The Effectiveness of Manual Therapy and Exercise For Mechanical Neck Disorders: A Systematic Review

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Study Design: Systematic review.

Objective: To determine the effectiveness of manual therapy and/or exercise, in relieving pain, improving function, and patient satisfaction, in adults with mechanical neck disorders (MND).

Background: Neck pain is a multifaceted problem, with a lifetime prevalence as high as 66%. It is one of the most common musculoskeletal problems requiring referral to physiotherapy. Manual therapy and/or exercises are the most commonly prescribed treatments for MND, yet there is only limited high-quality evidence supporting the effectiveness of these treatments.

Methods: A literature search was conducted between the years 2005-2009 using the electronic databases MEDLINE, CINAHL, SCOPUS, and EMBASE. References from these studies were also searched. Only randomized controlled trials and controlled clinical trials involving adults with MND including whiplash-associated disorders (WAD) category I and II, myofascial neck pain, and degenerative changes were included. 4 independent reviewers using the Jadad and PEDro rating scales conducted study selection and methodological quality assessment.

Results: 16 studies were selected for inclusion, 10 high, 4 moderate, and 2 low quality trials. There was strong evidence for decreasing pain intensity, neck disability, and/or improving quality of life for the exercise group as compared to controls. Moderate evidence supported the use of exercise in conjunction with pillow supports or manual therapy to decrease pain, neck disability, and/or increase cervical range of motion.

Conclusion: Strong evidence supports the effectiveness of various exercise programs and only limited evidence supports the use of manual therapy alone, in patients with MND.

Key Words: *exercise, manual therapy, mechanical neck disorders, physical therapy*

INTRODUCTION

Neck pain is a well-recognized and common disorder with suggested incidence of 6% and 22% and a global life-time prevalence of up to 71% in adults.[1] Although neck dysfunctions are typically not life-threatening, neck pain and stiffness may be detrimental to patients' physical, social and emotional well-being. Indeed, neck pain has been associated with decreased health status, work absenteeism and long-lasting psychological issues.[2] Given its high prevalence and the associated risks, individuals with neck pain represent a significant burden to health-care systems worldwide. Recent studies have shown that individuals with lost-time claims for neck pain account for approximately 11.3% of lost-time claims among workers in Ontario.[3] In the Netherlands in 1996, the total costs of neck pain were estimated to be 0.1% of that country's national gross domestic product.[4]

Mechanical neck disorders (MND) are neck disorders not related to an underlying systemic problem or serious pathology and correspond to diagnostic categories 1 and 2 of the classification system proposed by the Quebec Task Force on Spinal Disorders.[5] These disorders include conditions with muscle, joint, ligament, disc, or degenerative involvement. In Canada and the United States, mechanical neck disorders are commonly treated with nonsteroidal anti-inflammatory drugs (NSAID), exercise, or manual therapy.[6] To date, several previous systematic reviews have examined the effectiveness of conservative treatments in the patients with MND, yielding only limited high-quality evidence to support the effectiveness of these treatments.[7,8] The last published systematic review was by Gross et al. in 2007.[8] Since this systematic review a considerable (25 studies) amount of literature focusing on the effectiveness of exercises and manual therapy in the treatment of MND has been published, highlighting the need for an updated review. The purpose of this study, therefore, was to further evaluate the effectiveness

of exercise and manual therapy in relieving pain, improving function and patient satisfaction, in patient with mechanical neck disorders based on the most current evidence.

METHODS

A literature search was conducted for studies assessing the effectiveness of manual therapy and/or exercise in the treatment of MND between the years 2005-2009 using the electronic databases MEDLINE, CINAHL, SCOPUS, and EMBASE. Only articles published in English were included in this systematic review. Key words included terminology relating to the neck region (i.e., neck, cervical spine), neck dysfunction (i.e., mechanical neck disorders, neck pain, dysfunction or disorders), and types of conservative treatments (i.e., physical therapy/physiotherapy, manual therapy, and exercise). Articles published prior to 2005 were included in a systematic review by Gross et al[8] Four independent reviewers assessed the article titles and abstracts of the articles generated by the search along with their associated reference lists to identify possible articles for this systematic review. The lists from each electronic database were then compared to eliminate duplicates and to generate a master list. The search identified 50 articles that warranted further exploration. The reviewers then looked at the Methods sections of each article and excluded any articles that were not randomized control trials and/or did not comply with the inclusion/exclusion criteria (see below). Finally, 25 studies were selected and evaluated using the Jadad[9] (maximum score 5), and the Physiotherapy Evidence Database[10] (PEDro; maximum score 10) rating scales, as well as the Data Extraction & Critical Appraisal Form (DECAF) for this systematic review. Selection criteria included the following:

