ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

DOI: 10.5336/healthsci.2024-101989

The Comparison of the Factors Affecting Forward Head Posture in Academic Staff with Nonspecific Chronic Neck Pain: A Descriptive Study

Nonspecific Kronik Boyun Ağrısı Olan Akademik Personelde İleri Baş Postürünü Etkileyen Faktörlerin Karşılaştırılması: Tanımlayıcı Çalışma

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ABSTRACT Objective: The aim of the study the compare the factors affecting forward head posture in academic staff with nonspecific chronic neck pain. **Material and Methods:** Fifty subjects with nonspecific neck pain participated in this study. The subjects were divided into two groups, according to the cut-off value of the craniovertebral angle (CVA) as "normal cervical posture" and "forward head posture(FHP+)". Demographic information and the duration of sitting, computer and phone use were recorded. The pain severity during resting, sleep and activation were assessed using visual analog scale. The pain threshold of upper trapezius muscles and suboccipital region were assessed by algometer. Scapulothoracic muscle strength, deep cervical muscle endurance, and strength were assessed using a handheld dynamometer and a stabilizer pressure biofeedback unit, respectively. CVA was determined using photograph analysis methods. Cervical joint position sense was assessed using a dual digital inclinometer. **Results:** A total of 50 academic staff were included. Weight, body mass index and cell phone use duration were significantly higher in the FHP+ group(p=0.02; p=0.01). Also, the upper trapezius pain thresholds were significantly higher in the FHP+ group(p=0.02). Furthermore, significant difference was seen in the middle trapezius muscle strength, deep cervical flexor muscle endurance and joint position sense error, between the groups (p=0.02; p=0.03; p=0.01). **Conclusion:** In patients with nonspecific neck pain, FHP was associated with upper trapezius muscle pain thresholds, middle trapezius muscle strength and reduced deep cervical flexor muscle endurance and, neck joint position sense error respectively.

Keywords: Forward head posture; neck pain; academic staff

ÖZET Amaç: Çalışmanın amacı, nonspesifik kronik boyun ağrısı olan akademik personelde ileri baş pozisyonuna etkileyen faktörlerin karşılaştırılmasıdır. **Gereç ve Yöntemler:** Bu çalışmaya, nonspesifik kronik boyun ağrısı olan elli katılımcı dâhil edildi. Katılımcılar, kraniovertebral açı değerine göre "normal servikal pozisyon" ve "ileri baş duruşu(FHP+)" olmak üzere iki gruba ayrıldı. Demografik bilgiler ve oturma, bilgisayar ve telefon kullanım süresi kaydedildi. Dinlenme, uyku ve aktivasyon sırasındaki ağrı şiddeti, görsel analog skalası kullanılarak değerlendirildi. Üst trapezius ve suboksipital kaslarının ağrı eşiği algometre ile değerlendirildi. Skapulotorasik kas kuvveti, derin servikal kas kuvvet ve enduransı el dinamometresi ve stabilizer basınçlı biyofeedback ünitesi kullanılarak değerlendirildi. Kraniovertebral açı, fotoğraf analiz yöntemleriyle belirlendi. Servikal eklem pozisyon hissi, dijital inklinometre kullanılarak değerlendirildi. **Bulgular:** Toplam 50 akademik personel dâhil edildi. FHP+ grubunda kilo, beden kitle indeksi ve cep telefonu kullanım süresi anlamlı olarak daha yüksek olduğu belirlendi (p=0,02; p=0,01). FHP+ grubunda üst trapezius ağrı eşiğinin anlamlı olarak daha yüksek olduğu belirlendi (p=0,02). Gruplar arasında orta trapezius kas kuvveti, derin servikal fleksör kas dayanıklılığı ve eklem pozisyon hissi bakımından anlamlı fark olduğu belirlendi. (sırasıyla p=0,02; p=0,03; p=0,01). **Sonuç:** Nonspesifik boyun ağrısı olan hastalarda, FHP; üst trapezius kas ağrı eşiği, orta trapezius kas kuvveti, azalmış derin servikal fleksör kas dayanıklılığı ve servikal eklem pozisyon hissi ile ilişkilidir.

Anahtar Kelimeler: İleri baş postürü; boyun ağrısı; akademik personel

TO CITE THIS ARTICLE:
Uluğ N, Kılıç E, Begen SN, Aktaş Arslan C, Yılmaz Yelvar GD, Çırak Y. The comparison of the factors affecting forward head posture in academic staff with nonspecific chronic neck pain: A descriptive study. Turkiye Klinikleri J Health Sci. 2024;9(3):521-9.

