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Effects of Visual Display Terminal Works on Cervical Movement Pattern in Patients with Neck Pain

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Abstract. [Purpose] This study examined changes in the onset of neck movement in young adults with and without mild neck pain (MNP) during visual display terminal (VDT) work. [Subjects] Ten control subjects and 10 subjects with MNP who were VDT workers were recruited. The upper (UC) and lower cervical (LC) spine angles in the sagittal plane were collected using an ultrasound-based motion analysis system during VDT work for 5 min. [Results] The MNP group had faster movement initiation in the UC and LC compared with the control group during VDT work. [Conclusion] These findings suggest that young adults with MNP should be cautious when performing VDT work while sitting.

Key words: Movement onset time, Neck pain, VDT work

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INTRODUCTION

Visual display terminal (VDT) tasks performed for long periods in a static posture, especially while sitting, are associated with musculoskeletal disorders, including neck pain[1)] (Marcus et al 2002). Straker, Jones, and Miller[2)] reported that the discomfort score was increased in workers doing VDT work. In 27% of workers, VDT work induced constant neck discomfort, and frequent neck pain was experienced by 30% of workers. Prolonged flexed neck posture during VDT work increases the neck muscular tension and can ultimately lead to neck pain[3)]. Additionally, the flexed neck position was increased more in symptomatic individuals than in asymptomatic individuals when using a VDT[4)]. Therefore, faulty head and neck postures should be identified to reduce the risk of developing neck pain. In particular, cervical posture needs to be divided into the upper cervical spine (UC) and lower cervical spine (LC) because the UC and LC may have different movement patterns depending on the display position during VDT tasks[5)].

Recently, analysis of movement onset time has identified faulty motion of segments in clinical movement tests[6)]. Sahrmann[7)] proposed that if early faulty movement is repeated, it would contribute to accumulated microtrauma in specific segments, which might consequently lead to musculoskeletal pain. Thus, early movement onset of a neck-flexed posture may be present during VDT tasks in individuals with neck pain because subjects with neck pain have a faulty neck posture. Thus, this study compared alterations in the cervical movement onset time in young adults with and without MNP during VDT work.

SUBJECTS AND METHODS

For this study, 20 young adults who had used a computer for at least 1 year were recruited from a local University in Gimhae, South Korea, using a print media advertisement. Subjects were grouped into a mild neck pain (MNP) group and a control group based on their scores on the Neck Disability Index (NDI); the two groups had NDI scores > 8 and ≤ 8, respectively (Table 1). All subjects read and signed an informed consent form approved by the Inje University Ethics Committee for Human Investigations prior to participation.

Kinematics data for UC and LC angles in the sagittal plane were collected using a Zebris CMS20 ultrasound-based motion analysis system (Zebris Medical GmbH, Isny, Germany) at a 10 Hz sampling rate during VDT work. For measurement of the flexion angles of the UC and LC, four active single markers were attached, one each at the zygomatic bone, tragus, first thoracic spinous process, and sternum. The UC angle was calculated as the angle between the line from the tragus to the zygomatic bone and that from the tragus to the first thoracic spinous process, while the LC angle was defined as the angle between the line from the first thoracic spinous process to the tragus and that from the first thoracic process to the sternum. The transducer sensor was placed perpendicular to the right of the subject at a distance of 80 cm. After establishing the neutral cervical posture of

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Table 1. Characteristics of the study participants

Characteristic	Control group (n = 10)	MNP group (n = 10)
Age (years), mean (SD)	23.2 (1.6)	23.6 (1.7)
Height (cm), mean (SD)	169.3 (6.9)	168.9 (5.5)
Weight (kg), mean (SD)	63.2 (6.7)	63.1 (8.8)
Neck disability index (NDI) (%), mean (SD)	3.7 (2.7)	16.8 (7.1)

MNP, mild neck pain; SD, standard deviation

Table 2. Cervical movement onset time in the two groups

Segment	Group	
	Control group Mean (SD)	MNP group Mean (SD)
Upper cervical spine (UC)	6.10 (5.88)	2.10 (1.27) *
Lower cervical spine (LC)	3.87 (2.96)	2.00 (1.06) *

MNP, mild neck pain; SD, standard deviation
*Significant difference between the two groups, $p < 0.05$

each subject, the cervical angle in the neutral position was set at zero degrees in the motion analysis system.

Each subject was seated on an adjustable-height chair without a backrest, with the knee and hip joints at 90° degree angles and the feet on the floor. Initially, the subject posed in a neutral cervical posture during VDT work. The neutral position was defined as a cervical posture without rotation, lateral bending, or excessive cervical lordosis in the sitting posture, but with slight lumbar lordosis and a relaxed thorax. After sitting in the neutral posture, all subjects were instructed to use the desktop. Each subject freely used the messenger application or Internet using a desktop for 5 min. In total, each subject performed three test trials, with 3-min rest periods between trials. The significance of differences in the time of movement between the two groups was analyzed using an independent t-test. Statistical analyses were performed with SPSS version 18.0 for Windows (SPSS, Inc., Chicago, IL, USA). A p-value ≤ 0.05 was regarded as statistically significant.

RESULTS

The young adults with MNP had significantly earlier flexion movement onset times in the UC and LC compared with the control group ($p < 0.05$) (Table 2). Movement onset in the UC of the MNP group was almost 4 s faster than that in the control group, and movement onset of the LC was almost 1.87 s faster.

DISCUSSION

Correct neck posture is believed to minimize neck pain in visual display work. In the present study, a faster movement onset in the upper and lower cervical spines was found in the individuals with MNP compared with individuals without MNP ($p < 0.05$).

Szeto, Straker, and O'Sullivan[4] reported that during VDT work, subjects with neck pain had a more flexed neck posture than individuals without neck pain, and this difference resulted from an alteration in motor control of the head and neck muscles due to pain. Flexion of the upper and lower cervical spine was present earlier in young adults with MNP than in subjects without MNP. A possible cause for the early movement onset time in the MNP group may be proprioceptive deficits in the cervical region resulting from an incorrect postural perception and ligament creep caused by a prolonged habitual posture. Maintaining faulty neck posture for a long time is believed to induce neck pain[8]. Cheng et al.[9] reported that young adults with chronic neck pain had an approximately two-fold proprioceptive error relative to individuals without chronic neck pain in neutral-flexion-neutral cervical reposition tests. Taken together, these findings suggest that neck pain caused by prolonged faulty neck posture reduces proprioception. Thus, young adults with MNP may have difficulty maintaining a correct neck posture during VDT work compared with individuals without MNP because those with MNP have a reduced ability to hold a neutral neck posture.

Our findings indicate that earlier neck flexion movement occurs in individuals with MNP compared with healthy individuals. They suggest that young adults with MNP need to be aware of their posture and modify faulty alignment when performing VDT work. This study has several limitations. First, we did not measure the flexion angle of the lumbar spine during VDT work. Changes in lumbar flexion combined with cervical flexion when performing VDT work in a seated position need to be assessed. Second, we did not analyze cervical muscle activity. Third, we only compared young adults with and without MNP.

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