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The efficacy of manual therapy and therapeutic exercise in patients with chronic neck pain: A narrative review

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Abstract
The aim of this research was to investigate the effect of manual therapy and therapeutic exercise of the neck muscles on pain, disability and quality of life in individuals with neck pain.
Method: A literature review was performed on the databases of MEDLINE, SCIENCE DIRECT and COCHRANE between September and November of 2017. The following keywords were used: chronic neck pain, exercise, manual therapy and physiotherapy. Articles inclusion criteria were randomized clinical trials which applied to individuals with chronic neck pain and contained a combination of therapeutic exercise and manual therapy for the neck muscles.
Results: 10 randomized clinical trials met the inclusion criteria and were included in this review. In all of them, combined protocols of therapeutic exercise and manual techniques were applied. Few studies pointed out only short-term positive effects on pain and disability in their results. Additionally, in the majority of the studies, the manual techniques which were applied concerned mostly the cervical and thoracic spine (spinal manipulation and mobilization) and much less the neck muscles.
Conclusion: There is not enough evidence to support that the combination of spinal mobilization or manipulation and therapeutic exercise can improve further symptoms and quality of life in individuals with chronic neck pain that exercise alone. To the contrary, there is some evidence on the efficacy of therapeutic exercise and manual massage but this subject remains to be elucidated.
Further research is necessary using the above therapeutic combination in order to determine its short- and long-term effects on pain, disability and the quality of life of individuals with chronic neck pain.

Keywords: chronic neck pain, exercise, manual therapy, physiotherapy.

Introduction
Neck pain is one of the most common musculoskeletal disorders in western societies with high prevalence in the general population of up to 67% [1, 2]. It has been considered responsible for pain and disability in healthy adults [3] and thus has a direct impact on their quality of life[4]. According to the ICF (International Classification System), neck pain is classified into four major categories:

- Neck pain with mobility deficits, (cervicalgia and pain in thoracic spine)
- Neck pain with headaches, (headache and cervicocranial syndrome)
- Neck pain with movement coordination impairments, (sprain and strain of cervical spine)
- Neck pain with radiating pain, (spondylosis with radiculopathy and cervical disc disorders with radiculopathy) [5]

Neck pain shows repeatability and chronicity [6]. Chronic neck pain is defined as neck pain with duration of symptoms longer than three months and is associated with changes in the biomechanics of the neck region. The main contributing factor to the persistence of symptoms seems to be the muscular imbalance between the deep and superficial neck flexors [7]. The weakness of the deep neck flexors (longus capitis and longus colli) leads to tension and muscle spasm in the superficial neck flexors (sternocleidomastoid and anterior scalene) as confirmed by electromyography [8].
Therapeutic exercise plays a vital role in the restoration of this muscular imbalance. According to recent guidelines [5, 6, 9, 10] the implementation of a combined (resistance and endurance) exercise program lasting from 6 to 12 weeks, 3-5 times per week, increases the strength of the

neck muscles, reduces pain and improves functionality.

In the majority of studies either resistance or endurance exercise programs are applied. Although there has been much debate about which of the two types of training is most appropriate, it appears that greater benefits have been demonstrated in combined exercise programs involving both types of training [2, 8, 11, 12]**.** The manual therapy methods consist of hands-on techniques applied by health professionals in order to reduce pain and disability. Hakkinet and colleagues [13] state that manual therapy techniques are effective in reducing pain in individuals with chronic neck pain but on its own it does not constitute an efficient method for increasing muscle strength. Thus, they display mainly short-term positive results. Such techniques are spinal mobilization, spinal manipulations, soft tissue mobilization techniques, manual massage etc [14]. There is some evidence to support that cervical manipulation is more effective than acupuncture or anti-inflammatory drugs in individuals with chronic neck pain [15]. However, the effect of manual techniques and therapeutic exercise in individuals with chronic neck pain remains to be elucidated. The aim of this review was to study the efficacy of therapeutic exercise in combination with manual therapy concerning pain, disability and health-related quality of life in individuals with chronic neck pain.