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Peer review under responsibility of Turkiye Klinikleri Journal of Health Sciences.

Received: 06 Feb 2024 ***Received in revised form:*** 28 Jun 2024 ***Accepted:*** 01 Jul 2024 ***Available online***: 08 Jul 2024

One of the most common musculoskeletal conditions is chronic nonspecific neck pain (CNP), which significantly affects daily living and raises costs.[1] Incidence of neck pain within a year ranges from 10.4 percent to 21.3 percent, with a frequency of 86.8 percent in the general population.[2] Evidence suggests that physical work factors such as prolonged forward neck posture and repetitive movements are major contributors to neck pain.[3]

The forward displacement of the head on the cervical spine, known as forward head posture (FHP), is assumed to be the cause of pain around the neck and scapulothoracic region.[3]

This postural issue can be caused by a number of factors, including sleeping with your head up, using a computer for extended periods of time, and having weak neck muscles.[4,5]

Long-term work in front of a computer requires a static posture of the upper body. The muscles in the upper limbs, neck, and shoulders are overworked and damaged in trying to maintain a static posture.[6] Uncomfortable posture, especially depending on the viewing angle of the screen and the position of the chair and table, and may cause muscle tension, weakness, muscle fatigue and pain. The muscle tension and stress that occurs in shortened structures, this condition can cause FHP and pain.[7] This can develop a vicious cycle of muscle tension-pain-increased tension-increased pain.[6,8] It has been estimated that 61.3 percent of adult computer users experience FHP and neck pain.[4]

Academic staff may have to be in standing position and use a computer in a static sitting posture for a long time.[9] According to a previous study, academic staff with low-level physical activity, have the most common musculoskeletal problems in terms of the upper back and neck regions.[10] Although extensive research has been conducted on office workers and other professions, no single study exists which compares factors affecting FHP in academic staff with and without FHP in nonspecific chronic neck pain. The aim of the study the compare of the factors affecting forward head posture in academic staff with nonspecific chronic neck pain.

MATERIAL AND METHODS

DESIGN

This descriptive cross-sectional study conducted from February 2019-January 2020 in Atılım University. This study was approved by the Human Research Ethical Committee of Atılım University (59394181-604.01.01-752). This study was announced in the social network of Atılım University and 50 volunteers were enrolled.

Academic staff were invited to participate in the study. The principles of the Declaration of Helsinki were followed in the study. The study protocol explained to volunteers, and individuals who met the inclusion criteria were included in the study after signing the consent form. Clinical Trial registration number is NCT04712682

PARTICIPANTS

Fifty academic staff volunteers with a diagnosis of non-specific chronic neck pain between the ages of 25 and 55 years who had been suffering from chronic neck pain for more than 3 months were enrolled in the study. The exclusion criteria were as follows: diagnosis of cervical radiculopathy/myelopathy, history of cervical or thoracic spinal fractures or surgery, specific neck pain due to disc prolapsed, tumor of cervical spine, whiplash injury and any neurological signs consistent with nerve root compression. Patient allocation prosess was explained in Figure 1.

DEMOGRAPHIC INFORMATION

Identification and demographic data as gender, age, sex, height, weight, body mass index (BMI), academic titles, and duration of daily sitting, phone and computer use hours were recorded.

Neck pain severity, craniovertebral angle (CVA) in standing position were recorded. The subjects were divided into two groups, according to the cut-off value of the CVA angle to determine FHP. We evaluated the CVA according to the angle in the standing position because standing position is more sensitive posture to evaluate the FHP.[11] The two groups were compared in terms of demographic data and other measurements.

