



Original article

Inter-and intra-tester reliability of a battery of cervical movement control dysfunction tests

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ABSTRACT

Background: Apart from the cranio-cervical flexion test and the deep neck flexor endurance test, evidence related to reliability of cervical movement control dysfunction tests is lacking.

Objectives: This study investigated the inter- and intra-tester reliability of a battery of cervical movement control dysfunction tests and the effect of clinician experience on reliability in 15 patients with chronic neck pain and 17 non-neck pain controls. In addition, it explored whether impaired performance on this battery of tests was more frequently observed in the neck pain group.

Design: Inter and intra-tester reliability study.

Method: Participants were videotaped while performing a battery of nine active cervical movement control dysfunction tests. Two physiotherapists, with different levels of experience, independently rated all tests on two occasions two weeks apart. They were masked to participants' neck pain or non-neck pain status.

Results: Inter-tester reliability for the complete battery of tests was substantial ($\kappa = 0.69$; 95% CI: 0.62, 0.76). Intra-rater reliability values for the expert ($\kappa = 0.86$; 95% CI: 0.79, 0.92) and novice ($\kappa = 0.76$; 95% confidence intervals (CI): 0.68, 0.84) were overall comparable suggesting that novices can achieve good accuracy with the battery of tests if trained. The frequency of impaired performances in cervical movement control dysfunction tests was low and comparable between groups. Only two tests achieved a greater number of impaired ratings in the patient group.

Conclusions: Although reliable, further research in larger neck pain populations is required to explore this battery of tests, in order to establish their diagnostic accuracy for identifying clinically relevant cervical movement control dysfunction.

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1. Introduction

Neck pain is often a long-standing and recurrent condition (Kjellman et al., 2001; Carroll et al., 2009). It is estimated that 67% of the population experience neck pain at some point in their life (Cote et al., 1998), with a higher prevalence in women (Guez et al., 2002). As pathological mechanisms are frequently difficult to identify, clinical assessment of impairment and disability has become an accepted approach for the evaluation of people with

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neck pain to guide management (Childs et al., 2008). Analysis of the pattern of neck movement forms part of the assessment to identify movement faults and assess cervical neuromuscular control (Jull et al., 2004, 2008a; Sahrman, 2011; Comerford and Mottram, 2012). These movement faults may be termed cervical movement control dysfunction (cMCD), consistent with terminology used for lumbar spine movement dysfunction (Luomajoki et al., 2007). Altered neuromuscular control of neck movement is considered to be an important factor contributing to the recurrent nature of neck pain (O'Leary et al., 2009), as it may impose unwanted stresses on cervical structures (Jull et al., 2008a; Comerford and Mottram, 2012). Consequently, evaluation of cMCD and treatment directed towards its improvement forms an integral part of diagnosis and management of cervical musculoskeletal disorders (McDonnell et al., 2005; Childs et al., 2008; Jull et al., 2008a).

cMCD is defined operationally for the clinical setting as the presence of aberrant or uncontrolled movements of the cervical spine which are observed during prescribed active movements of the neck and/or upper limb (Comerford and Mottram, 2012). Physiotherapists assess cMCD through a series of clinical tests where, through observation and/or palpation of the cervical spine, the presence of altered movement control is identified (Jull et al., 2008a; Sahrman, 2011; Comerford and Mottram, 2012). Skills may vary between experienced and novice clinicians and thus influence the decision of whether movements are being performed in a normal or abnormal manner. Overall, experienced testers have shown better reliability with clinical screening tests for movement control (Carlsson and Rasmussen-Barr, 2013), albeit this systematic review pertained to non-specific low back pain. To date, the influence of examiner experience in the assessment of cMCD has not been explored. Greater confidence can be had in test reliability if examiner experience is not a factor.