2. Methods

A literature review was conducted between September and October of 2017 with the following keywords; chronic neck pain, exercise, manual therapy and physiotherapy. The literature search was performed in MEDLINE, SCIENCE DIRECT and COCHRANE databases. The results were summarized in a narrative synthesis.

2.1 Study selection

The inclusion criteria for this review were published randomized controlled trials (RCTs) of at least one type of exercise intervention in combination with at least one type of manual techniques which was applied to individuals with chronic neck pain. Trials on neck pain due to serious spinal pathology, systemic disease or other specific causes were excluded.

3. Results

This search strategy identified 10 clinical trials for inclusion in this literature review. Details of the included studies are presented in Table 1. Apart from two studies in which participants were elderly [16, 17], in the majority of clinical trials participants were women of middle age. The exercise interventions included resistance and/or endurance training for the neck muscles, while the manual techniques application included spinal manipulation, mobilization or different types of manual massage. The comparators followed no intervention or the application of only one of the two components (exercise or manual therapy alone). Outcomes measured were pain intensity, disability related to neck pain, maximum isometric strength, sick leave, pressure pain thresholds, ROM, health-related quality of life, patient satisfaction etc.

Table 1: Characteristics of the included studies

Study/Participants / Duration (weeks)	Interventions	Outcomes	Results.
Bronfort *et al*. 2001 [18] – 191 patients – 11 weeks	– spinal manipulation combined with rehabilitative neck exercise (spinal manipulation with exercise), – MedX rehabilitative neck exercise, or spinal manipulation alone.	– patient-rated neck pain, – neck disability, – functional health status (as measured by Short Form-36 [SF-36]), – global improvement, satisfaction – with care, – and medication use	They found that this combination had better results in reducing symptoms.
Evans *et al*. 2002 [19] – 191 patients – 11 weeks	– spinal manipulation combined with low-tech rehabilitative exercise, – MedX rehabilitative exercise, – spinal manipulation	– self-report questionnaires measuring pain, disability, – general health status, – improvement, – satisfaction, – OTC medication use	The results showed that the two exercise groups (1st and 2nd) had less pain after intervention by the control group, while the patients who combined both (1st group) appeared to be more satisfied with the care. However, the differences between the first two groups before and after the intervention were not statistically significant.
Hudson and Ryan 2010 [2] – 14 patients – 6 weeks	– strength training usual care – Physiotherapy.	– disability pain using the neck disability index (NDI) and the – pain numerical rating scale (NRS)	The results showed that the combined exercise program reduced pain and improved functionality in relation to the "conventional physiotherapy program".
Martel *et al.* 2011 [20] – 98 patients – 40 weeks	– Spinal manipulative therapy (SMT) – chiropractic preventive care (CPC) – no treatment	– Pain intensity with VAS, – Neck Pain Disability Index (NDI) and the – Bournemouth Questionnaire (BQ) – health-related quality of life (HRQOL) – SF-12 Questionnaire – Fear-avoidance Behaviour Questionnaire (FABQ)	A positive effect in pain severity, disability, ROM and quality of life were noted in all groups after the intervention but no group difference was observed.

