Can functional postural exercise improve performance in the cranio-cervical flexion test? – A preliminary study

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Objective

To assess the physiological effectiveness of deep cervical flexor (DCF) strengthening exercises performed in a functional upright posture.

Methods

A convenience sample of 20 participants aged between 18 and 54 years (10 male, 10 female; mean age 29.3 SD 11.4 years) with persistent neck pain and impaired muscle activity in the cranio-cervical flexion test (CCFT) were recruited. The CCFT involves a five stage upper cervical flexion procedure in a supine crook-lying position of incremental difficulty using a pressure biofeedback unit. Participants were randomly assigned into two groups: exercise intervention group (n=10) or a control non-exercise group (n=10). Over a two week intervention period the exercise group performed an upper cervical flexion manoeuvre in an upright posture with a neutral lumbo-pelvic position. The primary outcome measure was the difference in sternocleidomastoid (SCM) normalised surface electromyographic (EMG) amplitude over the five stages of the CCFT. Other measurements included the Neck Disability Index (NDI), the Visual Analogue Scale (VAS) as a report of pain and Patient Specific Functional Scale (PSFS) to assess function.

Results

Both groups were homogenous at baseline with respect to age, length of history of neck pain, VAS, NDI, PSFS scores and mean SCM EMG amplitudes for each stage of the CCFT. There were no significant differences for NDI, VAS or PSFS scores between the groups pre- to post-intervention although SCM EMG amplitudes were significantly less in the exercise group for all stages of the CCFT with the exception of the first stage (22 mmHg). Intra-group mean values in SCM EMG amplitudes of the CCFT were significantly less post-intervention at the first and third stages of the CCFT; 22 mmHg ($p = 0.043$) and 26 mmHg ($p = 0.003$) for the intervention group; no such differences were evident at any stage of the CCFT for the control group.

Conclusions

Training with an upper cervical flexion neck lengthening manoeuvre in a more functional upright position improved the cervical flexor motor patterning in the CCFT, measured as a decrease in SCM activity. Importantly, the results necessitate further investigation and provide justification for a larger study with direct measures of both SCM and DCF muscles using more invasive measures of muscle activity.

Commentary

Current literature suggests that training of the DCF muscles is an important component for the rehabilitation of neck pain disorders (Jull 2008). Traditionally DCF strengthening exercises are performed in a supine crook-lying position using a motor relearning approach using low load exercises (Jull 2008). From a practical viewpoint, training in supine limits the number of repetitions that a patient can practice in a day and there is mixed evidence demonstrating the transfer of improvement in DCF muscle performance to functional postures or activities with such training (Falla et al 2008). Additionally, for effective motor relearning to occur repetition is paramount. Hence, as evident by the good compliance rates by participants in this study, an exercise that is easily transferable into a person's daily activities is desirable.

Reduced activation of the DCF muscles has previously been demonstrated to be associated with increased activation of the superficial flexor muscles in studies using the CCFT in patients with persisting dysfunction and neck pain (Falla et al 2004, Jull et al 2009). Content validity issues aside, the inverse relationship that exists between SCM and DCF activity (i.e. with less SCM activity there is a corresponding increase in DCF) makes surface SCM EMG activity the measurement of choice for investigative research in this area (Falla et al 2004, Jull et al 2009). While some inferences can be made through deductive logic there are also face validity issues with the underlying premise that changes in DCF muscle function are a cause or effect of persisting pain states in the cervical spine. It is worth mentioning that it was not the purpose of this research to correlate DCF muscle dysfunction and neck pain, rather it was a necessary first step towards establishing the need for further enquiry into the efficacy of performing DCF strengthening exercises in a more functional upright posture.

This esteemed group of authors demonstrated that a more functional method of training the DCF in an upright position elicited favourable changes in SCM EMG amplitudes at the first and third stages of the CCFT. Although statistically significant changes were not demonstrated across all five incremental levels, the conclusion was made that DCF muscle retraining in a more functional upright postural position was provisionally useful. While this research may not have been sufficiently powered and its findings were not categorical, it is noteworthy that it was a pilot study used to determine if further high cost and invasive research was justified. In that regard, it was a suitable vehicle for that purpose and of sound methodological quality.

It is yet to be established conclusively that synergistic activity/inactivity of neck musculature (deep vs. superficial) is a predisposition for persisting cervical pain states, as is the case with other presentations (e.g. abdominal muscles and multifidus in those with low back pain). The authors readily acknowledge that focussing on a single muscle group is both inadequate and unrealistic in a clinical context given the multitude of contributing factors and where a multimodal intervention approach is often indicated. Nonetheless, based on current knowledge the clinical relevance of this work is significant especially if continuing research can demonstrate the effectiveness of DCF strengthening in a more functional position. This may eventually be of benefit to a large population of patients who present with persisting neck pain.

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REFERENCES

Falla D, Jull G, Hodges P (2008) Training the cervical muscles with prescribed motor tasks does not change muscle activation during a functional activity. *Manual Therapy* 13: 507-512.

Falla DL, Jull GA, Hodges PW (2004) Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. *Spine* 29: 2108-2114.

Jull GA (2008) Whiplash, Headache, and Neck Pain: Research-based Directions for Physical Therapies. Edinburgh: Churchill Livingstone/Elsevier.

Jull GA, Falla D, Vicenzino B, Hodges PW (2009) The effect of therapeutic exercise on activation of the deep cervical flexor muscles in people with chronic neck pain. *Manual Therapy* 14: 696-701.