Several tests have been nominated to assess the control of the cervical spine afforded by the flexor, extensor and rotator muscles (Jull et al., 2008a; Sahrman, 2011; Comerford and Mottram, 2012; Elsig et al., 2014). Possibly, the most popular test related to cMCD is the craniocervical flexion test, which was developed to allow clinicians to assess performance of the deep neck flexor muscles (Jull et al., 2008b). Its face validity (Falla et al., 2003) and reliability (James and Doe, 2010; Arumugam et al., 2011) has been demonstrated, although the latter mostly in asymptomatic subjects. However, apart from this test, evidence related to the reliability of other cMCD tests advocated for use by clinical experts (Table 1 and Appendix 1) is lacking. In fact, clinical practice guidelines for neck pain only include the craniocervical flexion test and the test of deep neck flexor endurance (Harris et al., 2005) as reliable tests for classifying a patient in the impairment-based category of neck pain with movement coordination impairments (Childs et al., 2008). This paucity of reliability data for other cMCD tests prompted this study.

Besides reliability, another clinimetric characteristic is discriminant validity, that is, the ability of cervical movement control tests to discriminate between patients with and without neck complaints. A recent systematic review found that the Fly Method™, head repositioning accuracy to the neutral head position and continuous linear movement technique are tests of cervical sensorimotor control which have discriminant validity (Michiels et al., 2013). In addition, a battery of head–eye movement control tests (Della Casa et al., 2014), the craniocervical flexion test (Elsig et al., 2014) and three tests evaluating movement control (i.e. cervico-thoracic extension, head protraction-retraction and quadruped cervical rotation) (Elsig et al., 2014), were also able to

discriminate between cases and controls. However, it is unknown if other tests as listed in Table 1 can also identify those with and without neck pain.

The primary aim of this study was to determine the inter- and intra-tester reliability of a battery of selected cMCD tests in a sample of patients with and without chronic neck pain. In addition, the effect of clinician experience on reliability was explored. A secondary aim was to make an initial exploration of whether impaired performance on this battery of cMCD tests was more frequently observed in patients with neck pain compared to neck pain free participants.

2. Methods

2.1. Subjects

Thirty-two participants were recruited for the study from two private physiotherapy practices in Valencia, Spain. Of these, 15 were patients with chronic non-specific neck pain. To be considered for the study, persons were required to be aged between 18 and 60 years, have a history of neck pain lasting 3 months or more over the last year and have a score of $\geq 5/50$ on the Neck Disability Index (NDI), to reflect the presence of at least a mild neck pain disorder (Vernon, 2008). The validated Spanish version of the NDI was used (Andrade Ortega et al., 2010). Patients without neck pain ($n = 17$), but receiving treatment for other musculoskeletal disorders, were included in the study to increase the variability in the test sample and, thus, avoid a possible bias by considering persons with neck pain only. Subjects in this latter group could not suffer from any musculoskeletal condition affecting the upper quarter region (i.e. shoulder, elbow or wrist pain), as this may have altered their performance on the cMCD tests that require movement or weight bearing of the upper limb.

Individuals were not considered for the study if they had previous cervical spine surgery, cervical radiculopathy, severe systemic disease (i.e. diabetes), fibromyalgia or other widespread musculoskeletal pain syndromes (i.e. chronic fatigue syndrome). Patients with acute neck pain were excluded, as pain may have prevented them from accomplishing the tests.

All participants received an information leaflet and gave written informed consent prior to entry into the study. The study was approved by the local Institutional Ethics Committee and the procedures were conducted according to the Declaration of Helsinki.

2.2. Study design

An inter- and intra-observer reliability study was conducted employing video analysis as used in a study of movement control tests of the low back (Luomajoki et al., 2007). Participants were videotaped by an independent researcher in a standardized manner while they performed a battery of nine active cMCD tests. Two physiotherapists, with different levels of experience, independently rated all tests. One had a post-graduate degree in manual therapy and 10 years working experience with the use of cMCD tests. The other was a novice physiotherapist with a post-graduate degree and one year of working experience, but with no prior familiarity with the evaluation of cMCD.

2.3. The test battery

Table 1 and Appendix 1 present the battery of nine tests evaluated in this study. They were selected based on work by Jull et al.

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