ORIGINAL RESEARCH

Intra- and inter-rater reliability of neutral head position and target head position tests in patients with and without neck pain

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KEYWORDS
Cervical spine; Physical therapy; Assessment tools; Joint position sense

Abstract
Background: Cervical proprioception is a common term used in neck rehabilitation, and it is examined using neutral head position (NHP) and target head position (THP) tests.
Objective: To investigate intra- and inter-rater reliability of the NHP and THP tests in patients with neck pain and in healthy controls.
Methods: The intra-rater (between-day) and inter-rater (within-day) reliability of the NHP and THP tests were assessed in 36 patients with neck pain and 33 healthy subjects. NHP testing was evaluated in cervical extension, while THP testing was evaluated in six directions of cervical motion: cervical flexion, extension, side bending right, side bending left, rotation right, and rotation left.
Results: The intra-rater reliability for the NHP tests had intraclass correlation coefficient (ICC) values of 0.74-0.78 and a standard error of measurement (SEM) of 1.78-1.88; the THP tests had ICC values of 0.70-0.83 and SEM of 1.45-2.45. Likewise, inter-rater reliability for NHP had ICC values of 0.74-0.79 and SEM of 1.79-1.87. For the THP test, the inter-rater reliability had ICC values of 0.62-0.84 and SEM of 1.50-2.23.
Conclusion: Intra- and inter-rater reliability ranged from good to very good agreement both for NHP and for THP tests of cervical proprioception.
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Introduction

Neck pain is a prevailing condition in the general population. It is reported to be the second most common musculoskeletal complaint, next to back pain.1,2 The one-year prevalence estimates of global neck pain range from 30 to 50% among...
adults. At any given point in time, approximately 12-14% of the middle-aged population reports having neck pain. Neck pain often causes impairment and disability and can contribute to work absences, which increases the cost both for compensation as well as for treatment, thereby affecting health related quality of life.

Proprioception refers to the afferent information sent by muscles, ligaments, joints, tendons, and associated mechanoreceptors to the nervous system. Proprioceptive inputs from periphery muscles, joints, joint capsules, and ligaments are processed in the spine, brainstem, cerebellum, and cortex in order to produce efficient and precise movement patterns with appropriate neuromuscular yield.

Methods for assessing cervical proprioception include the neutral head position (NHP) and target head position (THP) tests. During an NHP test, the subject tries to re-position the head to a neutral head position after being moved away from the NHP, whereas during a THP test, the subject re-positions the head to a target position predetermined by the investigator.

Cervical muscle fatigue and whiplash injuries can lead to proprioception deficits, which can also be considered a contributing factor in chronic neck pain. NHP and THP tests are sensitive to differences between patients with neck pain and healthy controls. In patients with neck pain, whiplash injury, and spondylitis, impaired proprioception measured by THP is associated with both poor functional performance measured by neck disability index and poor subjective estimation of neck function, measured by the visual analog scale. Thus, one can infer that proprioception is an important indicator for neck pain and neck injury deficits.

As cervical proprioception (joint position error) is a frequently evaluated in physical therapy practice for patients with neck problems, it is important for therapists to have an objective tool for its measurement. Cervical proprioception was evaluated in patients with and without neck pain using different measurement methods and techniques. Objective tests measure alterations in proprioception awareness as "errors" in head and neck re-positioning. Different analytic devices, such as the electromagnetic tracking device (3-space FastTrack) and the ultrasound-based measuring device (Zebris), show good intra- and inter-session reliability (intraclass correlation coefficient – ICC > 0.61–0.84) for cervical joint position error evaluation.

The digital inclinometer is a clinical tool used to measure cervical proprioception. From a clinical point of view, the digital inclinometer is easy to use, requires less time than the above-mentioned devices, and can be equipped quickly to test cervical proprioception in all directions. Furthermore, it is an affordable tool for clinics, compared to other motion analysis systems. The digital inclinometer can be used to assess a subject’s ability to relocate the head to NHP and THP (active cervical range of motion). However, the reliability of these cervical proprioception clinical tests is still unknown. The aim of this study is to assess the intra- and inter-rater reliability of the NHP and THP tests in patients with neck pain and in healthy controls.

Methods

Study design

An intra-rater (within-day) and inter-rater (within-day) design with a three-phase reliability protocol that consisted of: (1) preparation phase, (2) training phase, and (3) overall agreement phase was used. The reliability protocol is recommended by the International Academy of Manual/Musculoskeletal Medicine (IAMMM). The preparation phase consisted of agreement of study conditions and strategy. The training phase focused on replicating test procedures and judgment. The focus of overall agreement phase was designed to establish an overall agreement percentage greater than 80% between the two examiners. Once the protocol was completed, examiners A and B agreed upon the cut-off point, as well as how to perform and standardize each test. Each subject attended two evaluation sessions. Both examiners evaluated the subject on both occasions. Intra-rater reliability was established based on examinations that took place on two different days (≤3 working days apart). Inter-rater reliability between examiners A and B was established by comparing their examinations on both the first and second assessment sessions.

Subjects

The study was conducted in the department of physical therapy, approved by the Research Ethical Board of King Khalid University (HA-06-B-001), Abha, Kingdom of Saudi Arabia. All subjects were required to provide informed consent prior to the commencement of the study. The subjects with neck pain were recruited from the university’s physical therapy clinic. Patients were eligible to participate in the study if they met the following inclusion criteria: (1) patients had non-specific neck pain, (2) patients had visited a physical therapist for neck pain, and (3) patients were 18 years of age or older. Patient exclusion criteria were (1) spine surgery, (2) whiplash injury, (3) pregnant women, (4) musculoskeletal or neurological problems, and (5) symptoms of radiculopathy confirmed by positive Spurling’s test and upper limb tissue tension test. Healthy subjects were recruited using poster advertisements and word of mouth. Healthy subjects included in the study were 18 years of age or older. Exclusion criteria for the control group were: (1) neck pain in the last year, (2) any upper quarter problem, and (3) any rheumatic diseases or neurological disorders. Neck pain subjects did not receive any treatment during participation in the study. All the subjects were instructed not to engage in exertional activities and to follow their daily living routine activities between evaluation sessions.

Examiners

Clinical data were collected by two physical therapists (examiners A and B) working in the university’s physical therapy clinic. Both examiners have a minimum of ten years of experience. Two data recorders were employed; recorder 1 teamed up with examiner A, and recorder 2 teamed up