INTRODUCTION

Neck pain is often associated with prolonged sitting that involves sustained cervical flexion. Such postures can give rise to creep in spinal soft tissues, and may have detrimental effects on neck muscle function. Both animal and human studies have shown that soft tissue creep in the lumbar spine impairs reflex activation of the back muscles and spinal proprioception. The purpose of the present study is to investigate whether soft tissue creep in the cervical spine causes a similar impairment of neck muscle function.

METHODS

Thirty healthy volunteers (16F/14M, aged 20-56 yrs) gave informed consent to participate in the study which was approved by the Research Ethics Committee of the Faculty of Medical and Veterinary Sciences, University of Bristol. Range of flexion, reflex activation and proprioceptive function of the cervical spine were measured in all subjects before and after a one-hour period of cervical flexion. During this time, the neck was flexed by approximately 75% of its range to induce creep in the soft tissues of the cervical spine.

Range of flexion was assessed using an electromagnetic device, the 3-Space Fastrak, that tracked the movement of sensors on the forehead and the sternum at 60Hz. The angle between the two sensors indicated the range of cervical flexion and the sternum at 60Hz. The angle between the two sensors indicated the range of cervical flexion and the sternum at 60Hz. The angle between the two sensors indicated the range of cervical flexion.

Reflex activation was assessed by initiating a rapid perturbation of the head using a KinCom dynamometer. Subjects wore a blind-fold and headphones to eliminate audiovisual cues, and sat with their head bent forward and their forehead resting on the arm of the machine. The arm was set to move away from the head at 100°s⁻¹ in order to initiate sudden flexion of the cervical spine. Bilateral recordings of electromyographic (EMG) activity indicated the latency of the reflex response, its peak amplitude and the time to peak amplitude for both upper trapezius (TRAP) and sternocleidomastoid (SCM) muscles (Figure 1).

Proprioception was evaluated from measures of position sense and movement sense. Position sense was determined from Fastrak recordings obtained during a repositioning task where blindfolded subjects were asked to actively reposition their head in the upright posture and in a "halfway" flexed posture (50% of their full range of neck flexion). Position sense was assessed as the mean repositioning error between repeated attempts to reproduce both upright and flexed head postures. Movement sense was evaluated during movements initiated by the KinCom. Subjects wore a blind-fold and headphones, and sat in the dynamometer with their head rested against its arm. In separate tests, the arm was set to move at 1°s⁻¹ or 10°s⁻¹, and subjects were asked to press a trigger when they first detected any movement.

RESULTS

There was a significant increase in the range of cervical flexion from 60.9±9.8° before the creep intervention to 64.7±11.3° afterwards (n=30; p=0.0083), indicating that sustained neck flexion successfully induced creep in the soft tissues of the spine.

Table 1. Mean (SD) reflex response values for TRAP and SCM muscles before and after the "creep" intervention.

<table>
<thead>
<tr>
<th>Reflex Latency (ms)</th>
<th>Time to Peak (ms)</th>
<th>Peak Amplitude (µV)</th>
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<tr>
<td>Before Creep</td>
<td>After Creep</td>
<td>Before Creep</td>
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<tr>
<td>TRAP</td>
<td>SCM</td>
<td>TRAP</td>
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Figure 2. Mean repositioning error for upright and "halfway" flexed positions before and after creep. Bars indicate the standard error.

DISCUSSION

Sitting with the neck flexed for one hour, to induce creep, caused the expected increase in cervical range of flexion but was not associated with any impairment of sensorimotor function in cervical muscles. In contrast to findings in lumbar muscles, these results suggest that reflex activation and proprioception in the cervical muscles are not significantly affected by soft tissue creep. It is possible that the complex fibre architecture of the neck muscles and the high density of proprioceptors in cervical soft tissues may provide adequate protection against short term creep. Input from the vestibular apparatus to the neck muscles may also play an important role in retaining stability and control of the cervical spine.

These findings suggest that prolonged neck flexion does not impair muscle protection for the cervical spine.

REFERENCES


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