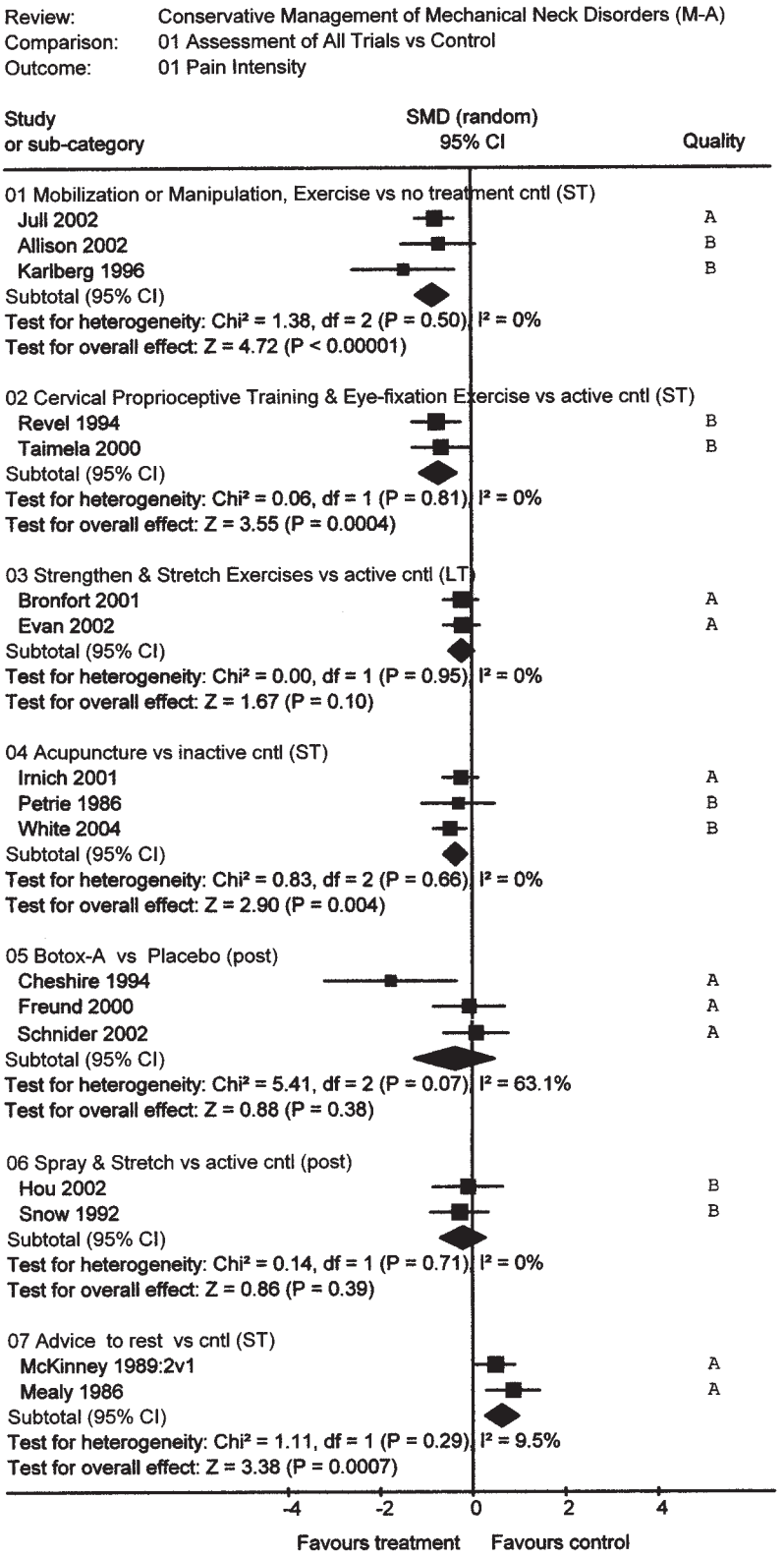

Figure 4. Metaanalyses for conservative treatments. "A": high/acceptable methodological quality (≥ 3), "B": low quality on the Jadad scale[31].

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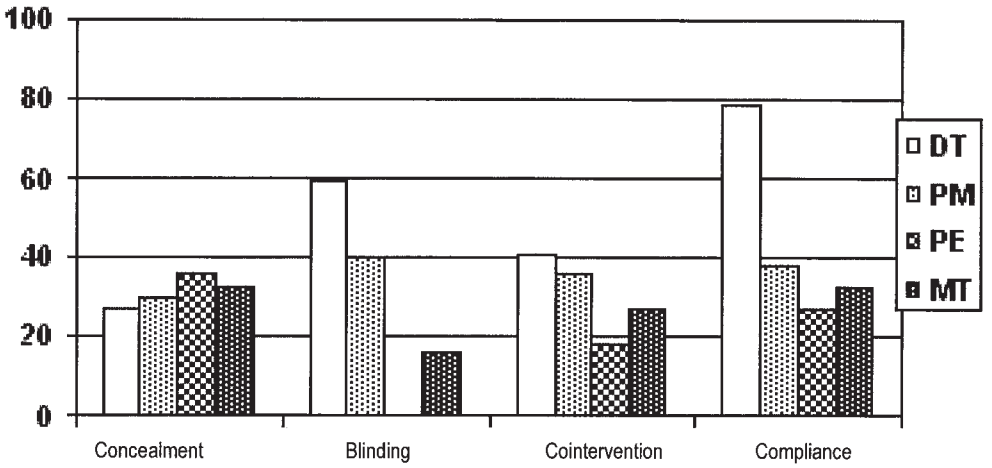

Figure 5. Proportion of studies (%) meeting quality criteria for concealment, blinding, cointervention, and compliance by treatment category. Proportion of studies meeting the van Tulder 2003 blinding criteria[30] across all treatments was: care provider 30%, patient 56%, outcome assessor 67%. DT: drug therapy, PM: physical medicine methods, PE: patient education, MT: manual therapy.

