

# THE EFFECT OF 3 DIFFERENT EXERCISE APPROACHES ON NECK MUSCLE ENDURANCE, KINESIOPHOBIA, EXERCISE COMPLIANCE, AND PATIENT SATISFACTION IN CHRONIC WHIPLASH

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## ABSTRACT

**Objective:** The purpose of this study was to compare the effects of 3 different exercise approaches on neck muscle endurance (NME), kinesiophobia, exercise compliance, and patient satisfaction in patients with chronic whiplash.

**Methods:** This prospective randomized clinical trial included 216 individuals with chronic whiplash. Participants were randomized to 1 of 3 exercise interventions: neck-specific exercise (NSE), NSE combined with a behavioral approach (NSEB), or prescribed physical activity (PPA). Measures of ventral and dorsal NME (endurance time in seconds), perceived pain after NME testing, kinesiophobia, exercise compliance, and patient satisfaction were recorded at baseline and at the 3- and 6-month follow-ups.

**Results:** Compared with individuals in the prescribed physical activity group, participants in the NSE and NSEB groups exhibited greater gains in dorsal NME ( $P = .003$ ), greater reductions in pain after NME testing ( $P = .03$ ), and more satisfaction with treatment ( $P < .001$ ). Kinesiophobia and exercise compliance did not significantly differ between groups ( $P > .07$ ).

**Conclusion:** Among patients with chronic whiplash, a neck-specific exercise intervention (with or without a behavioral approach) appears to improve NME. Participants were more satisfied with intervention including neck-specific exercises than with the prescription of general exercise. (*J Manipulative Physiol Ther* 2015;38:465-476.e4)

**Key Indexing Terms:** *Exercise Therapy; Neck Pain; Whiplash Injuries; Rehabilitation*

Among people with a whiplash injury, approximately 50% report symptoms that persistent for more than 1 year,<sup>1</sup> resulting in substantial costs to both the individual and society.<sup>2,3</sup> Persistent pain and disability

in chronic whiplash appear to be associated with impaired motor function,<sup>4-6</sup> which includes deficient neck muscle endurance (NME)<sup>7</sup> and altered function in deep and superficial neck muscles<sup>5</sup> that may negatively affect the

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Paper submitted September 23, 2014; in revised form June 4, 2015; accepted June 5, 2015.

0161-4754

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<http://dx.doi.org/10.1016/j.jmpt.2015.06.011>

physical support of the cervical spine.<sup>8–11</sup> The cervical spine is heavily dependent on neck muscles for its physical support,<sup>9,10</sup> and thus, specific neck muscle training is recommended within the management approach of patients with a whiplash-associated disorder (WAD).<sup>12</sup> However, although there is strong evidence that specific neck muscle training is effective in managing idiopathic neck pain,<sup>13,14</sup> such training has shown only modest benefits in WAD.<sup>15,16</sup> Therefore, specific neck exercises are often not used in this population. It is more commonly suggested that patients with WAD remain physically active using a more general exercise approach, which has shown positive effects in modulating<sup>17</sup> and preventing<sup>18,19</sup> chronic pain. However, the effects of general exercise have, to our knowledge, not specifically been studied in cases of chronic WAD.

Some individuals with WAD may associate neck-specific exercise with the risk of aggravating pain or (re)injury, inducing kinesiophobic behaviors that detrimentally affect exercise performance and adherence to the recommended exercise regimen.<sup>20,21</sup> This problem may be counteracted by incorporating a behavioral approach to neck-specific exercise. Behavioral approaches—that included progressive goal attainment strategies and pain physiology education in an attempt to modify inappropriate pain beliefs—have previously been used in conjunction with exercise to modify fear of pain and (re)injury related to physical activity.<sup>22,23</sup> This approach aims to modify maladaptive coping strategies and to enhance a patient's capacity to undertake daily activities.<sup>24,25</sup> However, randomized controlled trials (RCTs) investigating behavioral approaches in chronic WAD management have yielded at best only modest improvements.<sup>15,26,27</sup> Previous studies have been limited by methodological factors, such as small sample size<sup>26</sup> and poorly standardized treatment.<sup>15</sup> Thus, further investigation of the potential additional benefits of a behavioral approach to neck-specific exercise in chronic WAD is warranted.

The present study aimed to compare the effects of a neck-specific exercise intervention with and without the addition of a behavioral approach to that of a general exercise intervention in patients with chronic whiplash. Results were evaluated with regard to improved NME, perceived pain in response to endurance testing, kinesiophobia, exercise compliance, and patient satisfaction. We hypothesized that neck-specific exercise interventions with or without the behavioral approach would result in greater improvements in all outcomes compared with general exercise, and that the addition of a behavioral approach would result in greater improvements than seen with neck-specific exercise alone.

## METHODS

### Design

Here we analyzed the secondary outcomes of a multicenter, prospective, RCT (ClinicalTrials.gov

NCT01528579) with blinded outcome assessments conducted in 6 counties in southeast Sweden.<sup>28</sup> The primary outcome measure of the RCT was a Neck Disability Index (NDI), which is reported elsewhere.<sup>29</sup> This study was approved by the regional ethical review board and was conducted in accordance with the Declaration of Helsinki.

### Participants

Figure 1 shows the flow diagram of participant recruitment and retention. The recruited participants all reported ongoing symptoms associated with a whiplash injury that occurred 6 months to 3 years prior to study entry, and were diagnosed as having WAD grade II (neck pain and musculoskeletal signs) or III (neck pain plus neurologic signs).<sup>30</sup> Other inclusion criteria were an average neck pain intensity over the past week of greater than 20 mm using a visual analog scale (VAS)<sup>31</sup> and/or a score of higher than 20% on a neck disability index (NDI),<sup>32</sup> an age of between 18 and 63 years, and fluency in Swedish. Participants were excluded if they reported any of the following: signs of traumatic brain injury at the time of whiplash injury (loss of consciousness, retrograde and posttraumatic amnesia, disorientation, and confusion), previous serious neck pain causing sick leave of more than 1 month during the 12-month period before their whiplash injury, previous serious neck trauma/injury, neuromuscular or rheumatologic disease, severe mental illness, current alcohol or drug abuse, or any condition that contraindicated their performance of exercise.

### Study Procedure

Participant recruitment occurred between February 2011 and May 2012. Potential participants were identified via electronic medical records from health care registers and were subsequently recruited from primary health care centers, specialist orthopedic clinics, and hospital outpatient services. The first step of participant recruitment involved mailing an initial information and screening letter that contained basic study information, basic inclusion/exclusion criteria, VAS and NDI screening questionnaires, and a prepaid return envelope. Next, the apparently eligible respondents completed a telephone interview. Finally, individuals were subjected to a clinical examination by one of the study investigators to verify their diagnosis of WAD grade II or III.

The investigators were experienced physiotherapists located in each of the 6 participating counties. These investigators attended practical sessions together prior to the start of examinations and were trained to undertake the strict testing protocol. Each investigator's skill in conducting the testing protocol was assessed by one of the principal researchers. Potential sources of bias were minimized because these investigators were blinded to the participants'

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