

# Relationship between Forward Head Posture and Neck Pain as Well as Disability

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## Abstract

**Introduction:** One of the most common poor postures in the head and neck region is the forward head posture (FHP). It seems that improper posture for a long period of time causes abnormal physiological load on the neck. Thus, the result can be neck pain (NP). The aim of this study was to compare the relationship between intensity of FHP and a history as well as intensity of NP plus disability in the cervical region. **Material and Methods:** A total of 32 female students with FHP and history of mild NP participated in this study. The craniocervical angle (CVA) was measured by taking photos via a digital camera in standing and sitting positions. Intensity of pain was investigated using the Visual Analog Scale (VAS) and the severity of disability was tested with Neck Disability Index (NDI). **Results:** The Pearson's correlation coefficient was used to investigate the association between the CVA, VAS, NDI, and duration of neck pain. There was a significant positive relationship between the CVA in standing and sitting positions along with a negative correlation between CVA in both standing and sitting positions and the intensity as well as history of NP and severity of disability. **Conclusion:** Proper postural habits can contribute to prevention of NP. Also, postural correction training in subjects with FHP and NP, in addition to pain decrement methods, can help to reduce pain and disability in these subjects.

**Keywords:** Forward Head, Head Posture, Neck Pain, Neck Disability Index

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## Introduction

Ideal posture is a condition by maintaining musculoskeletal balance, causing the least amount of stress and strain to the body and providing conditions for more efficacy (1). Although proper posture is good, many people have poor posture. Especially among young people, the lifestyles and the spread of the use of computers and smartphones along with different technologies are contributing to abnormal postural habits, especially in the head and neck area (2-3). One of the most common abnormal postures in the head and neck area is forward head posture (FHP) (4, 5). In this situation, the head is deviated from the normal state and placed in the sagittal plane ahead of the trunk (1).

Any damage to the joints, muscles, and connective tissues may cause inappropriate posture. Also, any inappropriate posture may also cause anatomical structures to be subjected to

secondary damage resulting in symptoms such as pain (6, 7).

Neck pain is one of the problems of modern societies (8), which is often chronic (9). About 70% of people experience pain at least once in their lives (10) and about 10-5% of the elderly suffer from disability due to neck pain (10, 11).

Neck structures can be affected by certain causes such as degenerative diseases, trauma or inflammatory disorders, resulting in neck pain (12, 13, 14). Another group of neck pain is mechanical neck pain, which includes pains arising from habitual postures and degenerative conflicts (15). These problems seem to be caused by permanent and long-term inappropriate postures and abnormal physiological loads on the neck (16). Maintaining a constant posture for a long time requires muscle contraction to keep the body away from gravity (17). Staying in a constant posture for a long time, if repeated continuously, can lead to pain and damage (1, 18-20). Also, the

**Table 1.** Mean and standard deviation (SD) of demographic characteristics of subjects

Variables	Mean±SD	P-value*
Age (year)	21.62±2.25	0.601
Height (m)	163.28±4.53	0.470
Weight (kg)	57.75±4.64	0.887
Body Mass Index (BMI)	21.64±1.38	0.933
CV angle in standing position (degree)	45.61±1.55	0.441
CV angle in sitting position (degree)	41.49±3.32	0.715
Visual Analog Scale (VAS)	4.14±0.76	0.537
Neck Disability Index (NDI)	9.44±1.62	0.582
The history of neck pain (month)	24.31±3.10	0.490

\*P-value is for the Kolmogorov–Smirnov test ( $P>0.05$ )

**Table 2.** Relationship between CV angle in standing plus sitting positions and VAS, NDI, and history of neck pain ( $P<0.05$ )

Variables	Visual Analog Scale (VAS)		Neck Disability Index (NDI)		The history of neck pain (month)	
	Pearson correlation		Pearson correlation		Pearson correlation	
	R	P	R	P	R	P
CV angle in standing position (degree)	-0.054	0.385	-0.268	0.069	-0.242	0.091
CV angle in sitting position (degree)	-0.255	0.079	-0.092	0.309	-0.462	0.004*

FHP increases the compressive force on the zygapophysial joints of the neck, the posterior part of the vertebrae, and changes in length and strength of connective tissue due to the stretching of the anterior cervical structures and shortness of the posterior muscles as well as diminished tension production capacity of muscles. All these ultimately can lead to pain (1, 19, 21, 22).

