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Correlation between forward head posture and proprioception function in patients with cervical spondylosis

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Abstract

Background: cervical spondylosis and forward head posture are the most common musculoskeletal problems among the society. Few studies investigating the effect of FHP on proprioception function. **Objective:** The study aimed to determine the relationship between forward head posture (FHP) and proprioception function in patients with cervical spondylosis and to detect the effect of cervical spondylosis severity on FHP and proprioception function. **Patients and Methods:** sixty patients with cervical spondylosis from both sex were participated in the study. Their age ranged from 30-50 years old. Patients were divided into three equal groups; Mild group (GI), moderate group (GII) and severe group (GIII) according to cervical degenerative index (CDI). Lateral photography was used to measure craniovertebral angle (CVA) from sagittal plane. Cervical range of motion device (CROM) was used for assessment of proprioception error in flexion and extension. **Results:** There was a negative correlation between CVA and proprioception error. A statistical significant difference in the median values of CVA and proprioception errors between the three groups **(P<0.05)** with proprioception error is significantly higher in (GII) and (GIII) than (GI) and the CVA is significantly lower in (GIII) than other groups. **Conclusion**: Forward head posture is associated with reduced proprioception. Also, Progression of cervical spondylosis was concomitant with reduced CVA and increase error value of proprioception.

Key words: *cervical spondylosis, proprioception function, forward head posture.*

Introduction

Cervical spondylosis is a common degenerative condition of the cervical spine in the general population with incidence rate of 83 per 100.000 populations and prevalence of 3.3 cases per 1000 people. It occurs mostly in fourth and fifth decades of life .The etiology of cervical spondylosis is associated with ageing process, and is closely related to the intrinsic axial load imposed by the weight of the cranium lifelong **(Reddy et al., 2012).**

Proprioception provides sensory feedback from the body to the nervous system. It contributes to the maintenance of body alignment **(Lee et al., 2009).** Impairment in proprioception function is one of the main factors contributing to the development and maintenance of neck pain in spondylosis. Patients adopt posture

which place greater load on the neck. Change in the muscle length caused by poor posture for a sustained period of time result in forward head posture **(Weon et al., 2010; Kang et al., 2012).**Forward head posture considered a common postural disorder related to abnormalities in musculoskeletal balance. It is identified when that the head is anterior to a vertical line through the center of gravity **(Yip et al., 2005).**It increases the compressive forces to the cervical structures including facet joints and, posterior neck structures. These structures consist of huge amount of nociceptors **(Mcaviney et al., 2005).** Degenerative changes of intervertebral and facet joint occur **(Liber, 2002; Shaghayegh et al., 2015).**

The study aimed to determine the relationship between forward head posture (FHP) on proprioception function in patients with cervical spondylosis and to detect the effect of cervical spondylosis severity on FHP and proprioception function.

Patients and methods

Sixty patients from both sexes with cervical spondylosis were participated in the study. Their age was ranged from 30-50 years old. The patients were recruited from the Neurology clinics and Neurology department in Kaser El Aini Hospital in the period from April to October 2017. The diagnosis was confirmed by x-rays and MRI. Patients with history of trauma (whiplash injury), cervical myelopathy, and cervical radiculopathy were excluded.

Patients were divided into three equal groups; Mild group (GI), moderate group (GII), severe group (GIII) according to cervical degenerative index (CDI). Lateral photography was used to measure craniovertebral angle (CVA) from sagittal plane. Cervical range of motion device (CROM) was used for assessment of proprioception error in flexion and extension. The patients signed a written consent form after receiving information about the study purpose, whole procedures, and possible benefits to ensure full cooperation. The ethical committee of Faculty of Physical Therapy, Cairo University approved the study.

Lateral photographic method is a valid and reliable method to assess FHP **(Gadotti and Biasotto, 2010).**Each patient was asked to stand in a comfortable position in front of wall looking forward. The cervical region was exposed and adhesive markers were placed on spinous process of C7 and tragus of the ear. Digital camera was placed on a tripod 100 cm a part from the patient.

Sagittal plane images were taken by the camera and saved to the personal computer **(Lee et al., 2014).** The resultant images were analyzed by measuring the angle between the horizontal line and a line extending between tragus of the ear and spinous process of C7 using open access Kinovea software.

Cervical proprioception was measured with the CROM device in sagittal plane (flexion and extension). This device was placed on patient head. Two cervicocephalic sensibility tests were applied (neutral head position and target head position) (Revel et al.,1991).In neutral head position test (NHP) each patient was asked to sit upright in a comfortable position and look straight ahead **(Teng et al.,2012).** The patients instructed to flex or extend head and reposition neck to neutral position while eyes closed. In target head position test (THP) each patient head was moved to the predetermined target position (50% of the maximum range of motion). The head was maintained in the target position for 3 seconds and the patient was asked to remember that position the head

was bought to neutral position and the patients was asked to reposition actively by moving the head to the target position. When patient reached the reference position, the patient relocation accuracy was measured in degrees with CROM device. Three trials were executed consecutively, and the average of the trials was computed for analysis **(Reddy et al., 2016).**

Statistical analysis

The obtained data were collected and statistically analyzed using the descriptive statistics (median, Interquartile Range). Kruskal-Wallis test was used for comparison between the three groups followed by Dunn's multiple comparisons test for comparison between each two independent groups. Spearman's rank correlation test was used to correlate between variables. P value <0.05 was considered significant **(Kirkwood et al., 2015)**.