Type of Study Only published randomized control trials (RCTs), or RCTs “in press” and controlled clinical trials (CCTs) were included in this review.

Type of Participant Only adults (18 years of age or older) with acute (<30 days), subacute (30-90 days), or chronic (>90 days) mechanical neck disorders, including grades I or II whiplash-associated disorders (WAD), myofascial neck pain, and disorders secondary to degenerative changes were included in this review.

Types of Intervention Studies using manual therapy and/or exercise were included in this review. Manual therapy is a hands-on, passive technique performed by therapists. For this review, manual therapy treatments included mobilizations, manipulations, traction, active release therapy, muscle energy techniques, passive stretching, and/or massage. Exercise treatments included stretching, strengthening/endurance, range of motion, and/or behaviour graded activity programs (BGA).

Most of the control groups used in these studies received advice, general home exercise program, and/or general practitioner care. Other interventions that were not the main focus of this paper but were examined because of their association with either manual therapy or exercise were short-wave diathermy and transcutaneous electrical nerve stimulation (TENs).

Type of Outcome Treatment effectiveness in the studies reviewed was determined by improvements in pain, function, quality of life (QOL), strength, and/or patient satisfaction. Typical outcome measures included the Visual Analog Scale (VAS) for pain, the Neck Disability Index (NDI), Neck Pain and Disability Scale (NPDS), Northwick Park neck pain questionnaire (NPQ), neck range of motion, neck strength, or the Tampa Scale for Kinesiophobia for function, and self-report questionnaires for patient satisfaction. Improvements lasting < 3 months were considered short-term, while improvements lasting 3 months or longer were considered long-term.

Methodological Quality Four independent reviewers assessed each of the selected 25 studies for methodological quality using the Jadad, PEDro, and DECAF. Both the PEDro and Jadad scores were used to differentiate between high, moderate and low quality studies, while the DECAF was used to assist in determining the criteria cut-off points. Lastly, findings were categorized using levels of evidence (**TABLE 1**).[11]

RESULTS

Twenty-five articles were selected for review, and nine were excluded based on failure to meet inclusion criteria and methodological flaws (i.e., no wash out period for crossover studies, no randomization, contamination of treatment interventions). Of the 16 remaining articles, 1 examined acute,[12] 2 subacute,[13,14] 8 chronic,[15-22] and 5 mixed[23-27] neck pain. As well, 3 articles included only whiplash associated disorders[12,13,14] and 1 examined trapezius myalgia.[24] **TABLE 2** provides details on study sample sizes, interventions, reported results, rating scores, and methodological issues.

Based on the PEDro and Jadad scores, 10 of the reviewed studies were rated as high[12-17,19,23,26,27], 4 as moderate[18,20,21,24], and 2 as low[22,25] quality studies. The mean scores were 2.6 for the Jadad, and 6.75 for the PEDro. Common methodological weaknesses of the included studies were failure to describe or use appropriate concealment of treatment allocation (36%), and lack of effective blinding of participants (81%), therapists (94%), as well as assessors of outcomes (31%). In addition, failures to describe withdrawals (25%), use intention to treat analysis (25%), and obtain outcome measure scores for at least 85% of participants (31%) were common errors.

