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Relationship between head postural changes and dynamic balance in a symptomatic forward head posture student

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Abstract : Background: Forward head posture is a common type of postural deformity seen in patients with neck disorders, resulting in the movement of the center of gravity away from the body. **The purpose:** of this study to investigate the relationship between postural changes and dynamic balance in forward head posture students. **Subjects :**forty students their weight ranged from 50 to 86kg, age ranged from 18 to 21 years and height from 159 to 179 cm participated in this study. **Methods :**the postural changes of the head region (Head postural index)were measured by postureprint software and mediolateral stability, anterioposterior stability and over all stability were measured by biodex balance system .**Results :** there was no significant relationship between postural changes of head region and dynamic balance in forward head posture students. **Conclusion:** there was no relationship between postural changes of head and dynamic balance in forward head posture students.
Keywords: forward head posture, postureprint, biodex balance.

Introduction

Forward head posture is a common type of postural distortion seen in patients with neck disorders; there is change of head position that leads to changing of center of gravity location[1]. Forward head posture associated with many musculoskeletal problems[2], such as changing of mechanoreceptors function, changing the sensitivity of neck muscles spindles[3], coordination[4] and affection balance[5].

The movement of head forward leads to increase the anterior curve in the lower cervical vertebrae and increase the posterior curve in the upper thoracic vertebrae to maintain balance; that causes musculoskeletal pains, visual disorders, headache, and other symptoms[6-9].

There is rapid spread of forward head posture thatmay leads to chronic neck pain[10], there is associated areas may affected with the neck such as the thoracic vertebrae and shoulder, possibly causing an imbalance in the musculoskeletal system[11,12].

Previous studies regarding balance and the forward head posture reported that reduced sensation of joints is a major contributor to reducing balancing ability[12].Other studies have shown a deterioration of postural control when asking participants to stand with exaggerated extended head posture[13-14]. Kang et al. suggested that forward head posture may be associated with changes in postural control. They found that young healthy computer workers had lower balance scores, a more pronounced forward head posture[15].

However, there have been no studies directly evaluating the effects of postural changes in forward head posture on balancing ability; therefore, [12-14,15] this study aimed to find the effect of cervical postural changes on dynamic balance in forward head posture students,. In the current study, we used postureprint software which is valid and reliable and provide analysis of posture in terms of rotations in degrees and translations in millimeters of head, rib cage, and pelvis.[16-17.]

Subjects, Materials and Methods

1- Design of the study:

We used correlation design in this study

2- Subjects:

Forty students suffer from asymptomatic forward head posture, their age ranged from 18 to 21 year .All students diagnosed as asymptomatic forward head posture.

Exclusion Criteria:

No visual, auditory or perceptual deficits, no structural deformities at any joint of the lower limbs and spine, no surgical operations in the lower limbs, no deep sensory loss, no history of epilepsy, noDiabetes, and there is no any diseases affecting balance and neuromuscular control.

3- Instrumentation:

a- Weight and Height Scale: to measure Weight and Height

b- Biodex balance system: Biodex balance system was used to evaluate balance in this study. The BIODEX Balance System SD (BBS) (BIODEX Medical Systems, Shirley, NY)

c- Biotonixpostureprint: it is a new posture module. This posture software is computer analysis software of posture in terms of rotations in degrees and translation in millimeters.

Procedures of the study:

First, each subject was interviewed and personal information was collected and recorded, subjects were assessed according to inclusion and exclusion criteria then Subject's signature was taken in the consent from. The demographic data of each subject including the age, weight and height were measured and recorded.

Testing procedures

1- Dynamic Balance *assessment* Procedure:

First step: the goal of this step to test the subject’s ability to control the platform angle of tilt.

1. Each subject stands upright posture looking forward on the center of the "locked" platform with arms relaxed beside her body and assuming comfortable erect posture.
2. Biofeedback display was adjusted for each subject to ensure comfort and allow the subject to look straight at it.
3. The following test parameters were entered into the device:

The subject’s weight, height, and age.

- Platform firmness (stability level): eight for three repetitions and four for three repetitions.
- Test duration: 20 seconds.
- The subject’s eyes; open.

Second step: the goal of this step was to make the subject's center of gravity over the center of his base of support.

I asked each subject to stand on the locked platform. Then the platform was unlocked and display screen showed a circle with a central cursor. The subject was tried to be in centered position by shifting his feet position and correspondingly the cursor.

Once centering was achieved and the cursor was in the center of the display screen, each subject was instructed to maintain her feet position constant until the end of the testing procedures. Then we locked the platform. Then we recorded feet angles and heels coordinate from the platform. After introducing feet angles and heels coordinate into the BBS, the test then began. As the platform advanced to an unstable state, the subject was instructed to focus on the visual feedback screen directly in front of her (while standing with both arms at the side of the body without grasping the handrails) and attempt to maintain the cursor in the middle of the bull's eye on the screen.

At the end of each test trial, a printout report was obtained by the printer. This report included information concerning overall, mediolateral and anteroposterior stability indices.

