Cervical Proprioception in a Young Population Who Spend Long Periods on Mobile Devices: A 2-Group Comparative Observational Study

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Abstract

Objectives: The purpose of this study was to evaluate if young people with insidious-onset neck pain who spend long periods on mobile electronic devices (known as "text neck") have impaired cervical proprioception and if this is related to time on devices.

Methods: A 2-group comparative observational study was conducted at an Australian university. Twenty-two participants with text neck and 22 asymptomatic controls, all of whom were 18 to 35 years old and spent ≥4 hours per day on unsupported electronic devices, were assessed using the head repositioning accuracy (HRA) test. Differences between groups were calculated using independent sample *t*-tests, and correlations between neck pain intensity, time on devices, and HRA test were performed using Pearson's bivariate analysis.

Results: During cervical flexion, those with text neck (n = 22, mean age ± standard deviation [SD]: 21 ± 4 years, 59% female) had a 3.9° (SD: 1.4°) repositioning error, and the control group (n = 22, 20 ± 1 years, 68% female) had a 2.9° (SD: 1.2°) error. The mean difference was 1° (95% confidence interval: 0–2, $P = .02$). For other cervical movements, there was no difference between groups. There was a moderately significant correlation ($P \leq .05$) between time spent on electronic devices and cervical pain intensity and between cervical pain intensity and HRA during flexion.

Conclusion: The participants with text neck had a greater proprioceptive error during cervical flexion compared with controls. This could be related to neck pain and time spent on electronic devices. (J Manipulative Physiol Ther 2018;xx:1-6)

Key Indexing Terms: *Neck Pain; Proprioception; Cervical Vertebrae*

Introduction

The term "text neck" has been used to describe neck pain occurring in people who spend long periods using unsupported mobile electronic devices.[1] Seventy-five percent of the world's population spends time each day reading small unsupported screens of electronic devices such as cell phones, iPads, laptops, electronic readers, and video game consoles.[1] Spending longer than 20 hours a week on unsupported electronic devices is linked to the development of cervical spine musculoskeletal disorders.[2] Despite text neck becoming an increasingly common problem, as more and more time is spent on unsupported electronic devices, there has been little research to date describing the characteristics of people with this problem. Research is needed to assess and identify any deficits in this population so appropriate interventions and treatment can be recommended.

Previous research has indicated that proprioceptive deficits occur in people with traumatic neck pain such as whiplash injury,[3-8] as well as in those with insidious-onset neck pain.[5,9-11] However, as these studies were conducted mostly on older populations (mean age ± standard deviation [SD] ranging from 30 ± 9 years[5] to 56 ± 9 years[11]), it is not known if some of these proprioceptive deficits are age related. Teng et al compared head repositioning accuracy (HRA; as a measure of cervical spine proprioception) between a group of middle-aged participants with neck pain (59 ± 6 years), a middle-aged group without neck pain (55 ± 5 years), and a young asymptomatic group (age 22 ± 4 years).[12] As the repositioning errors were greater in both older groups, they concluded that age had an effect on cervical proprioception.[12,13] Studies of younger cohorts are required, as they are spending more time on mobile devices and are, thus, more likely to develop text neck. A survey of students at an Australian university found that students

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Paper submitted January 25, 2017; in revised form September 5, 2017; accepted October 19, 2017.

0161-4754

https://doi.org/10.1016/j.jmpt.2017.10.004

spent 4.1 ± 1.9 hours per day on mobile devices, with 66% of students reporting headache and 53% neck pain in the past year.[14] If deficits in proprioception are found in this young population with neck pain, they could be treated, which should lead to deceases in pain and disability. Previous research has indicated that patients with neck pain who undergo retraining of proprioceptive deficits report a reduction in symptoms.[10,15,16] Jull et al used a 6-week exercise regime of either proprioceptive training or craniocervical flexion training and found both groups had better proprioception and less pain.[15] Similar results were reported by Humphreys and Irgens following a 4-week rehabilitative exercise program of eye-head-neck coordination exercises.[10]