Supervised Physical Therapy (PT) Strength Training Programs Alone Eight trials compared supervised PT strength training programs against Qigong exercises,[21] home exercise programs,[13] general fitness training,[15,20,24] stretching alone,[18] PT advice,[12,20] and TENS.[16] When compared with a home exercise program, supervised PT strength training programs had statistically significant improvements in short-term self-efficacy (P<0.03), fear of movement/(re) injury (P<0.03), pain disability (P<0.03), and frequency of analgesic consumption (P<0.03).[13] In addition, a reduction in pain (P< 0.001) was demonstrated when compared to general fitness training, [24] and reductions in short term pain (P=0.005), disability (P=0.004), and improvements in QOL (P=0.003) were shown when compared to advice alone.[12] However, no differences were demonstrated between supervised PT strength training programs and Qigong exercises,[21] stretching alone,[18] general exercise programs,[15,20] or TENS.[16]

Manual Therapy Alone One randomized controlled trial compared specific manual therapy against random mobilizations and demonstrated no statistically significant differences between specific mobilizations and random mobilizations.[26]

Multimodal PT Care (i.e., Exercise and Manual Therapy) Four trials compared PT care (exercise and manual therapy) against general practitioner (GP) care,[14] behaviour graded activity programs,[19] minimal PT intervention/advice,[27] and advice with exercise, as well as advice, exercise and pulsed short-wave diathermy.[17] When compared to minimal intervention, multimodal PT care (exercise and manual therapy) had statistically significant improvements on short- and long-term pain ($P \leq 0.004$), disability ($P \leq 0.001$), and patient-perceived recovery ($P \leq 0.011$).[27] Nonetheless, when compared to GP care and behaviour graded activity programs there were no statistically significant differences in pain, disability, fear of movement, self-efficacy, or depression.[14,19] Lastly, one article examined the multimodal use of PT exercise and

pillow support against exercise alone, pillow alone, or control (hot, cold, massage).[23] Results showed a statistically significant and clinically meaningful interaction of exercise and pillow in the reduction of pain (P = 0.029).

Other Two trials examined specific forms of exercise: postural re-education compared to stretching,[25] and cervical flexion versus cervical extension strengthening exercises.[22] Neither intervention demonstrated statistically significant changes in pain, cervical range of motion (CROM) or quality of life (QOL).

Strong evidence Two high quality studies demonstrated that exercise therapy in patients with acute and subacute WAD I and II had statistically significant improvements in short-term (6-12 weeks) pain, disability, and QOL.[12,13]

Moderate evidence One high quality trial supported the use of exercise in conjunction with pillow supports,[23] by demonstrating significant improvements in neck pain for individuals with subacute MND. In addition, one high quality trial supported the use of exercise and manual therapy to significantly decrease short- and long-term pain, disability, and improve patient perceived recovery in participants with mixed MND.[27] Similarly, another high quality trial supported the use of exercise and manual therapy to improve cervical range of motion in participants with an acute WAD I or II.[14]

Limited evidence Limited evidence suggests there may be benefit in the use of specific strength training to decrease pain in participants diagnosed with trapezius myalgia.[24]

Conflicting/Unclear evidence Evidence from both high and moderate quality studies demonstrated statistically significant improvements across all intervention groups. Chiu et al[16]

found significant reductions in pain for both the TENS and the exercise intervention groups. In addition, Dziedzic et al[17] demonstrated significant improvements for all intervention groups (advice and exercise only versus advice and exercise with manual therapy versus advice and exercise with pulsed short-wave diathermy). Lastly, Häkkinen et al[18] found significant improvements in pain for both strength training and the stretching interventions.

Evidence of no benefit Three high quality trials suggested that exercise programs have no benefit in long-term (12, 36, 52 weeks) pain reduction in acute, subacute or chronic MND.[12,13,16]

DISCUSSION

For the treatment of acute, subacute and chronic MND, we found favourable results with supervised exercise programs alone,[12,13,24] exercise in conjunction with other physiotherapy treatments such as manual therapy,[14,27] as well as exercise with home pillow supports.[23] For acute and subacute WAD I and II, exercise therapy improved short-term pain, disability, and QOL,[12,13] whereas exercise in conjunction with manual therapy improved cervical range of motion.[14] For participants with acute, subacute and chronic MND, both short- and long-term benefits in pain reduction were seen with exercise in conjunction with manual therapy[27] and exercise with pillow supports.[23] Other commonly used interventions demonstrated no evidence of benefit compared to other active treatments.