Although many studies have reported that the FHP can cause neck pain (23-27), understanding the relationship between FHP and pain as well as disability, is important to select the proper type of interventions. So, the aim of this study was to determine the relationship between the amount of FHP and the history as well as severity of neck pain and disability in the neck area.

## Materials and Methods

A total of 32 females with FHP and history of mild neck pain were recruited into this study using easy and accessible sampling method. The inclusion criteria of study were: having craniovertebral (CV) angle of 48 degrees or less and neck pain beginning at least 6 months from the baseline of the study. The presence of acute neck pain, history of traumatic neck injury such as pleural effusion, radiculopathy or neck myelopathy, disturbances of the vestibular system, cervical scoliosis, and auditory impairment were exclusion criteria of this study. Volunteers signed a consent form once they were informed about the research procedure.

The outcome measures in this study included history and severity of pain as well as functional disability level. The history of pain was determined by filling in the questionnaire. The severity of pain was measured by the Visual Analog Scale (VAS).

In this regard, a 100 mm long line was drawn and the participants were asked to determine their pain severity. The neck pain in this study lasted at least 6 months from the baseline and in the last three weeks had not led to interruption in work or rest at home. Also, the maximum pain of these patients was 50 mm based on VAS and the minimum was 20 mm.

In this study, the Neck Disability Index (NDI) was used to estimate the functional disability level. This index is used to measure neck pain and functional disability in the neck. It contains 10 sections including: pain intensity, personal work, lifting, studying, headache, concentration, working, driving, sleeping, and recreational activities. The questionnaire is scored based on the Likert scale between zero (no disability) and 5 (maximum disability), with the total scores ranging from 0 to 50. In studies to better interpret the questionnaire, the score of the questionnaire is divided into 4 grades; grades 0-4 indicate lack of disability, 5-15 mild disability, 15-24 moderate disability, 25-34 severe disability, and above 35 indicate complete disability. The degree of disability in the participants in the current study was mild.

In order to examine the posture of head and neck, after the separation of subjects, the photographic method with a high precision digital camera (Canon IXY 12 MP, Japan) was used. In this regard, the person was asked to be in a comfortable position (in both standing and sitting situations). Square fluorescence labels that were placed on the spinous process of the seventh vertebrae and tragus of ear were utilized for marking. Then, the person stood on the right side at a distance of 1.5 meters from the digital camera and she was asked to look around and to be in a complete comfortable position.

The camera was placed parallel to the shoulder of the subjects on the base, where a picture was taken from their side view. The plumb line was also used in the photo to measure the actual vertical and the horizontal line. After taking pictures using the MB-Ruller software, the angles between the intersection of the lines passing from the spinous process of seventh vertebrae and tragus of the ear with a line parallel to the horizontal line passing from the spinous process of seventh vertebrae (CV angle) were measured. Angles of less than or equal to 48 degrees were considered as FHP.

SPSS software (version 22) was used at a significant level of 0.05. The normality of variables was evaluated by the Kolmogorov-Smirnov test. The Pearson correlation test was employed to determine the relationship between the magnitude of FHP and the history as well as severity of neck pain and disability in the neck region.

## Results

The variables of this study were normal by the Kolmogorov-Smirnov test ( $P > 0.05$ ). Table 1 details the demographic characteristics of the participants. The participant's characteristics include age, height, weight, and body mass index. Table 1 presents the mean and standard deviation of CV angle in the sitting and standing positions, pain intensity (VAS), the score of NDI, and the history of the neck pain.

The results of Pearson correlation test revealed a significant direct correlation between CV angles in two standing and sitting positions ( $R = 0.626$ ,  $P < 0.05$ ). Also, a significant reverse correlation was found between CV angle in sitting positions and the history of neck pain ( $P < 0.05$ ) (Table 2).

## Discussion

The findings revealed that there is a significant and an inverse correlation between the degree of CV angle in sitting positions and the history of neck pain. These findings are consistent with previous studies. For instance, Ruivo *et al.* found that adolescents with neck pain had a lower CV angle than normal individuals (28). Also, Szeto *et al.* observed that the magnitude of FHP was greater in workers with neck pain than those who were not asymptomatic (24).