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Table 1. Evidence of benefit translated into clinically meaningful terms. For example, a multimodal management approach (exercise, mobilization, and manipulation) is compatible with a 28% to 70% treatment advantage over a control and a sustained absolute benefit in pain reduction of 25 mm (0–100 mm numeric rating scale) from baseline for 1 in 2 to 5 patients with subacute or chronic MND/NDH. cntl deteriorated: **baseline values different between treatment and control; LT/IT/ST: longterm/intermediate/short-term results; SMD: standard mean difference; RR: relative risk; NA: not applicable; NPQ: Nordwick Park Questionnaire 0–36 scale converted to 0–100 scale; NDI: Neck Disability Index 0–50 scale converted to 0–100 scale; NPD: Neck Pain Disability VAS 0–100; MPQ: McGill Pain Questionnaire; DC: degenerative changes; OA: osteoarthritic.

Rx	Disorder Author	*vs Control* Outcome		Effect Size (95%CI)	NNT	Treatment Advantage	Absolute Benefit
Multimodal	Mobilization or Manipulation & Exercise						
	Chronic MND & subacute/chronic NDH	*vs active cntl*					
	Allison 2002[32]	Pain:	ST	pSMD -0.85 (-1.20,-0.50)	3	69%	25mm
	Karlberg 1996[36]				2	41%	23mm
	Jull 2002[35]		LT		5	28%	23mm
	Brodin 1985[33,34]			RR 0.67(0.43, 1.04)	4	NA	NA
	Jull 2002[35]	Function:	LT	pSMD -0.57 (-0.94, 0.21)	6	31%	14 NPQ
	Allison 2002[32]				11	13%	8 NPQ
	Jull 2002[35]	GPE:	LT	SMD -2.73 (-3.30,-2.16)	NA	NA	69%
Exercise	Strengthen & Stretch Exercises						
	Chronic NDH	*vs no Rx cntl*					
	Jull 2002[32]	Pain:	LT	SMD -0.59 (-1.00, -0.18)	6	28%	28mm
		Function:	LT	SMD -0.59 (-1.00, -0.18)	6	32%	16 NPQ
		GPE:	LT	SMD -2.51 (-3.05, -1.97)	NA	NA	60%
	Chronic MND	*vs no Rx cntl*					
	Gam 1998[37]	Pain:	ST	SMD -0.75 (-1.42,-0.07)	2	122%**	11mm
		vs active cntl					
	Bronfort 2001[40]	Pain:	ST	pSMD -0.32 (-0.59,-0.04)	9	13%	12mm
	Evans 2002[41]				13	10%	32mm
	Bronfort 2001[40]		LT	pSMD -0.23 (-0.50, 0.04)	15	10%	20mm
	Evans 2002[41]				14	9%	26mm
	Bronfort 2001[40]	Function:	ST	pSMD -0.31 (-0.59,-0.04)	11	3%	14 NDI
	Evans 2002[41]				14	3%	13 NDI
	Bronfort 2001[40]		LT	pSMD -0.34 (-0.62,-0.07)	NA	11%	11 NDI
	Evans 2002[41]					11%	11 NDI
	Bronfort 2001[40]	GPE:	ST	pSMD -0.24 (-0.52, 0.04)	NA	NA	14%
	Evans 2002[41]					NA	15%
	Bronfort 2001[40]		LT	pSMD -0.26 (-0.54, 0.02)	NA	NA	22%
	Evans 2002[41]					NA	22%
	Bronfort 2001[40]	Satisfaction	ST	pSMD -0.18 (-0.46, 0.10)	NA	NA	11%
	Evans 2002[41]					NA	13%
	Bronfort 2001[40]		LT	pSMD -0.26 (-0.54, 0.02)	NA	NA	13%
	Evans 2002[41]				NA	NA	15%
	AROM or Stretch Exercise alone						
	Acute WAD	*vs active cntl*					
	McKinney 1989[43,44]2v1	Pain:	ST	SMD -0.77 (-1.20, -0.35)	14	17%	23mm
	Home Exercise						
	Acute WAD	*vs active cntl*					
	McKinney 1989[43,44]3v1	Pain:	ST	SMD -0.58 (-0.96, -0.11)	12	19%	35mm
	Mealy 1986	Pain:	ST	SMD -0.86 (-1.44, -0.28)	5	32%	41mm
	Cervical Proprioceptive Training and Eye-fixation Exercises						

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Table 1. Continued.