Our findings are consistent with previous reviews showing strong evidence for multimodal treatments of exercise and manual therapy in the treatment of MND. Gross et al[8] found that the combination of exercise and manual therapy, exercise alone and low level laser therapy had a positive impact on pain, function and global perceived effect (GPE) in both the short- and long-term. Kay et al[28] also demonstrated short- and long-term benefits of multimodal treatments of

exercise and manual therapy for MND. Furthermore, other research has shown strong evidence for dynamic resisted strengthening exercises in chronic and frequent neck disorders.[29] However, in this review, strength training programs showed no benefits over Qigong exercises,[21] stretching only,[18] general exercise programs,[15,20] and TENs.[16] Lastly, a systematic review by Verhagen et al[30] found no benefits for active (exercise) or passive (rest, ultrasound) treatments to relieve the symptoms of WAD I or II. In contrast, two high quality trials examined in this review demonstrated improvements in short-term pain, disability, and QOL in the same population.[12,13]

In this review, only four commonly used electronic databases (MEDLINE, CINAHL, SCOPUS, EMBASE) were used, which could be deemed as a limitation to this study. Non-English databases were excluded from this review for time and cost reasons (i.e., effort needed to translate articles into English). The trials in this study did not have heterogeneity with regard to populations, interventions and outcomes; thus, making it difficult to pool the results.

Since Gross et al's[8] review, 25 RCTs have been published examining exercise and/or manual therapy, 16 of which were selected based on stringent inclusion and exclusion criteria. Main limitations for the studies were failure to reveal method of concealment for treatment allocation, blinding of participants, therapists and assessors, and not having a control group. With manual therapy and exercise interventions, it is challenging to perform these studies in a double-blinded manner (blinding of the participants and therapists), since these individuals are aware of which treatment they are receiving or giving. Therefore, it is crucial that assessors of the results be blinded to increase internal validity. Scoring higher than 8 out of 10 on the PEDro scale is difficult because two questions directly relate to blinding of the participants and therapists. The PEDro cuts off scores (high, moderate, low quality) made by the researchers of this paper were sensitive to this fact. Lastly, most studies included in this review did not have a control group, which may have lead to the insignificant results found in most studies.

CONCLUSIONS

In the treatment of MND, no consistent findings for manual therapy alone were found in this review; however evidence did support multi-modal interventions, and exercise alone. For future studies, researchers need to focus on blinding the assessors and having consistent control groups. It is essential that continued research be completed on conservative management of MND to help decrease pain, disability and improve patients' quality of life without causing additional strain on the healthcare system.

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TABLE 1. Classification of Level of Evidence

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

	PEDro Score	Jadad Score
High Quality	≥7	≥3
	≥8	2
Moderate Quality	7	2
	5,6	3
Low Quality	≤4	≤2

TABLE 2: Characteristics of Included Articles

First Author (yr)	Study Pop.	Neck pain duration	Intervention	Follow-up (wks)	Outcome measures †	Results *	Pedro	Jada
High Quality								
Bunketorp (2006)	47 sub-acute WAD	>6 wks, < 3 months	Home Exercise Program (HEP) vs Supervised Exercise Program (SEP)	12, 36	*Self efficacy, disability*, *fear of movement*, pain, CROM, sick leave, tenderness, analgesic consumption	12: SEP (+) improvement in self-efficacy (P<0.03), fear of movement/(re) injury (P<0.03), pain disability (P<0.03), and frequency of analgesic consumption (P<0.03) 36: (=)	8	3
Griffiths (2009)	74	> 3 mos	General exercise program (GEP) vs. Specific exercise program (neck stabilization) (SEP)	6, 26	*Pain, disability*, pain meds, pain affect, global improvement	(=) for primary outcome measures 6: SEP (+) decreased use of pain meds (P = 0.02)	9	2
Stewart (2007)	134 acute WAD 1-2	< 4 wks	Advice (by physiotherapist) vs. Advice and Exercise (general exercise program and home program)	6, 52	*Pain, Patient –specific functional scale, bothersome scale,* QOL, disability, Global perceived effect	6: (+) for primary and secondary outcome measures in the advice and exercise group 12: (=)	8	2
Helewa (2007)	151	> 2 mos, <12 mos	Control (hot, cold, massage) vs. Sleep support pillow with placebo vs. Neck and posture exercises with placebo vs.	3, 6, 12 24, 52	*Northwick park neck pain questionnaire (NPQ),* QOL, grip strength, anterior neck strength,	3, 6, 12, 24, 52: (+) improvement on the NPQ for exercise and pillow support plus placebo. (=) for secondary measures	8	2

