# Intertester Reliability and Diagnostic Validity of the Cervical Flexion-Rotation Test

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## Abstract

**Objective:** This article evaluates reliability and diagnostic validity of the cervical flexion-rotation test (FRT) to discriminate subjects with headache because of C1/2 dysfunction. In addition, this study evaluates agreement between experienced and inexperienced examiners.

**Methods:** These were 2 single blind comparative measurement study designs. In study 1, 2 experienced blinded examiners evaluated the FRT in 10 asymptomatic controls, 20 subjects with cervicogenic headache (CeH) where C1/2 was the primary dysfunctional level, and 10 subjects with CeH but without C1/2 as the primary dysfunctional level. In study 2, 2 inexperienced and 1 experienced blinded examiners evaluated the FRT in 12 subjects with CeH and 12 asymptomatic controls. Examiners were required to state whether the FRT was positive and also to determine range of rotation using a goniometer. An analysis of variance with planned orthogonal comparison, single measure intraclass correlation coefficient (2,1), and Bland-Altman plot were used to analyze FRT range of rotation between the examiners. Sensitivity, specificity, and examiner agreement for test interpretation were analyzed using cross tabulation and $\kappa$.

**Results:** In study 1, sensitivity and specificity of the FRT was 90% and 88% with 92% agreement for experienced examiners ($P < .001$). Overall diagnostic accuracy was 89% ($P < .001$) and $\kappa = 0.85$. In study 2, for inexperienced examiners, FRT mobility was significantly greater than for experienced examiners, but sensitivity, specificity, agreement, and $\kappa$ values were all within clinically acceptable levels.

**Conclusions:** The FRT can be used accurately and reliably by inexperienced examiners and may be a useful aid in CeH evaluation. (J Manipulative Physiol Ther 2008;31:293-300)

**Key Indexing Terms:** *Reproducibility of Results; Headache; Diagnosis; Physical Examination*

Cervicogenic headache (CeH) has been classified by the International Headache Society (IHS)[1] and is said to account for 15% to 20% of all chronic and recurrent headaches.[2] Individuals report reduced quality of life[3] and experience considerable restriction of daily function and emotional distress.[4] There is encouraging evidence that CeH can be successfully managed by physical treatment.[5,6]

The IHS[1] defined CeH as head pain, referred from a source in the neck that may arise from a variety of upper cervical spine structures.[7,8] People who have CeH also complain of associated neck pain and restriction of neck movement.[9] Unfortunately, neck pain is also a feature of other headache forms; hence, accurate diagnosis, by physical examination, is required to identify CeH.[10]

Although it has been suggested that CeH involves disorder of the articular, muscular, and neural tissue systems, Zito et al[10] determined that the presence of upper cervical joint dysfunction most clearly identified patients with CeH. It is believed that one dysfunctional level may be the source of primary symptoms, with C1/2 being the most commonly reported.[11-13]

Cervical joint dysfunction can be measured by manual examination.[14] Manual examination has high sensitivity and specificity to detect the presence or absence of cervical joint dysfunction in neck pain and headache patients.[15-17] However, these tests involve a high degree of skill on the part of the examiner, and their reliability has been

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questioned.[18] It has been suggested that evidence of low reliability for these tests may be a reflection of poor research methods used by the studies to investigate these tests.[18]

The cervical flexion-rotation test (FRT)[19] is a simplified form of manual examination purported to identify C1/2 dysfunction[19]; however, there are no studies that definitely support this conjecture. In this test procedure, the cervical spine is fully flexed, in an attempt to isolate movement to C1/2, which has a unique ability to rotate in flexion. Normal range of rotation in end range flexion has been shown to be 44° to each side.[12] In contrast, subjects with C1/2 dysfunction have an average of 17° less rotation.[20-22] Ogince et al[22] reported the FRT was positive, if range was limited to 32° or less. They also demonstrated that highly trained manual therapists using the FRT have high sensitivity (91%) and specificity (90%) in identifying subjects with CeH from asymptomatic controls or subjects with migraine with aura. A limitation of that study was that the comparative groups had no cervical involvement and the CeH group highly defined. Hence, the reported reliability, sensitivity, and specificity may be artificially high. Further studies are required to investigate the FRT in more heterogenous samples.