It seems that the neck pain and disability caused by forward head posture can emanate from disruption of the function of the contractile structures and may also be due to non-contractile structures.

Concerning the contraction of contracture structures in the forward posterior head, according to Haughie *et al.*, It can be argued that due to the adverse effect of this posture on the head and neck biomechanics, and as the head falls ahead its natural axis, for stabilization the magnitude of torque on the posterior neck muscles increases (29). Then over time, these muscles get shortened due to the maintenance of this undesired posture for a long time. As a result, increased stress on the posterior muscles of the neck can cause myofascial pain (30-33).

The other possible cause for the neck pain in the FHP is impaired function of non-contractile tissues. According to the findings of Silva *et al.*, as well as Pearson *et al.*, it seems that since the FHP leads to increased compressive load on the neck facet joints and posterior part of the vertebrae, excessive elongation of the capsular ligaments can ultimately can cause pain (34, 35).

In addition, it is possible that the compression of the nerve root can cause neck pain due to the reduction of the intervertebral space in the cervical vertebrae in people with FHP (27).

Yip *et al.* observed that people with more intense FHP had more disability (25). They believed that FHP has been just one of the factors associated with pain and disability in the neck area. Further, other factors such as osteoarthritis changes, frequent strains, overuse syndromes, and psychological factors can contribute to pain and disability levels. In this study, the CV angle was measured by a device called Head Posture Spinal Curvature Instrument with Northwick Park Neck Pain Questionnaire and Numeric Pain Rating Scale being used to measure neck disability. Yip *et al.* measured the CV angle only in standing position while in the present study, the measurements were carried out in both standing and sitting positions. The mean CV angle in the Yip *et al.* research was 49.9 degrees, while the mean of this angle was 45.6 degrees in our study. Therefore, it can be argued that the severity of FHP in the participants in the present study was greater and more carefully selected.

Findings of Kim *et al.* (36) were consistent with the present study and they observed that there was a significant and direct correlation between FHP and neck pain. They suggested that the cause of this phenomenon was the fatigue of the extensor muscles of the neck due to their efforts to maintain the position of the extension of the head and neck to match the line of sight thereby causing pain. In addition, Kim *et al.* stated that the facet joints and articular capsule also contribute to development of pain. In the study of Kim *et al.*, the mean CV angle was 61.4 degrees in standing position and 59.7 degrees in sitting position. On the other hand, in the present study, the mean CV angle was 45.6 degrees in standing position and 48.41 degrees in sitting position. Therefore, in

comparison to the research of Kim *et al.*, subjects with FHP were more carefully selected in this study. Also, the disability rate in the participants in the Kim *et al.* study was 4.9 according to the NDI scale, while in the present study, this scale was reported as 9.4. Therefore, the participants in this study had more considerable FHP and disability than those who participated in the study of Kim *et al.* (36). As a result, it can be stated that increasing the magnitude of the FHP intensifies the severity of pain and disability in the neck area. This can be due to the fact that as the amount of forward movement increases, the degree of disruption caused by these structures is grows even further. As a result, the severity of pain and disability will be higher in people with a lower CV angle. Also, with regard to the possible cause of the relationship between FHP and history of neck pain, it can be argued that in people with a lower CV angle, the dysfunction of the mentioned structures is likely to be more severe. Therefore, they show signs of pain and disability earlier than people with larger CV angles.

## Conclusion

The results of this study suggested that as the degree of FHP increased, the history of neck pain diminished. Regarding these findings, it can be argued that proper postural habits will be effective in preventing neck pain and disability. Also, posture correction exercises in patients with FHP and neck pain, along with other pain-relieving methods, help reduce pain and disability in these people.

### Limitations

One of the major limitations in communication research is their inability to recognize cause-effect relationships. Therefore, there is a need for further studies to discover how these variables are associated. Other limitations of the present study were the lack of correlation between FHP and the history and severity of neck pain and disability in men and in other age groups. For this reason, it is recommended that further research be done on both sexes (men and women), in different age groups and also on more cases.

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