

# Sensorimotor control and cervical range of motion in women with chronic neck pain

Kinematic assessments and effects of neck coordination exercise

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Aulan, Vårdvetarhuset, torsdagen den 4 december, kl. 09:00. Avhandlingen kommer att försvaras på engelska.

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**Institutionen för samhällsmedicin och rehabilitering,  
fysioterapi**  
Umeå universitet  
Umeå 2014

**Organization**

Umeå University  
Department of Community Medicine and Rehabilitation, Physiotherapy

**Document type**

Doctoral thesis

**Date of publication**

13 November 2014

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**Title**

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**Abstract**

**Introduction:** Neck pain is a common problem in society and is more prevalent among women. The consequences of neck pain for the individual often include activity and participation limitations, thus affecting many dimensions of life. There is still a lack of understanding of the underlying mechanisms of the disorder and likewise of efficient rehabilitation for people with neck pain. However, coordination exercises have shown promising short-term effects. To carry this line of research forward, there is a need to improve methods for objective characterization of impairments and to investigate novel methods of rehabilitation.

**Aims:** To characterize impairments of active cervical range of motion of the upper and lower cervical levels in women with chronic neck pain with a novel method (Study I and II) and identify the influence of head posture and movement strategies (Study II). Further, to investigate the effects of a novel method for neck coordination exercise on sensorimotor function and neck pain (study III) and the consistencies of motor variability metrics in a goal directed arm movement task to aid the design of future clinical research (Study IV).

**Methods:** All studies were laboratory based with kinematic assessments of neck movements (Study I-III), balance (Study III) and goal directed arm movements (Study III, IV). The studies had designs that were: cross-sectional (I and II), randomized controlled trial (III) or test-retest reliability study (IV). Participants in Study I (n=135) and II (n=160) were women with chronic non-specific neck pain and healthy controls. In Study III, women with chronic non-specific neck pain (n=108) were randomized into three different individually supervised 11 week interventions. Study IV included healthy women (n=14).

**Results:** It was found that cervical range of motion impairments in women with non-specific neck pain were direction- and level-specific; impairments were greater in extension in the upper and flexion in the lower levels of the cervical spine. The magnitude of impairments in range of motion was associated to self-ratings of functioning and health. Possible group differences in natural head posture were rejected as a cause for the direction specific effects. Neither could the effects be explained by a strategy to minimize torque in the cervical spine during movement execution. The neck coordination training was not superior to strength training (best-available) and massage treatment (sham) in improving sensorimotor functions or pain according to short-term and 6 months follow ups. The results from the study of the goal directed movement task showed that between and within-subject sizes of most motor variability metrics were too large to make the test suitable for application in clinical research.

**Conclusions:** Women with chronic non-specific neck pain have direction- and level-specific impairments in cervical sagittal range of motion. The underlying causes of these specific impairments remains unresolved, but the direction specific impairments are not related to natural head posture. The clinical validity of the method of characterization of cervical range of motion was supported and it can be useful in future clinical research. The novel method of neck coordination exercise showed no advantages on sensorimotor functions or pain compared with best-available treatment in women with chronic non-specific neck pain.

**Keywords**

Neck pain, Rehabilitation, Coordination training; Resistance training; Postural balance; randomized controlled trial, Musculoskeletal pain; Biomechanics; Range of motion, Kinematics, Head Movements

**Language**

English

**ISBN**

978-91-7601-170-6

**ISSN**

0346-6612

**Number of pages**

61 + 4 papers