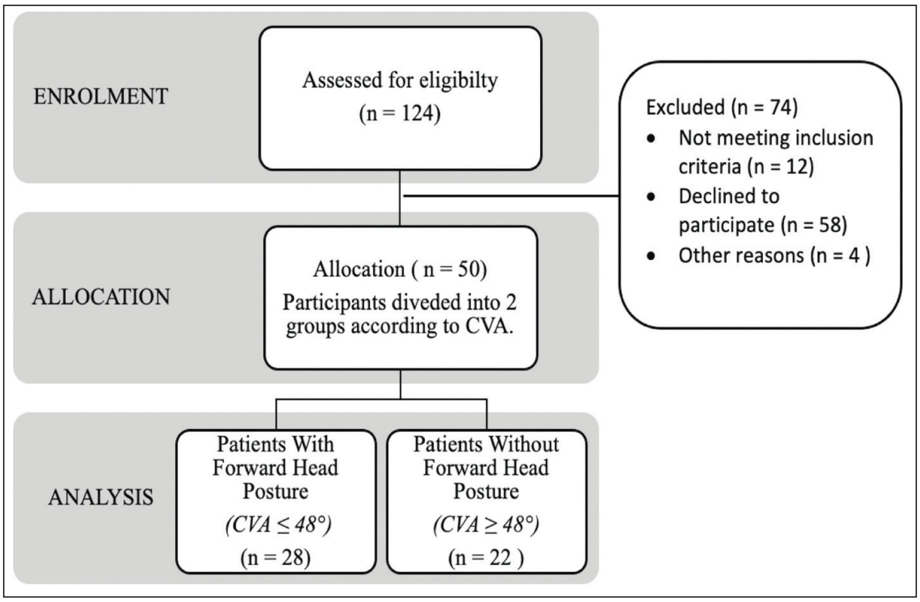

FIGURE 1: Participant Allocation Flow Chart.

PAIN AND PRESSURE-PAIN THRESHOLD

Pain assessment was performed in two different methods: the visual analog scale (VAS) and an algometer.

Participants were asked to indicate the severity of their resting pain, pain during sleep, and activity-related pain on a 100-mm VAS.[12]

The pain thresholds of the participants in the upper trapezius (UT) muscles and suboccipital regions were assessed using an algometer an analog algometer (Wagner Instruments, USA) with a 1 cm^2 surface area at the round tip. The compression pressure was progressively raised at a rate of around 1 $kg/cm^2/s$. When pain or discomfort started, the subject had to respond "yes" at which point the compression was halted.[13]

SCAPULOTHORACIC MUSCLE STRENGTH

Scapulothoracic muscles strength of upper middle and lower parts of the trapezius and serratus anterior muscles were measured using a portable dynamometer (Hoggan Health Industries MicroFET 2 MT Digital Handheld Dynamometer, West Draper, UT)

For the UT muscle strength, the participant was asked to elevate their shoulders against resistance in a sitting position. For the middle trapezius muscle strength, shoulder in 90^o abduction and the elbow in flexion position the participant was asked to adduct the scapulae in prone position. For the lower trapezius muscle strength, the shoulder in at 180^o flexion position, the participant was asked to maintain this position against the resistance in prone position. For the serratus anterior muscle, the shoulder flexed at 90 degrees and the elbow flexed, the participant was asked to perform scapular abduction against resistance in supine position.[14]

NECK MUSCLE STRENGTH AND ENDURANCE

The neck's flexor and extensor strengths were measured using a portable dynamometer (Hoggan Health Industries MicroFET 2 MT Digital Handheld Dynamometer, West Draper, UT). For neck flexor and extensor muscle strength, participants were positioned lying on their back with their necks hanging off the bed. They were instructed to maintain their heads in the same position against resistance while in a flexion position lying on their back and in a prone position for extension.[11]

The endurance of the deep cervical flexor muscles is assessed using the Stabilizer Pressure Biofeedback Unit. The participant was positioned in the supine position with a stabilizer placed under the cervical region. Stabilizer Pressure Biofeedback Unit projecting between the tragus and chin and inflated to 20 mmHg. The participant was asked to press down on the pressure biofeedback unit with maximal chin tuck movement and hold this position as long as possible. The duration was recorded in seconds.[15]

CRANIOVERTEBRAL ANGLE

CVA is one of the most common methods used to determine the presence of FHP. A marker was placed on the tragus of ear and the other one on the spinous process of the C7 and the digital camera fixed on a tripod recorded the subject photos at a distance of 200 cm from the subject. Using a digital camera and participants positioned at various angles, CVA was measured (sitting, standing, computer and phone use). The spinous process of the C7 was measured, and a line drawn between the tragus of the ear and the line intersecting an imaginary horizontal line that passed the C7 was used to determine the CVA.[16]

Previous investigations established 48 degrees as the CVA cut-off point.[14] A CVA with a degree of less than 48 is considered FHP.[9] Standing is a more sensitive position to assess the FHP.[17] CVA measurement of each sample was calculated by using tpsDig2 software post digitization of the markers.[18]

