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Research Paper: Influence of Body Positions on Craniovertebral Angle in the Elderly People With Forward Head Posture: A Pilot Study

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ABSTRACT

Introduction: Forward Head Posture (FHP) is one of the most common faulty sagittal postures of the craniocervical region in elderly adults. The sagittal alignment of the spine changes with different body positions. This study aimed to compare head postural alignment between sitting and standing positions in elder people with FHP.

Materials and Methods: The head posture was assessed in 32 participants including 16 old adults with FHP (Mean±SD age=67.9±3.8 years) and 16 normal matched individuals (Mean±SD age=67.5±3.4 years). Side-view photographs were taken in standing and sitting positions to determine the amount of the craniovertebral angle.

Results: The results of the paired t test indicated a significant difference between head postural alignment in sitting and standing positions for normal (P<0.003) group. However, there is no significant difference in sitting vs. standing in FHP group (P<0.09).

Conclusion: The assessment of head postural alignment in elder people using craniovertebral angle in two different positions, sitting and standing, demonstrated no changes in the alignment of head at FHP participants. It may be due to need for keeping the forward gaze.

1. Introduction

Poor posture is common among older adults [1]. Forward Head Posture (FHP) is one of the commonly poor head postures in the sagittal plane. In FHP, the weight of the head is maintained in front of the line of gravity, increasing the flexion moment on the spine. A linear relationship between age and FHP has been demonstrated in elderly people with an average angle of 49 degrees for individuals in the age range of 65 to 74 years, 41 degrees for those in the age range of 75 to 84 years, and 36 degrees in the 85 and older age [1]. It is shown that FHP has a major effect on cervical proprioception [2] and its resulting impaired

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balance and falling that is prevalent among the older people [3].

The common procedure to measure FHP is to determine the value of the craniovertebral angle in photographs. This is the angle between the line connecting the spinous process of the seventh vertebra to the tragus of the ear and a horizontal line crossing the spinous process of C7. The subject has FHP if the his or her Craniovertebral (CV) angle becomes smaller than 51 degrees. A greater FHP has a smaller craniovertebral angle [4, 5]. Reliability and validity of CV angle measurement have been confirmed in previous studies [6-8].

Measurement of spinal curvature in different positions of the body have been accomplished for several purposes, including spino-pelvic postural changes [9], lumbar lordosis, thoracic kyphosis [10], and head-neck posture [11]. The measurement of CV angle for evaluating of FHP has already been executed in different positions; sitting [12, 13] and standing [4, 5]. Changes in head posture between the sitting and standing positions have been reported in young individuals using craniovertebral angle [14]. This study aimed to compare FHP using CV angle between sitting and standing positions in elderly people.

2. Materials and Methods

Thirty-two participants including 16 old adults with FHP (11 females and 5 males; Mean±SD age=67.9±3.8 years; Mean±SD weight=71.3±9.2 kg; Mean±SD height=157.9±6.7 cm) and 16 normal matched individuals (13 females and 3 males; Mean±SD age=67.5±3.4 years; Mean±SD weight=63.5±9.4 kg; Mean±SD height=163.2±19.8 cm) were recruited from Elderly Health Center of Babol University of Medical Sciences.

The participants who had a history of any spine fracture, obvious spinal deformities, neurological and neuromuscular disorders, neck pain, headache, TMJ dysfunction, rheumatic disease, and balance disorders were excluded from the study. This study was approved by the Ethics Committee of the Babol University of Medical Sciences. All participant signed a written consent form after receiving proper explanation about the study.

Forward head posture assessment

A digital imaging of the lateral view of each participant was used to assess head posture in two different positions, relaxed standing and relaxed sitting position. For evaluating FHP in relaxed sitting position,