Result

There was significant negative correlation between crainovertebral angle and absolute angular error for both flexion and extension at neutral and target head position **(Table 1).**

Table (1): Correlation between crainovertebral angle (CVA) with absolute angular errors of flexion and extension at NHP and THP:

Variables	CVA and Absolute angular error (NHP)		CVA and Absolute angular error (THP)	
	Flexion	**Extension**	**Flexion**	**Extension**
r	-0.506	-0.347	-0.425	-0.43
P- value	0.0001*	0.0066*	0.0007*	0.0006*

r: Spearman's rank correlation, *Significant: P <0.05, NHP: neutral head position test,THP: target head position

Comparison of the median values of craniovertebral angle and absolute angular errors in flexion and extension at NHP and THP in the three groups revealed statistical significant difference **(P<0.05) (Table 2).** Comparison of the median values of CVA between each pair of the three groups revealed that absolute angular error both in flexion and extension were significantly higher in (GII) and (GIII) than (GI) and the CVA was significantly lower in (GIII) than other groups **(Table 3).**

Table (2): Descriptive statistics (median and Interquartile Range) and comparison tests for absolute angular error between the three groups:

Variables	Testing positions	GI median (IQR)	GII median (IQR)	GIII median (IQR)	P-value
Absolute angular error of neck flexion	**NHP**	3.33 (4.835)	10 (5.832)	13.33(8.33)	< 0.0001*
	THP	1.83 (4.583)	10 (5)	10 (1.67)	< 0.0001*
Absolute angular error of neck extension	**NHP**	1.83 (4.665)	10 (12.165)	13.33 (6.25)	< 0.0001*
	THP	2.16 (5)	10 (5)	10 (0)	< 0.0001*
CVA		45 (8)	44 (3.17)	37.5 (9.66)	0.0001*

NHP: neutral head position test, THP: target head position test.*significant= P < 0.05**.**

Table (3): Descriptive statistics (median and Interquartile Range) and comparison tests for CVA and absolute angular error between the three groups:

Variable	Testing positions	GI vs. GII		GI vs. GIII		GII vs. GIII	
		Mean rank difference	**P-value**	Mean rank difference	**P-value**	Mean rank difference	**P-value**
Absolute angular error of neck flexion	**NHP**	-19.70	< 0.001*	-31.75	< 0.0001*	-12.05	0.0842
	THP	-24.88	<0.0001*	-30.18	< 0.0001*	-5.3	0.98
Absolute angular error of neck extension	**NHP**	-22.98	<0.0001*	-22.98	<0.0001*	-7	0.6095
	THP	-21.15	0.0003*	-29.25	<0.0001*	-8.1	0.3964
CVA		6.450	0.7253	24.08	< 0.0001*	17.63	0.0042*

NHP: neutral head position test, THP: target head position test.*significant= P < 0.05.

Discussion:

The result of the present study show that CVA is at its smallest value in severe cervical spondylosis group**.** This may attributed to excessive compression of the facet joint articulation and the capsular ligament strain beyond the physiologic limit in the forward head posture which stretches anterior structures of the neck and reduces the length of posterior muscles **(Pearson et al.,2004;Silva et al.,2009).** Because facet joints planes are obliquely oriented, the forward head position might increase the compressive force between the facet articular cartilage of the inferior articular process and the adjacent facet of the superior articular process **(Porterfield and Derosa, 1995).** This leads to progression of cervical spondylosis**.**

The results of the present study showed that there are greater proprioceptive repositions errors for flexion and extension at both neutral head position and target head position in patients with moderate and severe cervical spondylosis in comparison to mild group. These results suggest that the severity of FHP affects joint position sense. The present study also demonstrated that there is a negative correlation between the degree of FHP and joint position sense. Additionally suggesting as FHP becomes more severe, joint position sense becomes worse.

Changes in the cervical region, induced by sustained poor head posture, cause excessive joint and muscle loading, and subsequently influencing weakness of the deep cervical muscles. Muscle imbalance, including weakness of cervical flexors and shortening of cervical extensors, has been reported in patients with FHP. These abnormal changes in the muscles can lead to disruption of afferent input from the muscle spindles, which may have an adverse effect on joint position sense **(Szeto et al.,2002;Dover and powers,2003;Proske,2006).**

Conclusion

Progression of cervical spondylosis was concomitant with reduced CVA and increase error value of proprioception. Also, Forward head posture is associated with reduced proprioception.

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Conflicts of interest

There are no conflicts of interest.

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