## THE CLINICAL PROTOCOL FOR THE CRANIOCERVICAL FLEXION TEST (1)

Indications: patients with neck pain disorders; acute, subacute and chronic presentations.

Contraindications: the test is performed in supine lying and is equivalent to the function of nodding to say "yes." Thus, there are few contraindications to its application. The presence of neural tissue mechanosensitivity causing pain with movement of craniocervical flexion would delay the test in its current format until this sensitivity has resolved. The CCFT should not produce head or neck pain.

## Stage 1: Analysis of performance of the craniocervical flexion action.

The patient is positioned in supine, crook lying with the pressure biofeedback in situ and is given the dial to guide performance of the test (Fig 1). They are requested to slowly feel the back of their head slide up the bed in a head nod action to elevate the target pressure from 20 to 22 mm Hg and to hold the position for two or three seconds before relaxing and returning to their starting position. If subjects have an apical breathing pattern, the nod should be performed on exhalation. (2) This process is repeated through each 2-mm Hg increment of the test to 30 mmHg.

The clinician analyses the motion of the head and the muscle activity in the superficial flexors by observation or palpation. The motion should be a head rotation of progressively increasing range through the five stages of the test, (3) and there should be negligible activity palpated or observed in the SCM or AS muscles until the last 1 or 2 stages of the test, if at all. Signs of abnormal patterns or poor activation of the deep cervical flexors include the following: the range of head rotation does not increase with progressive increments of the test and the movement strategy becomes more a head retraction action; the patient lifts the head in attempts to reach the target pressures; the movement is performed with speed; there is palpable activity in the superficial flexor or hyoid muscles in the first three stages of the test; the pressure dial does not return to the starting position, and reads a pressure greater than 20mm Hg, indicating an inability to relax the muscles after a contraction—an inability to relax the scalenes is often palpated with this occurrence.

The baseline assessment: the stage of the test (increment of pressure increase) that the patient can achieve and hold for 2 to 3 seconds with the correct craniocervical flexion action, without palpable activity of the superficial flexors provides quantification of performance in this stage of the test.

## Stage 2: Testing isometric endurance of the deep cervical flexors at test stages that the patient is able to achieve with the correct craniocervical flexion action.

This stage is conducted when the patient can perform the correct craniocervical flexion action, even if they cannot reach all target pressures. It is delayed when substitution movements (eg, head retraction) are observed in stage 1 of the test.

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The patient performs the head nod action to first target the lowest level (22 mm Hg) and holds the position for 10 seconds. In assessment, if the patient can perform at least 3 repetitions of 10-second holds without substitution strategies, the test is progressed to the next pressure target.

The clinician continues to observe the movement strategy that the patient uses to ensure that it remains a craniocervical rotation. Signs of reduced endurance at the test increment include the following: the patient cannot hold the pressure steady and it decreases (although they seem to be holding the head in the flexed position); the superficial flexors are overtly recruited; and the pressure level is held but it is with a jerky action, suggesting an alternate muscle is being sought by the patient to hold the pressure level, and most likely indicates weakness or fatigue of the deep cervical flexors.

The baseline assessment is documented as the pressure level that the patient can hold steady for repeated 10-second holds, with minimal superficial muscle activity and in the absence of any other substitution strategies.



Fig 1. The clinical application of the craniocervical flexion test. The patient is guided to each progressive pressure increment of the test by feedback from the pressure sensor. The clinician analyses the movement and detects the presence of any activity in the superficial flexors.

Another substitution strategy is the attempted use of the hyoid muscles to augment the contraction of the deeper muscles. The patient may use one of two strategies. One is to clench the jaw and the other is to perform craniocervical flexion with jaw opening. These strategies should likewise be corrected as required by requesting the patient to adopt a rest position of the mandible. That is, the patient is asked to place the tongue lightly on the roof of the mouth, lips together with teeth slightly apart before and when repeating the test action.

Two other situations in which an aberrant sign may be observed involve the return to the resting position. The first is that on return from a designated pressure, the biofeedback device registers less pressure than the baseline of 20mmHg. This may occur if the pressure in the chamber has not been adequately stabilized before testing begins, but negating this occurrence, it may indicate a deficit in proprioceptive acuity with the patient overshooting the neutral head position on return from the movement. Likewise, on return to the starting position the dial may read a pressure greater than 20 mmHg. Again, this may indicate a deficit in proprioceptive acuity with the patient undershooting the neutral head position but it more likely indicates an inability to relax the muscles following a contraction, which holds the neck in some flexion. This is often readily appreciated with palpation of the scalene muscles where tension will be felt. Lifting the chin to neutral will result in return of the needle on the dial to 20 mmHg as well as softening/relaxation of the scalenes.

You should, document the activation score as the level of mmHg by the number of 10 second holds.

E.g. 24 mmHg x 7 x 10 second holds = 4 x7 = 28

The highest score being 100.

It is expected that subjects without neck pain should perform the test to the 3rd or 4th stage i.e. 26-28mmHg (1).

After completing this assessment, it is advised to reassess sitting cervical extension to evaluate the immediate effect of activation of these muscles on neck pain during active range of movement (4 p.175). It not only tells you about the connection between pain and muscle function but also shows patients the impact that improving the control of these muscles will have on their problem.

In regards to abnormal test findings, there is one point I wish to explain further. "One thing that is important to observe for is the change in neck movement as the test continues. Research shows that the first level 20-22mmHg correlates with 22.9% of available craniocervical flexion. This incrementally increases and in the final stages, 28-30mmHg, 76% of the range should be used" (1 pg.528). So, if your patient isn't moving further into range they are not performing the test correctly and the test should be stopped at the previous level they performed well.

- Jull GA, O'Leary SP, Falla DL J. Clinical assessment of the deep cervical flexor muscles: the craniocervical flexion test. Manipulative Physiol Ther. 2008 Sep;31(7):525-33.
- 2. Cagnie B, Danneels L, Cools A, Dickx N, Cambier D. The influence of breathing type, expiration and cervical posture on the performance of the cranio-cervical flexion test in healthy subjects. Man Ther 2008;13:232-8.

Performing the CCF-T during slow expiration diminishes the activity of the SCM muscles in subjects with a predominantly upper costal breathing pattern. Using a costo-diaphragmatic breathing pattern while performing the test will optimize the performance.

- 3. Falla DL, Campbell CD, Fagan AE, Thompson DC, Jull GA. Relationship between cranio-cervical flexion range of motion and pressure change during the cranio-cervical flexion test. Man Ther 2003;8:92-6.
- Whiplash, Headache, and Neck Pain,1st Edition,Research-Based Directions for Physical Therapies. Gwendolen Jull Michele Sterling Deborah Falla Julia Treleaven Shaun O'Leary (2008)