CERVICAL JOINT POSITION SENSE

Cervical joint position sense (CJPS) as an assessment of proprioceptive function, was evaluated by using a dual digital inclinometer (HALO, Australia). CJPS measurements were done in neutral sitting position. A physiotherapist performed passively 45° of flexion, 45° of extension and 45° Right/left rotation on each subject under the control of digital goniometer. The subjects were asked to take the above described positions 3 times .The mean deviation from the described positions was recorded.[19]

STATISTICAL ANALYSIS

Sample size calculation was performed with the G*Power 3.1.9.7 software (University of Düsseldorf, Germany). According to the power analysis with a 0.75 effect size, at a 5% significance level and a power of 80% with an 85% confidence level, it was determined that 46 participants were required. However, we included 50 participants in the study to account for potential dropouts and ensure reliable results.

SPSS Version 23.0 (IBM Corporation, New York, USA) was used to perform analyze the data. Qualitative data were expressed as numbers/percent and quantitative data as mean±standard deviation. Quantitative data was expressed as mean±standard deviation and qualitative data as number/percent (n/%) for the purpose of descriptive statistics calculation. The relationship between FHP and Demographic information, daily total time of sitting, computer and phone use, pain measurement, the pain threshold, scapulothoracic muscle strength, deep cervical muscle endurance and strength, cervical joint position were analyzed using in Spearman's correlation coefficient (r) in non-parametric conditions and Pearson's correlation coefficient (r) in parametric conditions. Correlations between 0.05 and 0.30 indicate low or no correlation, 0.30 to 0.40 indicate low to moderate correlation, 0.40 to 0.60 indicate moderate correlation, 0.60 to 0.70 indicate good correlation, 0.70 to 0.75 indicate very good correlation and 0.75 to 1.00 indicate excellent correlation.[20] The independent sample t-test was used to compare groups in parametric conditions. The significance level was set at p=0.05.

RESULTS

A total of 124 individuals responded to the study invitation. Among them, 50 individuals who met the inclusion criteria and volunteered to participate were included in the study.

A total of 50 participants, 33 females (66%) and 17 males (34%) with a mean age of 32.84±7.95 years, were included in the study. While 90% (n=45) of the participants are right dominant, 10% (n=5) are left dominant. Of the participants, 24% (n=12) had right neck pain, 28% (n=14) had left neck pain, 48% (n=24) had neck pain on both sides. The academic titles of the participants, the duration of sitting, computer use and telephone use, and the CVA values in different positions are given in Table 1.

TABLE 1: Demographic information.

	Normal posture n=22 X̄±SD	Forwardhead posture n=28 Minimum-maximum
Age (year)	32.84±7.95	25-52
Height (cm)	166±8	152-184
Body mass (kg)	64.30±13.74	44.00-107.00
BMI (kg/m²)	23.24±3.67	18.37-34.54
Work year	8.56±7.77	1.00-29.00
Duration		
Sitting (hour)	9.36±2.75	14.00-5.00
Computer use (hour)	7.68±2.20	12.00-3.00
Phone use (hour)	3.64±1.87	7.00-1.00
CVA		
Sitting (˚)	46.95±5.84	34-57
Standing (˚)	47.08±5.18	38-57
Computer use (˚)	31.91±11.17	3-53
Phone use (˚)	28.24±11.79	2-50
Title	**n**	**%**
Professor	2	4
Associate professor	10	20
Assistant	38	76

SD: Standard deviation; BMI: Body mass index; CVA: Craniovertebral angle.

The relationship between CVA and demographic information, pain and pain threshold, muscle strength, cervical muscle strength and endurance, joint position sense was examined. The analysis included all participants. A moderate negative correlation was found between CVA and body mass, BMI; left trapezius pain threshold, right and left middle trapezius muscle strength, deep cervical flexor muscle strength, respectively (r=-0.50, p=0.001; r=-0.53, p=0.004; r=-0.33, p=0.01; r=-0.32, p=0.02; r=-0.37, p=0.008; r=0.28, p=0.04) (Table 2). There was no relationship between dominancy and the neck pain side (p=0.86) (Table 2).