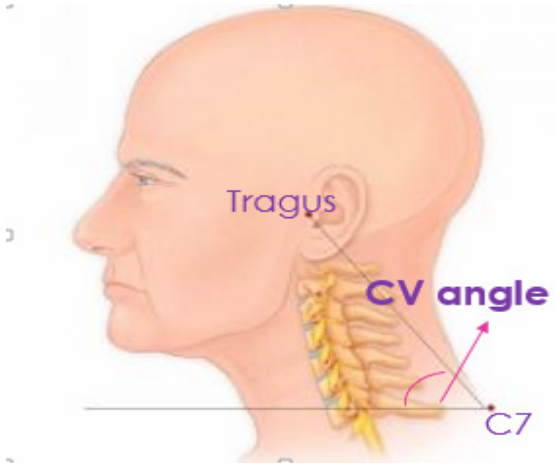

Figure 1. Measurement of craniovertebral angle JMR

all participants sit comfortably on a chair with buttock against the back of the chair and feet flat on the floor with hands resting on their laps. When participants were assessed in standing position, the they were asked to stand comfortably and divide their weights on both feet equally. They were also instructed to keep natural head posture and focus eye directly on a focal point ahead on the wall in both positions. A digital camera (Olympus vg-160, China) was set at the height of the subject's shoulder at the distance of 1.5 m. The spinous process of C7 and the tragus of the ear was marked with a pointer taped to the skin. Once the picture was taken, CV angle was measured to assess FHP (Figure 1).

Statistical analysis

The obtained data were analyzed with the SPSS version 18. Kolmogorov-Smirnov test was performed to assess the normal distribution of the data (P>0.05). The Independent t test was used to compare the head posture between two groups (P<0.05). Paired t test was performed to compare the head posture between two positions in each group (P<0.05).

3. Results

The Kolmogorov–Smirnov test results indicated that all variables had normal distribution. There were no statistically significant differences between the two groups in height, weight and age (P>0.05). The results of the Independent t test showed a significant difference in the CV angle between the FHP and normal groups in both position of sitting (P<0.0001) and standing (P<0.0001). The results of the Paired t test indicated a significant difference between CV angle in standing and sitting postures for normal (P<0.003) groups. However, these

Table 1. Comparison between sitting and standing positions in each group (Paired t test results)

Group	Position	Mean±SD	No.	t	P
FHP	Sitting	42.1±7.1	16	1.78	0.09
	Standing	39.6±8.5			
Normal	Sitting	60.5±4.5	16	3.50	0.003
	Standing	57.5±4.9			

JMR

two positions in FHP group didn't reveal any significant differences (P<0.09) (Table 1).

4. Discussion

In order to assess the influence of human body position on sagittal head posture in elderly people, the relaxed sitting and standing position were selected. In this study, head posture alignment using CV angle revealed that this angle increased in the sitting position compared to standing position in normal old people but not statistically difference was seen between two positions in the elderly people with FHP.

Changes in body curvature depending on the body position have been reported in many studies. Lee et al. assessed the changes in the lumbar spine curvature in five positions; lying, three different sitting positions, and standing position. They reported that lumbar lordosis increased in the standing position both in the young and older adults [15]. Meakin et al. reported the changes of the spine curvature using spine modeling method in three different positions; lying, sitting and standing. They confirmed that the changes of position from sitting to standing increased lumbar lordosis [16].

As mentioned above, there are limited reports about changes of head posture in different positions. Previous studies indicate a postural correlation between adjacent and non-adjacent spinal curvatures with different magnitude among sitting and standing positions. In standing position, more lumbar lordosis may be related to less FHP; in contrast, less lumbar lordosis is associated with more FHP in sitting position [17, 18]. In addition, Shaghayegh fard et al. reported that FHP increased in sitting position compared to standing position in both normal and FHP young adults [14]. Their results are inconsistent with our findings.

Kuo et al. reported that postural angles were different in various age groups [19]. Therefore, it is reasonable to claim that different curve changes in our study is due to elder participants involved in our study. Furthermore in our findings, head posture difference between sitting and standing position was significant in normal elder participants but there is no significant changes in individuals with FHP between sitting and standing positions. It may be due to compensatory postural correction at the head posture to keep the gaze forward.

The study results suggest that changes in body position, sitting vs. standing, produce changes in the alignment of head posture in normal older adults; however, there is no such changes in the head postural alignment in elder people with FHP in sitting compared to standing position. It may be related to fixed spinal posture for keeping the forward gaze in older people with FHP.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of Babol University of Medical Sciences approved this study.

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Authors contributions

All authors have read and approved the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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