Rx	Disorder Author	*vs Control* Outcome	Effect Size (95%CI)	NNT	Treatment Advantage	Absolute Benefit
	Chronic MND	*vs active cntl*				
	Taimela 2000[46]	Pain: ST	pSMD -0.72 (-1.12,-0.32)	5	32%	27mm
	Revel 1994[45]			4	34%	22mm
	Revel 1994[45]	Function: ST	RR 0.55 (0.33, 0.89)	3	NA	NA
	Taimela 2000[46]	GPE: post	SMD -2.32 (-3.10, -1.53)	NA	NA	77%
		IT	SMD -1.60 (-2.30,-0.91)	NA	NA	72%
	Home Exercise					
	Acute WAD	*vs active cntl*				
	McKinney 1989[43,44]3v1	Pain: ST	SMD -0.58 (-0.96, -0.11)	12	19%	35mm
	Mealy 1986[78]	Pain: ST	SMD -0.86 (-1.44, -0.28)	5	32%	41mm
Massage	Traditional Chinese Therapeutic Massage					
	Chronic MND	*vs wait cntl*				
	Cen 2003[67]	Function: post	SMD -1.75 (-2.82, -0.68)	2	72%	19NPQ
Traction	Intermittent Traction					
	Acute to chronic MND, NDR, DC	*vs active cntl*				
	Zybergold 1985[58]	Pain: ST	SMD -0.78 (-1.36,-0.21)	5	36%	2MPQ
	Goldie 1970[59]	Pain: ST	RR 0.50 (0.27, 0.90)	3	35%	NA
	Goldie 1970[59]	GPE: ST	RR 0.50 (0.27, 0.90)	3	NA	NA
Acupuncture	*Subacute/chronic MND*	*v inactive cntl*				
	Petrie 1986[60]	Pain: ST	pSMD -0.37 (-0.61,-0.12)	17	-11%*	15mm
	Irnich 2001[61]			13	14%	30mm
	White 2004[62]			12	16%	29mm
		vs active sham				
	Petrie 1983[65]	Pain: post	RR 0.14 (0.02, 0.88)	2	86%	NA
	Irnich 2002[64]	Pain: post	SMD -0.49 (-0.98, -0.01)	2	38%	16mm
		vs sham				
	Birch 1998[79]	Pain: post	SMD -0.72 (-1.45, 0.01)	5	30%	29mm
	White 2000[80] (MS)	Pain: post	SMD -1.73 (-2.41,-1.04)	3	29%	29mm
	White 2000[80] (ESNS)	Pain: post	SMD -1.40 (-2.05,-0.75)	3	25%	25mm
	Chronic NDR	*v wait list cntl*				
	Coan 1982[63]	Pain: ST	SMD -0.74 (-1.49, 0.00)	3	41%	24mm
Laser	Low Level Laser Therapy (LLLT)					
	Acute/subacute/chronic MND with DC (OA)	*vs placebo*				
	Ceccherelli 1998[70]	Pain: IT/post	SMD -1.74 (-2.64, -0.83)	2	104%**	38mm
	Özdemer 2001[50]	Pain: IT/post	SMD -3.86 (-4.73, -2.98)	2	63%	54mm
	Soriano 1996[52]	Pain: IT/post	RR 0.39 (0.24, 0.64)	3	50%	NA
	Taverna 1990[51]	Pain: IT/post	RR 0.30 (0.12, 0.76)	3	47%	NA
	Özdemer 2001[50]	Function: post	SMD -4.51 (-5.48, -3.53)	2	62%	68mm

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Table 1. Continued

Rx	Disorder Author	*vs Control* Outcome	Effect Size (95%CI)	NNT	Treatment Advantage	Absolute Benefit
Electrotherapy	Pulsed Electromagnetic Field (PEMF)					
	Chronic MND/DC	*TAMMEF vs placebo*				
	Rigato 2002[55]	Pain: post	RR 0.30 (0.18, 0.51)	2	70%	NA
		Extreme LF vs placebo				
	Trock 1994[57]	Pain: post	Significant	NA	NA	NA
		ST	Not significant	NA	NA	NA
		ADL: post,ST	Not significant	NA	NA	NA
		GPE: post, ST	Not significant	NA	NA	NA
		HF vs placebo				
	Foley-Nolan 1990[53]	Pain: post	Significant	NA	NA	NA
		LF vs active cntl				
	Rigato 2002[55]	Pain: post	RR 0.31 (0.19, 0.52)	2	69%	NA
	Acute WAD I & II	*HF vs placebo*				
	Thuile 2002[56]	Pain: post	SMD -2.82 (-3.41, -2.24)	3	57%	44mm
	Foley-Nolan 1992[54]	Pain: post	Not significant	NA	NA	NA
	Repetative Magnetic Stimulation (rMT)					
	Chronic MND - (myofascial)	*vs placebo*				
	Smaria 2003[66]	Pain: ST	SMD -1.39 (-2.44, -0.33)	3	56%	37mm
		Function: ST	SMD -1.39 (-2.44, -0.33)	2	57%	29NPD
Medication	Intravenous Glucocorticoid					
	Acute WAD	*vs placebo*				
	Petterson 1998[47]	Pain: ST	SMD -0.90 (-1.57, -0.24)	NA	NA	NA
	Intra-muscular injection: local anesthetic (lidocaine)					
	Chronic MND (myofascial)	*vs placebo*				
	Esenyel 2000[69]	Pain: ST	SMD -1.36 (-1.93, -0.80)	3	45%	40mm

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Table 2. Jadad, *et al*[31] and van Tulder, *et al*[30] methodological quality criteria lists and classification of "Level of Evidence"[29,30].

Methodological Quality Criteria Lists	
Jadad et al *(Total score 5; high quality ≥ 3)*	
1a.	Was the study described as randomized? *(Score 1 if yes)*
1b and 1c.	Was the method of randomization described and appropriate to conceal allocation? *(Score 1 if appropriate and −1 if not appropriate)*
2a.	Was the study described as double-blinded? *(Score 1 if yes)*
2b and 2c.	Was the method of double blinding described and appropriate to maintain double-blinding? *(Score 1 if appropriate and −1 if not appropriate)*
3.	Was there a description of how withdrawals and dropouts were handled? *(Score1 if yes)*
Van Tulder et al *(Total score 11; high quality ≥ 6)*	
A.	Was the method of randomization adequate? *(Score1 if yes)*
B.	Was the treatment allocation concealed?
C.	Were groups similar at baseline regarding the most important prognostic indicators?
D.	Was the patient blinded to the intervention?
E.	Was the care provider blinded to the intervention?
F.	Was the outcome assessor blinded to the intervention?
G.	Were cointerventions avoided or similar?
H.	Was the compliance acceptable in all groups?
I.	Was the withdrawal/dropout rate described and acceptable?
J.	Was the timing of the outcome assessment in all groups similar?
K.	Did the analysis include an intention-to-treat analysis?

