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Effect of Forward Head Posture on Vocal Fatigue

Himanshu Mathur[1], Sohrab Ahmad Khan[2]

[1]MPT (Musculoskeletal); JamiaHamdard, New Delhi

[2]Assistant Professor; JamiaHamdard, New Delhi

Abstract: ***Introduction**: Forward head posture is a common problem among regular computer users. With the increased rate of development various health hazards have been associated alongwith. Vocal fatigue on the other hand is self-perceived increasedphonatory effort resulting from references to vocal loading or prolonged voice use resulting in disturbance of function. **Method**: A correlational study was performed on 50 individuals having a history of regular computer usage atleast from last 3 years and more than 5 hours a day. UTHSCSA image tool software version 3.0 was used to measure craniovertebral angle. Scale method was used to evaluate vocal effort. Subjects were allowed to speak a vowel i.e /a/ at a sustained pitch and loudness for 10 seconds. The experience of the subject was recorded using a self rating 100mm visual analogue scale. **Results**: Pearson's correlation revealed a significant positive correlation (p<0.005) between forward head posture and self perceived phonatory effort. **Conclusion**: Based on the findings, it can be concluded that forward head posture has a deteriorative effect on phonatory effort.*

Keywords: Forward head posture, vocal fatigue, craniovertebral angle

1. Introduction

Technology has truly become an inseparable part of our life & becoming an essential tool in every field. Due to excessive inclusion of electronic gadgets in our lives, physical activity has decreased to a greater extent.This is making our lifestyle sedentary even at workplace.An online survey conducted by India bytes in 2008, computer users in India were 64.4 million either at home or work. This overuse of electronic gadgets has hazardous effects on health.By this review, we would emphasize on increasing musculoskeletal effects of sedentary lifestyle induced by this *techno-era*. With a frequent development of global electronic technology and explicit usage of internet, there has been an evolution of various visual display devices from computer desktops to laptops, mobile phones, digital gears etc. And a concomitant increase in craze for the usage of such gadgets is quite prevalent in young adults now days. Longer working hours even prevents the professionals to get up from their seats. That's why the human -computer interface is no free from health hazards. Among the effects of using computer on musculoskeletal system, keeping a posture of staring at a monitor, located below the height of eye sight for long time makes the head moves forward to maintain balance; this is known as forward head posture. The effect of posture on health is becoming more evident. Spinal pain, headache, mood, blood pressure, pulse and lung capacity are among thefunctions most easily influenced by posture. One of the most common postural problems is the forward head posture.Since we live in a forward facing world, the repetitive use of computers, TV, video games, trauma and even backpacks have forced the body to adapt to aforward head posture. It is the repetition of forward head movements combinedwith poor ergonomic postures and/or trauma that causes the body to adapt toforward head posture. Ideally, the head should sit directly on the neck and shoulders, like a golf ball sits on a tee. Theweight of the head is more like a bowling ball than a golfball, so holding it forward, out of alignment, puts a strain on your neck and upper back muscles. The result can be muscle fatigue and often an aching neck. When spinal tissues are subject to asignificant load for a sustained period of time, they deformand undergo remodelling, changes that could becomepermanent. In addition, forward head posture has been shown to flatten the normal neckcurve, resulting in disc compression, damage and early arthritis and many disastrous musculoskeletal outcomes. This abnormal position of neck is also responsible for many tension headaches, often termed as cervicogenic headaches [1].

Forward head position is characterized by an extension of the head together with the upper cervical spine (C1 to C2) accompanied by a flexion of the lower cervical spine (C4 to C7) This posture is associated with weakness in deep cervical short flexor muscles (capital flexors), and mid thoracic scapular retractor (i.e., rhomboids, middle and lower fibres of trapezius) and shortening of the opposing cervical extensor and Pectoralis muscles [1, 2]. When the head is positioned forward the upper trapezius muscles activity is significantly higher than it is when in the normal alignment, the more the patient is to have pain from overusing the muscles [3]. Forward head posture mostly occurs by the weakness of the anterior cervical neck flexor muscles which result in tightness of the sternocleidomastoid [4]. Taking in account the ill-effects of regular overuse of such visual display gadgets on the musculoskeletal system, the major concentration of studies done till now has been the joints of neck and rest of the spine. Very few studies have concentrated towards the other joints & the affections of visceral functions of the body. On examination, when vocal cords appearnormal, vocal fatigue is due to Muscle Tension Dysphonia (MTD).MTD is the improper usage of intrinsic and extrinsic muscle of larynx & neck.It is a common complaint of professional voice users such as teachers, singers, speakers etc[7].

2. Materials and Methods

Fifty subjects (25 male and 25 females) were randomly selected to participate in this study from Global Nest Pvt. Ltd., Govindpuri, New Delhi, India by extraction of formal permission from the organisation. Subjects were conveniently assigned for the study. General assessment of the subjects was performed prior to the commencement of the study. Selected subjects were between the age of 25-35 years with the subjects working regularly on computer from atleast or more than 3 years and a regular usage of 5 hours or more and with a forward head posture [5]. Craniovertebral angle is the measure of forward head posture. Forward head posture was assessed using UTHSCSA software version 3.0 by taking a still picture from the side by placing a visible marker on the spinous process of C_7 vertebra. Subjects with Craniovertebral angle in abnormal range were assigned for the study [6]. BMI was also calculated for each subject prior to the commencement of the study and subjects lying within normal BMI range of 18-24 kg/m^2 were selected for the study. The methodology used in the study as illustrated in the figure, subjects having systemic and metabolic disorders, with a history of trauma or pathology to neck, shoulder or rest of the spine, pathology of temporomandibular joint, regular tobacco consumers, subjects having neurological disorders with vocal deficits, or persistent deformity at foot, ankle, knee or hip were excluded from the study. Subjects who agreed to participate were informed about the objective of this study and their rights to withdraw any time from the study. A formal informed consent was obtained from all the subjects after the study protocol had been explained to them.