In addition to the correlation analysis, participants were divided into two groups based on their CVA assessment: those "normal cervical posture" and "forward head posture". Forty-four percent of the participants had a normal posture (n=22), and 56% had FHP (n=28). The groups were compared in terms of demographic information, pain and pain threshold, muscle strength, cervical muscle strength and endurance, and joint position sense. There was no difference between the groups in terms of gender, academic title, work year and height. Body mass and BMI were found to be higher in the group with FHP (p=0.02, p=0.01). Also, the right and left trapezius pain thresholds were significantly lower in the FHP group (p=0.02, p=0.03). Deep cervical flexor endurance and left rotation joint position sense were lower in FHP group (p=0.03, p=0.01). Comparations of the groups in Table 3 and Table 4.

TABLE 2: Correlation analysis results between CVA and demographic information, pain, pain threshold, scapulothoracic muscle strength, cervical muscle strength and endurance, joint position sense error measurements.

	CVA (Standing position) r value	p value
Demographics		
Age (year)	-0.24	0.08
Gender	-0.02	0.84
Height (Cm)	-0.14	0.33
Body mass (kg)	**-0.50**	**0.001***
BMI (kg/m²)	**-0.53**	**0.004***
Work year	-0.14	0.31
Pain and pain threshold		
Resting pain	-0.02	0.85
Sleeping pain	0.17	0.22
Activity pain	-0.01	0.96
Right upper trapezius pain threshold	-0.22	0.10
Left upper trapezius pain threshold	-0.33	0.01*
Suboccipital pain threshold	-0.01	0.93
Scapulothoracic muscle strength		
Right upper trapezius muscle strength	0.05	0.69
Left upper trapezius muscle strength	-0.04	0.76
Right lower trapezius muscle strength	-0.20	0.16
Left lower trapezius muscle strength	-0.19	0.19
Right middle trapezius muscle strength	**-0.32**	**0.02***
Left middle trapezius muscle strength	**-0.37**	**0.008***
Right serratus anterior muscle strength	-0.01	0.97
Left serratus anterior muscle strength	-0.09	0.52
Cervical muscle strength and endurance		
Deep cervical flexor muscles endurance (sec)	**0.28**	**0.04***
Cervical flexor muscle strength	0.07	0.60
Cervical extansor muscle strength	-0.22	0.11
Joint position sense error		
Extension	0.10	0.45
Flexion	0.07	0.60
Right rotation	0.01	0.94
Left rotation	0.26	0.06

BMI: Body mass index; CVA: Craniovertebral angle.

TABLE 3: Comparison of demographics of groups.

	Normal posture n=22		Forwardhead posture n=28		
	n	%	n	%	p value
Gender					
Female	15	30	18	36	0.77
Male	7	14	10	20	
	X̅±SD	Minimum-maximum	X̅±SD	Minimum-maximum	
Age (year)	22±21.3	25-48	28±28.80	25-52	0.07
Height (cm)	164±8	153-183	167±9	152-184	0.12
Body mass (kg)	58.64±11.50	46.00-87.00	68.75±13.90	44.00-107.00	0.02*
BMI	21.65±2.53	18.37-27.12	24.49±3.98	18.55-34.54	0.01*
Work year	6.36±6.71	1.00-29.00	10.29±8.22	1.00-29.00	0.06
Title	n	%	n	%	
Professor	1	2	1	2	0.35
Associate professor	4	8	6	12	
Assistant	17	34	21	42	
Duration	X̅±SD	Minimum-maximum	X̅±SD	Minimum-maximum	
Sitting (hour)	9.41±2.97	14.00-5.00	9.32±2.63	14.00-5.00	0.09
Computer use (hour)	7.64±2.01	12.00-3.00	7.71±2.37	12.00-3.00	0.09
Phone use (hour)	4.00±1.93	7.00-1.00	3.36±1.81	7.00-1.00	0.03*

SD: Standard deviation; BMI: Body mass index.

TABLE 4: Comparison of groups.