In the Mulligan[23] and other manual therapy concepts, dysfunction on the FRT is used as an indicator to apply a specific treatment technique in patients with CeH. Many physiotherapists learn the FRT on postgraduate courses with limited supervision. It is not known whether, having learned the technique, physiotherapists are able to apply the FRT with the same degree of reliability, sensitivity, and specificity as more experienced examiners.[12,22]

The purpose of this study was 2-fold. Firstly, to determine the reliability, agreement, and validity of the FRT when used by experienced examiners evaluating a heterogeneous sample of subjects with CeH. Secondly, to determine the influence of examiner experience on reliability of measurement, range of motion, and agreement of interpretation of the FRT. It was hypothesized that, when compared to experienced examiners, inexperienced examiners would be less reliable, record different range of motion, and be less sensitive and specific at identifying FRT dysfunction in patients with CeH.

## Methods

This was a single-blind, comparative measurement study design, undertaken as 2 separate studies, as a matter of convenience and to avoid exacerbation of subjects by repeated application of the FRT by multiple examiners. Study 1 was to investigate agreement between experienced examiners and to investigate the validity of the FRT as a test of C1/2 dysfunction. Study 2 was to investigate the influence of examiner experience on reliability, sensitivity, and specificity of the FRT. The study design is illustrated in a flow chart shown in Figure 1.

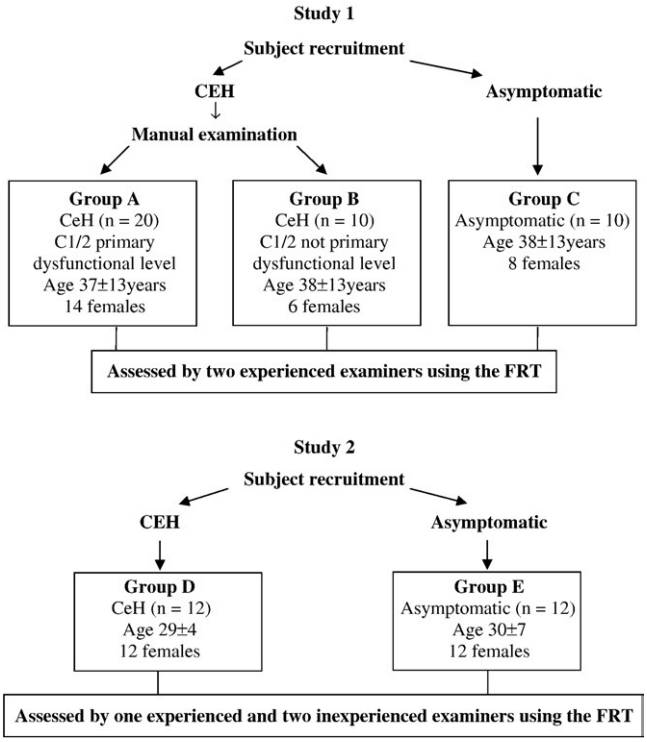


**Fig 1.** *Flow chart of study design.*

In study 1, 2 experienced examiners, blinded to each other, evaluated the FRT in a cohort consisting of 3 subgroups. Group A had CeH with C1/2 dysfunction, and group B also had CeH but with dysfunctional levels other than C1/2. Group C were all asymptomatic controls.

In study 2, 2 inexperienced and one of the previous experienced examiners from study 1, again blinded to each other, evaluated the FRT in 2 groups. Group D were subjects with CeH, and group E were all asymptomatic control. This study was approved by Curtin University (Perth, Western Australia) human research ethics committee. The rights of individuals were respected at all times. In addition, subjects were able to withdraw from the study at anytime and gave written informed consent before the study commencement.

### Subjects

Subjects were recruited as a sample of convenience from physiotherapy and medical clinics and physiotherapy course attendees. Subjects in study 1 did not take part in study 2. On entering the study, subjects were allocated to a CeH group or asymptomatic control group based on the following criteria. Asymptomatic controls had no significant history of neck pain or headache and were excluded if they had a headache more than once per month and neck pain that had required treatment in the last year. Inclusion criteria for CeH were based on guidelines of the Headache Classification Subcommittee of the IHS[1] together with the Cervicogenic