Evans *et al*. 2012 [21] – 270 patients – 12 weeks	– high-dose supervised strengthening exercise with spinal manipulation (exercise therapy combined with spinal manipulation therapy [ET + SMT]), – highdose supervised strengthening exercise (ET) alone, – low-dose home exercise and advice (HEA).	– Patient rated pain – disability, – health status, – global perceived effect, – medication use, – Satisfaction.	The results showed that supervised exercises with or without manipulations effectively reduced pain.
Bronfort *et al*. 2012 [16] – 272 patients – 12 weeks	– SMT: manipulation of areas of the spine with segmental hypomobility – Medication: nonsteroidal anti-inflammatory drugs – HEA: self-mobilization exercise	– participant-rated pain – self-reported disability, global improvement, – medication use, – satisfaction, – general health status – adverse events	The SMT group applied vigilant exercises under supervision and manipulations in the spine while the second group applied a home exercise program. The researchers found a positive effect on both groups without, however, observing statistically significant differences between the two groups.
Akhter *et al.* 2014 [22] – 62 patients – 12 weeks	– Manual therapy (manipulation) with supervised exercise regime whilst 31 subjects – Supervised exercise regime	– Pain intensity with VAS, – Neck Disability Index (NDI)	The manual therapy (manipulation) with an exercise regime appeared as a favorable treatment preference compared to an exercise regime alone.
Maiers *et al.* 2014 [17] – 245 patients – 12 weeks	– spinal manipulative therapy – supervised rehabilitative exercise – home exercise	– qualitative interviews	The results of this study showed that the combination of exercise and manipulation increased participants' satisfaction and perceived value of care.
Beltran-Alacreu *et al.* 2015 [23] – 45 patients – 16 weeks	– manual therapy (MT) techniques – therapeutic patient education (TPE) – therapeutic exercise (TEX)	– Neck Disability Index (NDI) – Spanish validated Tampa – Scale of Kinesiophobia (TSK) – Fear Avoidance Beliefs Questionnaire – (FABQ) – Neck Flexor Muscle Endurance (NFME) test	A multimodal treatment is a good method for reducing disability in patients with non-specific chronic neck pain in the short- and medium-term.
Celenay *et al.* 2016 [24] – 60 patients – 4 weeks	– Progressive structured cervical – Scapulothoracic stabilization exercise program	– Pain intensity with VAS, – pressure pain threshold with digital algometer, – level of anxiety with Spielberger State Trait Anxiety Inventory, – and quality of life with Short Form-36	The results showed that both groups improved the clinical picture and the quality of life of the patients

4. Discussion

Therapeutic Exercise in the management of chronic mechanical neck pain has been studied extensively over the last decades. Numerous studies have shown that the implementation of therapeutic exercise improve symptoms and quality of life in both the short- and long-term [8, 11, 12, 22, 25, 26].

The aim of this review was to examine if the combination of therapeutic exercise and manual therapy could improve further the positive effect which exercise alone has.

The following authors attempted to investigate the combined effect of exercise and manual techniques on patients with chronic neck pain.

Bronfort and colleagues [18] studied in 191 patients with chronic neck pain the combined effect of spine manipulation and exercise in relation to manipulation alone. They found that this combination had better results in reducing symptoms. However, this study failed to highlight the therapeutic value of manual techniques since it was not clear if this positive effect was due to the application of exercise and not to the combination of exercise and manipulation.

Evans and colleagues [19] studied the effect of 3 different exercise protocols for 11 weeks in 191 individuals with chronic neck pain. To the first group, spinal manipulations and dumbbell shoulder exercises for neck and upper limb muscles were applied. The second group followed a neck muscles resistance training with MedX and to the third group spinal manipulations were applied. The results showed that the two exercise groups (1st and 2nd) had less pain after intervention than the control group. Furthermore, participants of the 1st group appeared to be more satisfied with their care. However, the differences between the first two groups after the intervention were not statistically significant.

Hudson and Ryan [2] studied the effect of an exercise program for neck muscles in 14 individuals with chronic neck pain. The intervention group followed a combined protocol of stabilization, proprioceptive and resistance exercises while the control group followed a "conventional physiotherapy program" which included a combination of spinal mobilization and manipulation. The results showed that the combined exercise program reduced pain and improved disability in comparison to the "conventional physiotherapy program". Consequently, neither this study managed to reveal any positive effect of the combination of therapeutic exercise

and manual techniques.