People using smartphones spend, on average, 2 to 4 hours a day bent forward to use mobile electronic devices; this can put stress on their cervical spines, which could be linked to neck pain. Studies have found that as the head goes more into flexion, the weight of the head on the cervical spine increases.[17] Hansraj found that the adult head weighs 10 to 12 pounds in the neutral position.[17] However, as it tilts forward, the forces in the neck increase to 27 pounds at 15°, 40 pounds at 30°, 49 pounds at 45°, and 60 pounds at 60°.[17]

The purposes of this study were (1) to evaluate if young people with neck pain who spend more than 4 hours a day on mobile devices differ in cervical spine proprioception from those without neck pain and (2) to assess any correlations between the amount of time spent on mobile devices and neck pain and proprioception.

Methods

Design

This study was a comparative observational study of 2 groups of young adults (<35 years old) who all spend more than 4 hours a day on mobile electronic devices. One group had cervical pain (n = 22) and the other group was asymptomatic (n = 22). The study was approved by the Human Research Ethics Committee at the Australian Catholic University under Approval No. 2013-334N. Informed consent was obtained in writing from the participants after the procedures were explained to them.

Participants

Forty-four participants (22 with neck pain and 22 asymptomatic controls) were recruited at an Australian university from January 2014 to May 2014 via posters and e-mails requesting volunteers. All participants (both groups) had to have spent ≥4 hours per day, over the past 2 years, on unsupported electronic devices such as phones, laptops, and iPads.[2,18] All participants were between ages 18 and 35 years. Additionally, to be in the neck pain group, participants were required to have neck pain ≥20 mm on a 100-mm visual analogue scale (VAS) for at least 3 months.[19] An inclusion criterion for the control group was absence of current or previous cervical spine pain.

Exclusion criteria for all participants in both groups were traumatic neck injuries, inflammatory joint disease, cervical spine infection, bony disease or marked osteoporosis, marked cervical spine disc protrusion, foramen nerve blockage, cervical spine cancer, cervical spine fracture/dislocation in the last 3 months, surgery to the cervical spine, severe migraines, vestibular disorders, and vertebrobasilar insufficiency.

Measurements

Questionnaire. All participants included in the study completed a questionnaire detailing age, sex, whether cervical spine pain was present, average time spent on unsupported electronic devices a day (in the past 2 years) and checking exclusion criteria. Participants with cervical spine pain completed a VAS to record intensity of cervical spine pain on a 100-mm line, ranging from "no pain" to "worst cervical spine pain experienced," averaged over the past week.

Head Repositioning Accuracy. Four cervical spine movements (flexion, extension, left rotation, and right rotation) were assessed using the HRA test as described by Revel et al.[20] A laser was attached to a lightweight headband (Fig 1) positioned on the participant's head. The laser was projected at a bull's-eye target (90 cm in front of the participant) that converts HRA values from centimeters to degrees based on the formula angle = $\tan^{-1}$[error distance/90 cm].[21] This target reading is accurate to ±0.5.[21] Participants were instructed to keep their eyes closed.

Procedure

Participants were seated with their heads in a natural straight-ahead position that they were asked to focus on and memorize. Each cervical spine movement (flexion, extension, right rotation, left rotation) was demonstrated to the participant, and they were allowed 1 practice movement.

Participants were then asked to keep their eyes closed and perform the movements in a slow, controlled manner. The participants were asked to move to half the reported normal range of motion (flexion = 30°, extension = 35°, right rotation = 40°, left rotation = 40°)[22] to avoid any potential end-range pain or stretch provocation. This range of movement was standardized by the researcher using a CROM device (Performance Attainment Associates, St Paul, Minnesota) (Fig 1). They were then instructed to return slowly to their starting position and indicate verbally when there. The difference between the starting and relocation positions was recorded. Each movement was performed 3 times and averaged. All participants were given the same instructions, and no feedback was given