Level of Evidence	
Strong	Consistent findings in multiple high-quality RCT
Moderate	Findings in a single, high-quality RCT or consistent findings in multiple low-quality trials
Limited	A single low-quality RCT
Conflicting/unclear	Inconsistent results in multiple RCT
No evidence	No studies were identified

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Table 3. Methodological quality of selected trials. Agreement between both methodological criteria list scores was acceptable (Spearman rank correlation: rho = 0.76). Specific major gaps continue to be dominant for concealment of treatment allocation, blinding (outcome assessor, patient, and treater), avoiding cointervention, and compliance to intervention (see Figure 5). Mobs/manip: mobilization and/or manipulation.

Author and Treatment	Jadad Criteria List								van Tulder Criteria List											
	1a	1b	1c	2a	2b	2c	3	Total	A	B	C	D	E	F	G	H	I	J	K	Total
Allison 2002[32] Mobs/manip	1	0	0	0	0	0	0	**1**	0	0	0	0	0	1	0	0	1	1	1	**4**
Basmajian1978[128] Drug	1	0	0	1	1	0	0	**3**	1	0	0	1	1	1	1	1	1	1	1	**9**
Basmajian1983[129] Drug	1	1	0	1	1	0	0	**4**	1	1	1	1	1	1	0	0	0	1	0	**7**
Birch 1998[79] Acupuncture, thermal	1	0	0	0	0	0	1	**2**	0	0	1	1	0	0	0	1	1	1	0	**5**
Bitterli 1977[101] Mobs/manip	1	0	-1	0	0	0	0	**0**	0	0	1	0	0	0	0	0	1	1	0	**3**
Borchgrevink 1998[115] Orthosis; education	1	0	0	0	0	0	1	**2**	0	0	0	0	0	1	0	0	1	1	0	**3**
Bose 1999[132] Drug	1	0	0	1	1	0	1	**4**	0	0	0	1	1	1	0	0	0	1	0	**4**
Brockow 2001[87] Drug	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	1	1	1	1	1	**7**
Bronfort 2001[40] Exercise; mobs/manip	1	1	0	0	0	0	1	**3**	1	1	1	0	0	1	1	0	1	1	1	**8**
Brewerton 1966[117] Traction	1	0	0	0	1	0	1	**3**	0	0	1	0	0	1	1	0	1	1	0	**5**
Brodin 1984-5[33,34] Mobs/manip; exercise; massage	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	0	0	1	1	0	**5**
Castagnera 1994[136] Drug	1	0	0	0	0	0	1	**2**	1	0	0	1	0	1	0	1	1	1	1	**7**
Ceccherelli 1989[49] Laser therapy	1	0	0	1	1	0	1	**4**	1	0	1	1	1	1	1	0	1	1	0	**8**
Cen 2003[67] Massage	1	0	0	0	0	0	1	**2**	0	0	1	0	0	0	1	0	1	1	0	**4**
Cheshire 1994[70] Drug	1	0	0	1	1	0	1	**4**	0	0	1	1	0	1	1	1	1	1	1	**8**
Chee 1986[120] Electrotherapy	1	0	0	1	1	0	0	**3**	0	0	0	1	1	1	0	0	0	1	0	**4**
Coan 1982[63] Acupuncture	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	0	1	1	1	1	**7**
Dostal 1978[134] Drug	1	0	0	1	1	0	1	**4**	0	0	1	1	1	1	0	1	1	1	1	**8**
Esenyel 2000[69] Drug	1	0	0	0	0	0	0	**1**	0	0	1	0	0	0	0	0	0	1	0	**2**
Evans 2004[41] Exercise; mobs/manip	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	1	1	1	1	1	**8**
Fialka 1989[106] Electrotherapy; massage	1	0	0	0	0	0	1	**2**	0	0	1	0	0	0	0	0	1	1	1	**4**
Flynn 1986[103] Thermal; electrotherapy	1	0	0	0	0	0	1	**2**	0	0	0	0	0	0	0	0	1	1	1	**3**
Foley-Nolan 1990[53] Electrotherapy	1	1	0	1	1	0	1	**5**	1	1	1	1	1	1	0	1	1	1	0	**9**
Foley-Nolan 1992[54] Electrotherapy	1	1	0	1	1	0	1	**5**	1	1	1	1	1	1	0	1	0	1	0	**8**
Freund 2000[72,73] Drug	1	1	0	1	1	0	1	**5**	1	1	0	1	1	1	1	1	1	1	0	**8**
Gam 1998[37] Exercise; thermal	1	1	0	1	1	0	1	**5**	1	1	0	1	1	1	1	0	1	1	0	**7**
Gennis 1996[114] Orthosis	0	0	0	0	0	0	1	**1**	1	1	1	0	0	0	0	0	1	1	0	**5**
Glossop 1982[137] Education	1	0	0	0	0	0	1	**2**	1	1	0	0	0	0	0	0	0	1	1	**4**
Goldie 1970[59] Traction	1	0	1	0	0	0	1	**3**	0	1	0	1	1	0	1	1	0	1	0	**5**
Hanten 1997[99] Massage	1	0	0	0	0	0	1	**2**	0	0	0	0	0	1	1	1	1	1	1	**6**
Hanten 2000[102] Massage	1	0	0	0	0	0	1	**2**	0	0	1	0	0	1	0	1	0	1	1	**5**
Horneij 2001[97] Exercise; education	1	0	0	0	0	0	1	**2**	0	0	1	1	0	1	0	1	1	1	0	**6**
Hou 2002[76] Massage; thermal	1	0	0	0	0	0	1	**2**	0	0	1	0	0	0	0	0	1	1	1	**4**
Hong 1982[107] Electrotherapy	1	0	0	1	1	0	1	**4**	0	0	0	1	1	1	0	1	1	1	1	**7**
Howe 1983[100] Manual therapy	1	1	0	0	0	0	0	**2**	1	1	0	0	0	1	0	0	0	1	0	**4**
Hseuh 1997[108] Electrotherapy	1	0	0	1	1	0	1	**4**	0	0	1	1	0	1	1	1	1	1	1	**8**
Hurwitz 2002[82] Thermal; electrotherapy; manual therapy	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	1	0	1	1	1	**7**

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Table 3. Continued.