Evans and colleagues [21] studied the effect of 3 different exercise protocols for 12 weeks in 270 patients with chronic neck pain. In the first group, resistance exercises were applied under supervision, as well as spinal manipulation. In the second group, only exercises under supervision were applied, while the 3rd group followed a home-based exercise program. Their results showed that supervised exercises, with or without manipulations, effectively reduced pain in comparison to the home-based program, but there were not any significant differences between the groups 1 and 2. Thus, according to the results of this study, authors could not claim that the combination of manual therapy and exercise further improved the symptoms of individuals with chronic neck pain.

Saeed Akhter and colleagues [22] evaluated the role of manual therapy with exercise regime versus exercise regime alone in the management of non-specific chronic neck pain. 62 participants with chronic neck pain were allocated to 2 groups. The first group followed an exercise program in combination with spinal manipulation, while the 2nd performed only supervised exercise regime for the period of 3 weeks. Pain and disability were improved in both groups. However, there were not any differences between the groups.

Beltran-Alacreu and colleagues [23] studied the effect of a multimodal treatment in 45 individuals with chronic neck pain. The sample was divided into three groups: control group, subjected to a protocol of manual therapy (cervical mobilization and manipulation); intervention group 1, subjected to a protocol of manual therapy and therapeutic patient education; and intervention group 2, subjected to manual therapy, therapeutic patient education and a therapeutic exercise protocol. The researchers found that the combination of exercise, patient education and manual therapy was more effective than the performance of manual therapy alone. However, from the results of this study it was not clear if that positive effect was due to the combination of the manual therapy and exercise or exercise alone.

Martel and colleagues [20] evaluated the efficacy of spinal manipulation with and without exercise in 98 individuals with chronic neck pain. Participants were allocated to three groups (placebo group, spinal manipulation group and spinal manipulation plus exercise group). A positive effect in pain severity, disability, ROM and quality of life were noted in all groups after the intervention, but no group difference was observed.

Celenay and colleagues [24] studied the effect of neck stabilization exercises and connective tissue massage in 60 patients with chronic neck pain. The first group followed a 4-week combined protocol of stabilization exercises and connective tissue massage, while the second performed only stabilization exercises. The results showed that there was a positive effect in symptoms reduction and quality of life of the participants in both groups. This improvement was greater in the first group. Thus, the authors claimed that the combination of both (exercise and connective tissue massage) improved further the symptoms of the participants and the health-related quality of life.

Bronfort and colleagues [16] studied the effects of spinal manipulation and exercise in relation to a home exercise program in 241 elderly patients with chronic neck pain. Participants were divided into two groups. The first group followed a combined program of progressive resistance exercises for the neck muscles and spinal manipulations, while the second group performed a home-based exercise program. The researchers found a positive effect on both groups, but there was not any significant difference between the two groups.

Maiers and colleagues [17] explored perceptions of spinal manipulative therapy and exercise among adults aged 65 years and older with chronic neck pain. In their study, 245 elderly followed a 12-week intervention phase during which the participants received spinal manipulative therapy and exercise interventions. Participants were randomized to receive 12 weeks of: i) spinal manipulative therapy with home exercise, ii) supervised rehabilitative exercise plus home exercise, or iii) home exercise alone. The results of this study revealed that the combination of exercise and manipulation increased the satisfaction of the participants and their perceived value of care.

5. Conclusions

From the results of these studies, it could be derived that the combination of exercise and spinal manipulation or mobilization techniques does not improve further the severity of symptoms and health-related quality of life of individuals with chronic neck pain. All the authors point out the therapeutic value of exercise and its efficacy in reducing symptoms severity with or without the combination of manual therapy. However, there is some evidence that the combination of exercises and connective tissue massage can improve further the positive effect of exercise on symptoms and quality of life [24]. It is worth mentioning that manual techniques which focus on the muscular system could be more beneficial for people with chronic neck pain, since their symptoms derive mostly from neck muscles spasms. Further studies are necessary for the investigation of combined treatment protocols for a longer time period. Further research is needed for the investigation of this therapeutic combination (exercise and manual massage) in individuals with chronic neck pain.

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