	Normal posture n=22		Forwardhead posture n=28		
	X̅±SD	Minimum-maximum	X̅±SD	Minimum-maximum	p value
Pain and pain threshold					
Resting pain	3.73±2.71	0-10	3.57±2.17	0-7	0.90
Sleeping pain	3.23±2.51	0-9	2.43±2.06	0-6	0.31
Activity pain	3.36±2.57	0-8	3.46±3.19	0-9	0.80
Right upper trapezius pain threshold	6.77±2.27	3.20-11.00	7.96±1.74	4.50-11.00	0.02*
Left upper trapezius pain threshold	6.26±1.48	4.20-9.20	7.58±2.17	4.50-11.00	0.03*
Suboccipital pain threshold	6.75±2.08	4.00-11.00	7.25±1.93	4.10-11.00	0.35
Scapulothoracic muscle strength					
Right upper trapezius	55.73±15.13	15.00-84.00	55.13±15.61	29.10-88.00	0.81
Left upper trapezius	55.15±14.78	19.00-80.00	56.19±16.54	23.00-93.80	0.81
Right lower trapezius	14.01±7.88	4.00-32.00	17.42±12.63	3.00-56.00	0.30
Left lower trapezius	14.49±8.86	4.00-37.10	16.44±10.33	4.00-49.10	0.30
Right middle trapezius	21.09±8.97	8.00-45.00	27.49±10.59	16.00-55.00	0.008*
Left middle trapezius	19.90±8.42	10.00-43.00	26.19±12.58	12.00-64.00	0.02*
Right serratus anterior	42.15±10.00	16.00-62.00	45.00±15.09	23.00-91.00	0.84
Left serratus anterior	40.70±9.32	19.00-57.00	43.13±12.12	20.00-73.70	0.40
Cervical muscle strength and endurance					
DCF endurance (sec)	30.62±18.11	9.00 – 81.00	21.74±15.53	6.00-73.00	0.03*
Cervical flexor muscle strength	20.28±5.87	10.80 – 35.00	22.88±13.25	9.00-81.20	0.92
Cervical extansor muscle strength	31.82±9.27	12.00 – 64.00	34.63±6.80	24.00-46.00	0.12
Joint position sense error					
Extension	4.64±3.36	0-10.00	3.46±3.24	0-12.00	0.19
Flexion	6.05±5.38	0-22.00	5.68±4.51	0-15.00	0.96
Right rotation	6.59±4.59	0-15.00	5.48±5.09	0-20.00	0.31
Left rotation	6.27±4.62	0-15.00	3.56±4.21	0-15.00	0.01*

SD: Standard deviation.

DISCUSSION

The incidence of neck pain is highest among all musculoskeletal problems in the academic staff.[10] However, to our knowledge no study has analyzed the correlation, if any, with FHP in this population. In this study, we found that FHP was not always correlated with neck pain. We observed that FHP was correlated with decreased UT pain thresholds, decreased middle trapezius muscle strength, and decreased deep cervical flexor muscle endurance and increased neck joint position sense error. We have also found that periods of sitting and standing, and cell phone use showed a negative correlation with FHP in academic stuff.

The relationship between FHP and neck pain is debatable in the literature. In our study, we grouped the patients with neck pain according to a specified cut-off value to find the correlation, if any, between FHP and neck pain.[21] Although FHP has been claimed to be related to neck pain, in our study group only 56% of the patients had FHP. However, our study group is not suitable to make a conclusion for this relation and further studies with large series that compare the incidence of neck pain in subjects with or without FHP are required.

The use of new information and communication technologies is increasing the amount of time we spend texting and computing, and this may be affecting neck pain in the long term, possibly because of longer periods of neck flexion.[22] The prevalence of FHP has increased as a result of the growing use of computers and smartphones.[2]

Prolonged sitting position in front of a computer and desk may be a predisposing factor for FHP. Staying in flexed spine posture for a long time while working during computer and desk tasks can create a risk factor for the FHP posture.[17] Academic staff spends a long time at these tasks, therefore, the FHP posture may be inevitable for this group.

Previous research indicated that individuals with higher BMIs in standing positions often had lower CVAs, however a different study found a modestly negative correlation between adult women's BMI and CVA.[17,23] Consistent with the literature, this study found a negative correlation between BMI and FHP in standing position. This correlation may be due to thickening of the adipose tissue around C7 vertebrae. Excess adipose tissue might have affected measurement of CVA.[24]

The Serratus anterior and UT are the main scapular stabilizer muscles during functional movements. However, when the hyperextension and cervical lordosis increases, the UT could cause FHP.[25] The increased activation of the UT with neck pain may result in a lowering of the pain threshold.[26] Our result was consistent with that FHP was associated with UT pain thresholds. We think that since the length-tension relationship of the muscles changes in FHP, the muscle shortens, tonus increases and the pain threshold decreases.