Author and Treatment	Jadad Criteria List								van Tulder Criteria List											
	1a	1b	1c	2a	2b	2c	3	Total	A	B	C	D	E	F	G	H	I	J	K	Total
Irnich 2001[61] Acupuncture	1	0	0	0	0	0	1	**2**	0	0	1	0	0	1	1	0	1	1	1	**6**
Irnich 2002[64] Acupuncture	1	1	0	1	1	0	1	**5**	1	1	1	1	1	1	1	1	1	1	1	**10**
Jull 2002[35] Mobs/manip; exercise	1	1	0	0	0	0	1	**3**	1	1	1	0	0	1	0	1	1	1	1	**8**
Kamwendo1991[116] Education	1	0	0	0	0	0	1	**2**	1	0	1	0	0	0	1	1	1	1	0	**6**
Karlberg 1996[36] Mobs/manip; education	1	0	0	0	0	0	1	**2**	1	0	1	0	0	0	0	0	1	1	1	**5**
Karppinen 1999[113] Orthosis	1	0	0	1	1	0	1	**4**	0	0	1	1	0	1	0	1	0	1	0	**5**
Klaber-Moffett 1990[118] Traction	1	0	0	1	1	0	1	**4**	1	0	0	1	0	1	0	1	1	1	0	**6**
Kogstad 1978[126] (Danish) Mobs/manip; education	1	0	-1	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	**0**
Koes 1991-93[90-96] Mobs/manip; exercise; education	1	1	0	1	0	0	1	**4**	1	1	1	0	0	1	0	0	1	1	1	**7**
Lewith 1981[104] Thermal	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	0	0	1	1	0	**6**
Lundblad 1999[38] Exercise	1	0	0	0	0	0	1	**2**	0	0	1	0	0	0	1	1	0	1	0	**4**
McKinney 1989[43,44] Exercise; orthosis; education	1	1	0	0	0	0	1	**3**	1	1	1	0	0	1	0	0	0	1	0	**5**
Mealy 1986[78] Exercise; orthosis; education	1	1	0	1	0	0	1	**4**	1	1	1	0	0	1	0	0	1	1	0	**6**
Nasswetter 1998[127] (Spanish) Drug	1	0	0	1	0	0	1	**3**	0	0	1	1	0	0	1	1	1	1	0	**6**
Nordemar 1981[121] Electrotherapy; Mobs/xanip	1	0	0	0	0	0	1	**2**	0	0	0	0	0	0	0	1	1	1	1	**4**
Özdemir 2001[50] Laser	1	0	0	1	1	0	1	**4**	0	0	1	1	0	1	0	0	1	1	1	**6**
Payne 1964[133] Drug	1	1	0	1	1	0	1	**5**	1	1	1	1	1	1	0	1	1	1	1	**10**
Persson 1996-2001[122-125] Education; mobs/manip	1	1	0	0	0	0	1	**3**	1	1	1	0	0	0	0	0	1	1	1	**6**
Petrie 1983[65] Acupuncture	1	0	0	0	0	0	1	**2**	1	0	0	0	0	0	0	0	1	1	1	**4**
Petrie 1986[60] Acupuncture	1	0	0	0	0	0	1	**2**	1	0	0	0	0	1	0	0	1	1	1	**5**
Pettersson 1998[47] Drug	1	1	0	1	1	0	1	**5**	1	1	1	1	1	1	0	1	1	1	1	**10**
Philipson 1983[105] (Danish) Electrotherapy	1	1	0	1	1	0	1	**3**	1	1	1	1	0	1	1	1	1	1	0	**9**
Revel 1994[45] Exercise	1	0	0	0	0	0	1	**2**	0	1	0	1	0	0	1	0	1	1	0	**5**
Rigato 2002[55] Electrotherapy	1	0	0	0	0	0	1	**2**	0	0	0	1	0	1	0	0	0	1	0	**3**
Salzmann 1993[131] (German) Drug	1	0	0	1	0	0	1	**3**	0	0	1	1	1	1	1	1	1	1	1	**9**
Sand 1992[86] Drug	1	0	0	1	0	0	1	**3**	1	0	1	1	0	1	0	1	1	1	1	**8**
Schnabel 2002[119] Massage	1	0	0	0	1	0	1	**3**	0	0	1	1	0	1	0	1	1	1	1	**7**
Schnider 2002[71] Drug	1	0	0	1	1	0	1	**4**	0	0	1	1	0	1	1	1	1	1	0	**7**
Soriano 1996[52] Laser	1	0	0	1	1	0	1	**4**	0	0	0	1	1	1	1	0	1	1	0	**6**
Seidel 2002[111] Laser	1	0	0	1	1	0	1	**4**	0	0	1	1	1	1	1	0	1	1	0	**7**
Sloop 1982[98] Mobs/manip	1	1	0	1	1	0	1	**5**	1	1	1	1	0	1	0	1	1	1	1	**9**
Smania 2003[66] Electrotherapy	1	1	0	1	1	0	1	**5**	1	1	1	1	1	1	0	0	1	1	1	**9**
Stav 1993[48] Drug	1	0	0	0	0	0	1	**2**	1	0	1	0	0	0	0	0	0	1	0	**3**
Snow 1992[77] Thermal	1	0	0	0	0	0	0	**1**	1	0	0	0	0	1	0	0	0	1	0	**3**
Taimela 2000[46] Exercise	1	0	0	0	0	0	1	**2**	0	0	0	0	0	1	0	0	1	1	1	**4**

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Table 3. Continued.