			Exercise and pillow support with placebo					
Chiu (2005)	218	>3 mos	Control (infraradiation and advice) vs TENS with placebo vs Exercise with placebo	6, 52	*NPQ, pain, isometric strength of the neck muscles*	6: (+) decrease in pain for the TENS and exercise groups 6, 52: (=) for NPQ and isometric strength	7	3
Dziedzic (2005)	350	> 6 mos	Advice and exercise only vs Advice and exercise with manual therapy vs. Advice and exercise with pulsed shortwave diathermy	6, 26	*NPQ,* global assessment of change, QOL, satisfaction with physiotherapy	(=) improvements for primary and secondary measures for all groups	8	3
Walker (2008)	94	Mixed	Manual Therapy & Ex. (MTE) Vs. Minimal intervention (MIN)	3, 6, 52	*Disability, pain, perceived recovery,* success rate	3, 6: MTE (+) decrease in pain ($P \leq 0.004$) 3, 6, 52: MTE (+) improvements in disability ($P \leq 0.001$) and patient-perceived recovery ($P \leq 0.011$).	7	3
Scholten-Peeters (2006)	80 sub acute WAD 1 or 2	>4 wks post accident	GP Care vs. PT (exercise and minimal manual therapy (MT)	8, 12, 26, 52	*Pain, headache, ADL's,* functional recovery, general health, CROM, fear of movement, coping, disability	8, 12, 26, 52: (=) primary outcome measures 12, 26: PT (+) in CROM 52: GP (+) for functional recovery, coping, and physical functioning.	7	3
Vonk (2008)	139 chron. neck pain	> 3 mos	PT (conventional exercise with some MT) vs. Behavior Graded Activity program (BGA)	4, 9, 26, 52	*Global perceived effect*, physical complaints, pain, functional status, self efficacy, fear of movement, depression, QOL	4, 9, 26, 52: (=)	7	3
Kanlayanaphotporn (2009)	60 unilat neck pain	> 1 wk	Specific Mobs vs Random Mobs	Immediate	Pain, CROM, global perceived effect,	(=)	10	5
Moderate Quality								
Häkkinen (2008)	101	> 6 mos	Strength training and stretching vs. stretching alone	8, 52	*Pain, disability*, CROM, strength	(=) in neck pain Improvements in disability were significant in both groups (P<0.001)	7	2
Andersen (2008)	42 female	> 1mos	Specific strength training (SST) vs. General fitness training (GFT) vs. control	10	*Pain*, strength, VO2max	SST: (+) decrease in worst & general pain (79%; $P < 0.001$) GFT: (+) decrease in acute pain (5 mm; $P < 0.05$)	5	1
Lansinger (2007)	122	> 3 mos	Qigong Exercises vs. PT strength training programs	12, 24, 52	*Disability, pain,* CROM, grip strength	(=)	5	3
Blangsted (2008)	549	>12 mos	Reference group (advice) vs.	12	*Pain, perceived work ability*	(=)	5	3

			Specific resistant exercise (SRE) vs. All-round physical exercise					
Low Quality								
O'Leary (2007)	48 female	> 3 mos	Cranio-cervical flexion (CCF) vs. Cervical flexion endurance (CF)	immediate	*Pain,* pressure pain threshold (PPT)	(=)	4	2
Cunha (2008)	31 female	> 12 wks	Global postural exercise (GPE) vs. Conventional stretching	Immediate, 6	*Pain*, C/S ROM, health QOL	6: (=)	3	2

†Primary in *italics.*

* (=) denotes lack of clinically relevant difference observed between intervention and comparator; (+) denotes statistically significant difference between intervention and comparator.