Our study's results indicate that there is a substantial difference in deep neck muscular endurance in the FHP group. These findings are consistent with our study's findings that FHP is related to cervical muscle endurance.While Janda was describing the upper crossed *syndrome*, he stated that FHP was accompanied by deep cervical flexor muscle weakness.[27] Standing with the neck-flexed position in front of the screen for a long time may facilitate FHP, which causes deterioration of the head posture and changes in the length and strength of the muscles. We think that deep muscle endurance may be altered in patients with neck pain with FHP due to the elongation and weakness of the deep cervical flexor muscles.

Accoring to the correlation analysis of all participants, CVA was correlated with decreased scapulothorasic muscle strength. The FHP posture may be the result of prolonged abnormal (increased thoracic kyphosis) sitting posture and accompanies upper crossed syndrome. This incorrect posture weakens the deep neck flexors and scapular retractors, such as the rhomboid and inferior trapezius fibers, and shortens the UT, levator scapulae, pectoralis major, and pectoralis minor.[27] FHP results in weakness of the cervical flexors and shoulder blade retractors, such as the middle trapezius muscle. A muscle's capacity to produce strength depends on its length. A muscle that is shortened or extended from its resting position loses some of its force-producing capacity. This indicates that muscle activity, which has a force-length relationship, is impacted by changes in muscle length.[28,29] FHP reduced the electromyographic activities of the middle trapezius muscle, the splenic muscle and the sternoclaideomastoideus muscle. These findings suggest that the reduced activity is caused by changes in muscle length caused by FHP and is linked with reduced strength generation capacity.[26] Previous research found that compared to individuals without symptoms, CNP patients had higher stiffness in the levator scapulae, sternocleidomastoid, and UT (but not in the splenius capitis). However, in our study, it was found that people with FHP had greater middle trapezius muscle strength. Other studies have also shown increased tone and activity in the middle trapezius muscles of patients with FHP.[29,30] This can be a compensatory mechanism for the reduced scapulothoracic muscle imbalance.

While propriception provides sensory feedback to the nervous system which contributes to maintain optimal body alignment, neck muscles play a key role in providing the proprioceptive sensory information.[31] Previous studies reported that FHP in other words decreased CVA may affect the proprioception of muscles, such as the function of mechanoreceptors, and alter the sensitivity of the spindles of the deep muscles of the neckand FHP may increase cervical load, reduce cervical range of motion, reduce muscle activity, and reduce cervical proprioception.[32,33] In addition to this, kinesthetic acuity of neck motions could be affected.[34] Our study supports evidence from previous researches.[32,35] These studies results show that alterations in the neck muscle length caused by FHP may have a negative effect on muscle spindle activity related to proprioception, and this can lead to decrease in the perception of joint position. We believe that the main source of proprioceptive afferents in the neck is the deep cervical muscles, which are rich in muscle spindles. The fact that the endurance of these muscles that have been affected may have caused the decrease in joint position sense.

Highlights

- Research to date has not yet analyze the results of forward head posture in academic staff with neck pain.
- FHP may not always accompany neck pain
- FHP adversely affected upper trapezius muscle pain thresholds, middle trapezius muscle strength and deep cervical flexor muscle endurance and neck joint position sense.

LIMITATION

There are several limitations to our study. Firstly, we have included only academic staff with nonspecific neck pain. A control group with FHP but without neck pain could be included to describe, if there is, any correlation between FHP and neck pain. Secondly, a larger sample size may be helpful to define the risk factors for FHP.

CONCLUSION

In our study, we have observed that FHP may not always accompany neck pain. The presence of FHP in patients with neck pain deforms the neck posture. The decrease of CVA adversely affects muscle pain threshold, scapulothoracic muscle strength, cervical muscle endurance and neck proprioception. This abnormal neck posture and accompanying neck pain, may be prevented by education of academic staff in terms of neck postural exercises and ergonomic intervention.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Naime Uluğ, Gül Deniz Yılmaz Yelvar;* ***Design:*** *Naime Uluğ, Erdem Kılıç;* ***Control/Supervision:*** *Naime Uluğ, Erdem Kılıç;* ***Data Collection and/or Processing:*** *Sena Nur Begen, Cansu Aktaş Arslan;* ***Analysis and/or Interpretation:*** *Sena Nur Begen, Yasemin Çırak;* ***Literature Review:*** *Naime Uluğ, Gül Deniz Yılmaz Yelvar;* ***Writing the Article:*** *Naime Uluğ, Erdem Kılıç;* ***Critical Review:*** *Naime Uluğ, Erdem Kılıç, Sena Nur Begen.*

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