Author and Treatment	Jadad Criteria List 1a	1b	1c	2a	2b	2c	3	Total	van Tulder Criteria List A	B	C	D	E	F	G	H	I	J	K	Total
Takala 1994[42] Exercise	1	0	0	0	0	0	1	**2**	0	1	0	1	0	0	1	0	1	1	0	**5**
Taverna 1990[51] Laser	1	1	-1	1	1	-1	0	**2**	1	1	0	1	1	1	0	0	0	1	0	**6**
Terzi 2002[135] Drug	1	0	0	1	1	0	1	**4**	0	0	1	1	1	1	1	1	1	1	1	**9**
Thomas 1991[130] Drug	1	0	0	0	0	0	1	**2**	0	0	1	0	0	0	1	1	1	1	1	**6**
Thorsen 1991[109] Laser	1	0	0	1	1	0	1	**4**	1	0	0	0	0	1	1	1	1	1	1	**7**
Thorsen 1992[110] Laser	1	0	0	1	1	0	1	**4**	1	0	0	1	1	0	0	0	1	1	1	**6**
Thuile 2002[56] Electrotherapy	1	0	0	0	0	0	1	**2**	1	0	0	0	0	0	0	0	0	1	0	**2**
Trock 1994[57] Electrotherapy	1	1	0	1	1	0	1	**5**	1	1	1	1	0	1	0	1	1	1	1	**9**
van Wieringen 2001[88] Drug	1	0	0	1	1	0	1	**4**	0	1	1	1	1	1	0	0	1	1	1	**8**
Waylonis 1988[112] Laser	1	0	0	1	1	0	1	**4**	1	0	0	1	1	1	0	0	1	1	0	**6**
Wheeler 1998[74] Drug	1	0	0	1	1	0	1	**4**	0	0	1	1	1	1	0	1	1	1	0	**7**
Wheeler 2001[75] Drug	1	0	0	1	1	0	1	**4**	0	0	1	1	1	1	0	1	1	1	1	**8**
White 2000[80] Acupuncture	1	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	1	0	1	0	**2**
White 2004[62] Acupuncture	1	0	0	0	0	0	1	**2**	0	0	0	0	1	0	0	0	1	1	0	**2**
Ylinen 2003[39] Exercise	1	0	0	0	0	0	1	**2**	0	0	1	0	0	0	1	1	1	1	1	**6**
Zylbergold 1985[58] Traction	1	0	0	0	0	0	1	**2**	0	0	1	0	0	1	1	0	1	1	0	**5**

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Table 4. Review article findings by intervention characteristics categorized as showing evidence of benefit/no benefit. Strong level of evidence denotes consistent findings in multiple high-quality randomized controlled trials; Moderate evidence denotes findings in a single, high-quality randomized controlled trial or consistent findings in multiple low-quality trials; Limited evidence indicates a single low-quality randomized trial. The comparisons noted after the author in column 2 are those noted by the author. ST/IT/LT: short-term, intermediate, longterm; neg: negative results; MND: mechanical neck disorder; NDH: neck disorder with headache; NDR: neck disorder with radicular findings; DC: degenerative changes; WAD: whiplash associated disorder; M-A: results based on a metaanalysis; s: session; w: week; Rx: treatment; mobs: mobilizations; manip: manipulation.

Rx	Treatment Details and Disorder	Author	Level of Evidence		
			Strong	Moderate	Limited
EVIDENCE of BENEFIT					
Multimodal	Multimodal: stretching & strengthening exercise, mobilization, and manipulation for subacute/chronic MND/NDH/NDR	Allison 2002[32]: NT v CG Brodin 1985[33,34]: 3 v 1 Karlberg 1996[36] Jull 2002[35]: MTExT v Cntl	LT pain (M-A) LT GPE LT function (M-A neg)		
Exercise	Strengthening & stretching of neck region • for chronic MND	Bronfort 2001[40]: SMT/Ex v SMT Evans 2002[41]: SMT/Ex v SMT		*M-A all outcomes* ST pain/function ST GPE (neg) ST Patient satisfaction (neg) LT pain (neg) LT function LT GPE (neg) LT Patient satisfaction (neg)	
		Gam 1998[37]		ST pain	
		Lundblad 1999[38]		LT pain (neg) LT function (neg)	
		Ylinen 2003[39]: EvC; SvC		LT pain	
	• for chronic NDH	Jull 2002[35]		LT pain LT function LT GPE	
	Strengthen & stretching of shoulder region plus total body conditioning for chronic MND • Group exercise class (gymnastics) at work	Takala 1994[42]		ST pain (neg) ST function ST/LT pain (neg)	
	• Feldenkrais intervention	Lundblad 1999[38]		ST function LT function (neg)	
	Active range of motion or stretch exercise for acute WAD	McKinney 1989[43,44]: 2 v 1		ST pain	
	Cervical proprioceptive training and eye fixation exercises • for chronic MND	Revel 1994[45]		ST pain/ function ST pain/ function /GPE;	
		Taimela 2000[46]		LT pain (neg) LT GPE	
	Home exercise for acute WAD	McKinney 1989[43,44]: 3 v 1 Mealy 1986[78]: Active v Standard		ST pain ST pain	
Medicine	Intravenous glucocorticoid for acute WAD	Petterson 1998[47]		ST pain IT sick leave	
	Epidural injections with methylprednisolone and lidocaine for chronic neck disorder with radiation	Stav 1993[48]		ST/LT pain ST/LT function	
	Intramuscular injection local anesthetic for chronic MND (myofascial pain)	Esenyel 2000[69]			IT pain
Massage	Traditional Chinese therapeutic massage for chronic MND	Cen 2003[67]			Post function

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Table 4. Continued.