2 - postureprint testing procedure

Starting position of the patients:

Patients stood 61 cm (two feet) from the center of the wall grid. In the AP view along a line perpendicular from the center of the wall grid, patients positioned their feet such that the perpendicular bisected mid stance. While setting up the wall grid and camera, from mid wall grid, a perpendicular line was drawn on the floor outward for 2.74 m. the camera was placed on this line. In each of the two lateral views, the patients ankles were placed such that the mid ankle bisection was directly in line with the perpendicular from mid wall grid. In this manner, each patient was positioned with their feet centered relative to the camera and grid reference frame. The patients were asked to wear tight fitting clothes in order for examiners to find various anatomical sites. The examiner has placed 13 markers on each participant before taking the three photographs, for the photographs, patients were instructed to stand, not their head up and down twice with their eyes closed and then assume what they felt to be a neutral body posture. In this stance, the eyes were open and the subject refrains from motion[16,17].

Statistical procedures:

Data collection:

The data concerning the postural changes of the head region (Head postural index**)** collected using postureprint software after assessment of patients and overall, mediolateral and anteroposterior stability indices using biodex balance system.

Data and Statistical Analysis:

1. Descriptive statistics to calculate the mean ± SD for all measured variables.
2. Person Product Moment Correlation Coefficient was conducted to determine the correlation between variables.
3. The level of significance for all statistical tests was set at $p < 0.05$.
4. All statistical measures were performed through the statistical package for social studies (SPSS) version 19 for windows.

Results:

1- General characteristics of subjects:

Forty students with forward head posture participated in this study. Their mean ± SD age, weight, height, and BMI were 19 ± 1.15 years, 68.55 ± 11.03 kg, 172.45 ± 5.22 cm, and 23.03 ± 3.39 kg/m² respectively as shown in table 1 .

Table 1. Descriptive statistics for the mean age, weight, height and BMI of the study group.

	$\overline{X}$±SD	Minimum	Maximum	Range
Age (years)	19 ± 1.15	18	21	3
Weight (kg)	68.55 ± 11.03	50	86	46
Height (cm)	172.45 ± 5.22	159	179	20
BMI (kg/m²)	23.03 ± 3.39	17.3	30.64	13.34

$\overline{X}$: Mean
SD: Standard Deviation

Descriptive statistics of stability indices:

The mean ± SD anteroposterior stability index at level 8 was 0.49 ± 0.53, and that for mediolateral and overall stability indices were 0.34 ± 0.3 and 1.42 ± 0.64 respectively as shown in table 2.

Table 2. Descriptive statistics for the stability indices of the study group.

	Stability index	$\overline{X}$±SD
Level 8	**Anteroposterior**	0.49 ± 0.53
	Mediolateral	0.34 ± 0.3
	Overall	1.42 ± 0.64

$\overline{X}$: Mean
SD: Standard Deviation

Relationship between head postural change index and dynamic balance at level 8:

There was a weak positive non significant correlation between head postural index and anterioposterior stability index (r = 0.19, p = 0.34), there was a weak negative non significant correlation between head postural index and mediolateral stability index (r = -0.2, p = 0.32), there was a weak positive non significant correlation between head postural index and over all stability index (r = 0.28, p = 0.16. (Table3).

Table 3. Correlation between head postural change index and stability indices at level 8.

Stability index	Postural changeindex	r value	p value	Sig
Anteroposterior	**Head postural index**	0,19	0.34	**NS**
Mediolateral	**Head postural index**	-0.2	0.32	**NS**
Overall	**Head postural index**	0.28	0.16	**NS**

r value: Correlation coefficient value p value: Probability value S: Significant
NS: Non significant

Discussion

This study was designed to find the correlation between the postural changes in head region and dynamic balace using biodex balance system for assessment dyamic balance and postureprint software that used to assessment postural changes.

The result of the present study is in agreement with silva, et al. they evaluated postural control forward head posture students in college, and found that FHP was not challenging enough disrupt postural control young healthy subjects[18].

The results of the present study were accordance to those reported by Johnson, et al, who tried to find the effect of head position on postural control. They found head extension impacted postural control compared with head neutral, as indicated by increased COP velocity in the A/P direction and a reduction in the time-to-contact the A/P stability boundary[19].

The results of this study also agree with those reported by Um Jy, . He found that FHP does not largely influence static balance .However,the participants in this previous study were children. COG is generally lower in children than in adults, and therefore, postural deformity might have had a low impact on balance control and in this study the researcher examined the effect on static balance not dynamic balance[20].

Our results strengthened by study of Lee. Joon-Hee.He FoundThere was no effect of forward head posture on dynamic balance by using spine balance 3D[21].

Also Karajgi, et al.Found There was no statistically significant effect of forward head posture on an individual's balance by using Modified Clinical Test for sensory interaction in balanceand limits of stability with Neurocom Basic balance master in Asymptomatic Young Adults[22].

The results of the present study are supported by Hyong and Kim,who used Tetrax portable multiple systemThey found that forward head posture did not influence static balance.This is probably because overall static balance is good among healthy undergraduates[23].

To our knowledge there were few studies that contradicted with the current study, the results of the current study were against by study of Kang et al,. Who showed that heavy computer user had significantly decreased ability to control posture and mobility, compared to the control group[24].

Our results differed from those reported by Pociask et al., who found that balance was significantly worse in the extended head posture group than in the control group[25].

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