Rx	Treatment Details and Disorder	Author	Level of Evidence: Strong	Moderate	Limited
Electrotherapy	Pulsed electromagnetic field for acute MND/WAD & chronic OA				
	• extremely low frequency	Trock 1994[57]		ST pain ST function (neg) GPE (neg)	
	• low frequency	Thuile 2002[56] Rigato 2002[55]		Post pain Post pain	
	• high frequency @ 2-3 W Rx	Foley-Nolan 1990[53] Foley-Nolan 1992[54]		Post pain Post pain	
	@ 4-6 W Rx	Foley-Nolan 1990[53] Foley-Nolan 1992[54]		Post pain (neg) Post pain	
	@ 12 W Rx	Foley-Nolan 1992[54]		Post pain (neg)	
	• TAMMEF	Rigato 2002[55]		Post pain	
	Repetitive magnetic stimulation for chronic myofascial pain	Smania 2003[66]			ST pain
Laser	Low level laser therapy (GaAl-830 or 904 nm) for chronic MND/DC (OA)	Ceccherelli 1998[49] Özdemir 2001[50]		Post/IT pain Post/IT pain Post function	
		Taverna 1990[51] Soriano 1996[52]		Post/IT pain Post/IT pain	
Traction	Intermittent traction for chronic MND, NDR, DC	Goldie 1970[59]: trac v Cntl Zylbergold 1985[58]: 2 v 4		ST pain, ST GPE	
Orthosis	Orthopedic pillow for chronic MND	Jochems[68]			ST pain ST GPE
Acupuncture	Acupuncture			*ST pain (M-A)*	
	• Traditional Chinese medicine for chronic MND, NDR • Japan-style for subacute/chronic MND & WAD	Coan 1982[63] Irnich 2002[64] Birch 1998[79]		ST pain, Post pain ST pain	
	• Electroacupuncture for chronic MND & DC	White 2000[80]		Post pain	
	• Western for chronic MND	White 2004[62]		Post pain, ST/IT/LT pain (neg) ST/IT/LT function (neg)	
	• Local standard points for chronic NDR	Petrie 1983[65]		Post pain	
	• Local standard points for chronic MND	Petrie 1986[60]		ST pain (neg)	
	• Dry needling over ear TP for chronic MND	Irnich 2001[61]		ST pain, IT pain (neg)	
	• Traditional Chinese medicine (dry needling TP) for chronic MND	Irnich 2002[64]		Post pain (neg)	
EVIDENCE of NO BENEFIT					
Medicine	Botulinum-A injection for chronic MND with or without radiculopathy or headache	Cheshire 1994[70] Schnider 2002[71] Freund 2000[72,73] Wheeler 1998[74] Wheeler 2001[75]		ST pain (neg M-A)	

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Table 4. Continued.

Rx	Treatment Details and Disorder	Author	Level of Evidence		
			Strong	Moderate	Limited
	Intracutaneous injection of sterile water for NDH	Sand 1992[86]		ST pain (neg)	
	Subcutaneous injection of a vasodilator for chronic MND	Brockow 2001[87]		Post pain (neg)	
	Melatonin for chronic WAD, MND	van Wieringen 2001[88]		Post function (neg)	
	Morphine added to epidural injection of triamcinolone plus lidocaine for chronic NDR	Castagnera 1994[136]			Post/LT pain (neg)
Exercise	Home exercise for chronic MND and NDR	Allison 2002[32]: AT v Cntl		ST pain (neg) ST function (neg)	
		Koes 1992[90-96]: GP v pl		ST pain (neg) ST function (neg)	
		Brodin 1985[33,34]: 2 v 1		ST pain (neg)	
		Horneij 2001[47]: IT v Cntl		LT pain (neg) LT function (neg)	
Manual Therapy	Manipulation alone • 1 session (s) for acute, subacute, chronic MND • 3-4s/3w for chronic NDR/NDH	Sloop 1982[98]		ST pain (neg)	
		Bitterli 1977[101]: B v C		ST pain (neg)	
	Manipulation, mobilization and modalities for chronic NDR/DC	Brodin 1985[33,34]: 3 v 2		ST pain (neg)	
		Kogstad 1978[126]: MT v pl		LT GPE (neg)	
	Massage alone • Ischemic compression for chronic myofascial neck pain and MND	Hou 2002[76]: B2 v B1		Post/ST pain (neg)	
		Hanton 2000[102]			
	• occipital release for MND • Western massage for subacute MND	Hanton 1997[99]			
		Irnich 2001[64]: M v S		Post pain (neg)	
	• occipital release for MND	Hanton 1997[99]: 1 v 3		Post pain (neg)	
Thermal Agents	Ultrasound for chronic MND (myofascial) • at 8s/4w, 3 w/cm^2, 3 min per TP	Gam 1998[37]:US v pl		Post pain (neg) Post function (neg) Post/IT GPE (neg)	
	• at 10s/2w, 1.5w/cm^2, 6 min per TP	Esenyel 2000[69]: US v Cntl		Post/IT pain	
	for acute WAD	Flynn 1986[105]: US v pl		Post pain (neg)	
	Hot pack for chronic MND	Hurwitz 2002[82]: (heat, mobs v mobs); (heat, manip v manip); (heat, mobs, EMS v mobs, EMS); (heat, manip, EMS v manip, EMS)		LT pain (neg) LT function (neg) LT patient satisfaction (neg)	
	Infrared light • for subacute/chronic MND/DC	Lewith 1981[104]		ST pain (neg)	
	• for myofascial neck pain	Birch 1998[79]		ST pain (neg)	
	Spray & stretch for chronic MND (myofascial)	Snow 1992[77] Hou 2003[76]		Post pain (neg M-A)	
Electrotherapy	Modulated galvanic current (diadynamic current) for chronic NDR/NDH	Philipson 1983[105]			Post pain (neg) Post GPE (neg)
	Iontophoresis for acute WAD	Fialka 1989[106]			Post pain (neg)
	Magnetic necklace (static magnet) for chronic MND	Hong 1982[107]			Post pain (neg)

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Table 4. Continued.

Rx	Treatment Details and Disorder	Author	Level of Evidence		
			Strong	Moderate	Limited
	Electrical muscle stimulation for chronic MND, NDR, NDH	Hseuh 1997[108] Hurwitz 2002[82]: (EMS, manip v manip); (EMS, mobs v mobs); (EMS, heat, manip v heat, manip); (EMS, heat, mobs v heat, mobs)		LT pain (neg) LT function (neg) LT patient satisfaction (neg)	
Laser	Low-level laser therapy (GaAs-830 nm) for subacute/chronic MND (myofascial)	Thorsen 1991[109]		ST pain (neg)	
	for chronic MND (myofascial)	Thorsen 1992[110] Seidel 2002[111]		ST pain (neg) ST pain (neg)	
	Low-level laser therapy (HeNe-632.8 nm) for chronic MND (myalgia)	Waylonis 1988[112]			Post pain (neg)
Orthosis	Oral splint for chronic MND, NDH	Karppinien 1999[113]		ST/ LT pain (neg)	
	Soft collar for acute WAD or NDH	Gennis 1996[114] Borchgrevink 1998[115]		ST pain (neg) IT pain (neg) IT sick leave (neg) IT GPE (neg)	
		McKinney 1989[43,44]: 1 v 3 Mealy 1986[78]		ST pain (neg M-A) ST pain (neg M-A)	
Education	Advice to activate for subacute/chronic MND	Koes 1992[90-96]: GP v pl Kamwendo 1991[116]:A v C Glossop 1982[137]: I v II		ST/IT pain	
	Advice to rest for acute WAD	McKinney 1989[43,44] Mealy 1986[78] Borchgrevink 1998[115]		ST pain (neg M-A) ST pain (neg M-A) IT pain (neg) IT sick leave (neg) IT GPE (neg)	
	Advice on pain and stress coping skills for chronic MND	Horneij 2001[47]: SM v Cntl			LT pain (neg)
	Neck school for acute/ subacute/ chronic MND	Kamwendo 1991[116]: A v C, B v C			ST pain (neg)
Traction	Static traction for acute to chronic MND, NDR, DC	Brewerton 1966[117] Klaber-Moffet 1990[116] Zylbergold 1985[58]: 1v3		ST pain (neg) ST function (neg)	

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Table 5. Treatments with conflicting evidence.

Treatments with Conflicting Evidence	Author	Outcome
Massage (multimodal) • plus electrotherapy for chronic MND, DC • plus exercise (+/- other treatment) for acute WAD, subacute or chronic MND/NDH/NDR, chronic DC	Hou 2002[76]; Brodin 1985[33,34] Gam 1998[37]; Karlberg 1996[36]; Brodin 1985[33,34]; Fialka 1989[106]; Schnabel 2002[119]; Koes 1992[90-96]; Hanton 2000[102]	Post, ST, IT, LT for pain (variable), function (variable)
Mobilization and manipulation for subacute/chronic MND; chronic NDH	Koes 1992[90-96]: MT v pl; Bitterli 1977[101]: A v C; Jull 2002[35]: MT v Cntl	ST, LT for pain (M-A, neg), function (neg), GPE
Transcutaneous electrical nerve stimulation including Ultra-Reiz (143 Hz) for WAD, acute MND, chronic NDR	Flynn 1986[103]: UR v Pl Chee 1986[120] Hsueh 1997[108] Nordemar 1981[121]	Post pain (neg) Post pain (neg) Post pain ST pain (neg)
Interferential (50 Hz) • for acute WAD/NDH, • chronic myofascial neck	Fialka 1989[106] Hou 2002[76]	Post pain Post, ST, LT pain (neg)
Education within multimodal context for acute WAD, subacute/chronic MND, NDH, NDR	Karlberg 1996[36]; Persson 2001[122-125]: PT v Col; Horneij 2001[47]: IT v cntl; Lundblad 1999[38]: F v cntl, PT v cntl; Kogstad 1978[126]: CT v Pl	Post, ST, IT, or LT pain (variable), function (variable)
Oral psychotropic agents • Cyclobenzaprine for subacute MND	Nasswetter 1998[127] Basmajian 1978[128]	Post pain Post muscle spasm (neg)
• Diazepam for subacute MDN for acute MND for chronic DC	Basmajian 1978[128] Basmajian 1983[129] Thomas 1991[130]	Post muscle spasm (neg) Post pain (neg) Post pain (neg)
• Tetrazapam for acute MND	Salzman 1993[131]	Post pain, GPE
• Eperison hydrochloride for chronic MND	Bose 1999[132]	ST pain
• Phenobarbital for acute MND • Meprobamate for chronic NDR	Basmajian 1983[129] Payne 1964[133]	Post pain (neg) Post pain
Oral antiinflammatory agents and oral analgesics • Ibuprofen for chronic NDH	Dostal 1978[134]	ST pain
• Oral antiinflammatory, analgesic, education	Koes 1992[90-96]	ST pain (neg), GPE (neg), function (neg)
Nerve block injections • Prilocaine 2% anesthetic block of greater occipital nerve for NDH	Terzi 2002[135]	Post pain

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