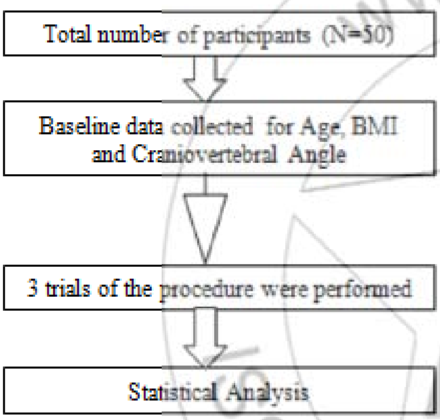


Figure 1

3. Experiment Procedures and Outcome Measures

Subjects fulfilling the inclusion criteria and ruling out the exclusion criteria were assigned for the study. Subjects were taught the proper procedure by verbal instruction, demonstrations and practice.

Subjects in sitting were requested to speak a vowel 'o' for 25 seconds with same pitch and loudness. 3 trials were obtained for the same procedure with each subject. After each trial, the subjects were asked to rate the difficulty experienced during the procedure on a visual analogue scale of 100mm. the difficulty was rated between 0-100, where rating between 0-40 was considered least effort, 40-60 was considered to be habitual effort and that from 60-100 was considered an increased effort [7]. The mean of 3 trials was taken for main analysis.

The spoken time of vowel was measured using digital stopwatch.

Figure 2

Data Analysis

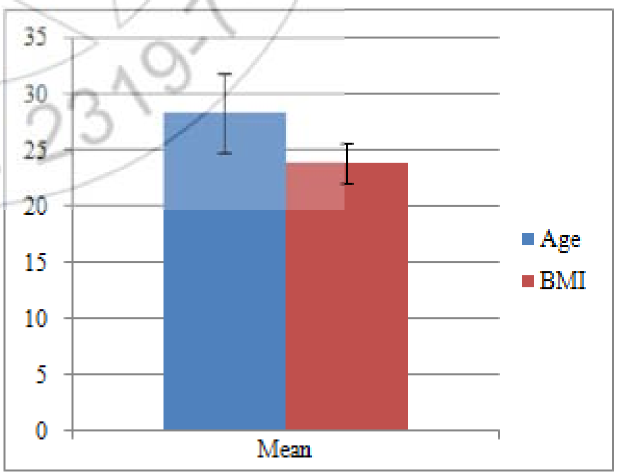
Data analysis was accomplished using SPSS (version 20), Microsoft EXCEL (Professional Edition 2007; Microsoft Corp, Redmond, WA). Pearson's Correlation test with Gaussacian distribution assumed was used to correlate the extent of vocal fatigue among the participants. A statistically significant difference was defined as 'p' value was less than 0.001.

4. Results

The demographic data of the subjects have been mentioned in table 1 and within the group correlation of craniovertebral angle and visual analogue scale has been explained in table 2.Marked differences were noticed in the group with regard to both demographic data including age and BMI and craniovertebral angle measurements, which indicates that the sample were homogenously distributed.

Table 1: DEMOGRAPHIC CHARACTERSTICS OF THE SUBJECTS

	Mean	Standard Deviation
Age	28.42	3.575
BMI	23.85	1.766



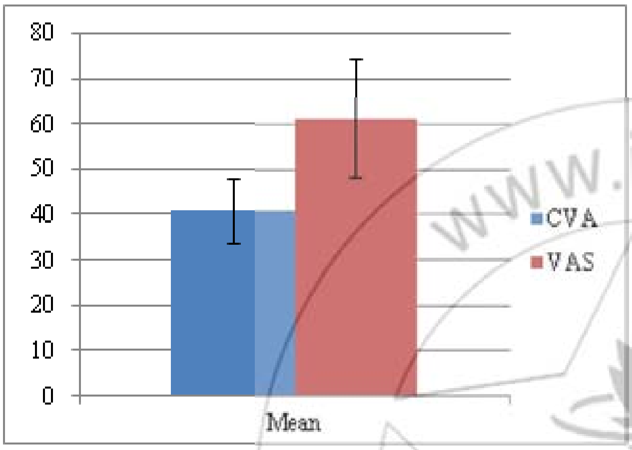
Graph 1: Showing Mean and Standard Deviation of Age and BMI

The Craniovertebral Angle (CVA) is the measure of extent of forward head posture. The mean value for craniovertebral angle for participants came out to be 41.05 degrees±7.22 and that for Visual Analogue Scale was 61.54±12.91.

Within the group correlational analysis of Craniovertebral Angle with score of Visual Analogue Scale was conducted using Pearson's test, with level of significance, p set at 0.05. The analysis of baseline readings for craniovertebral angle & Visual Analogue Scale score of the participants was found to be statistically significant (0.0001) having a negative correlation with the correlation coefficient 'r' to be -0.667.the mean and standard deviation comparison has been shown in Graph 2.

Table 2: Correlation of Craniovertebral Angle & Visual Analogue Scale

	Mean	Standard Deviation	r	P-Value
Age	41.05	3.575	-0.667	0.0001***
BMI	61.54	12.91		



Graph 2: Showing Mean and Standard Deviation of Craniovertebral Angle and Visual Analogue Scale

5. Discussion

The hypothesis of our study is fairly supported by the results that forward head posture has a significant effect on the vocal fatigue. These effects were significantly observed in subjects working regularly on computer for more than 3 years and for more than 5 hours daily and having an evident forward head posture without any pre-existing spinal and vocal impairments [5]. The vocal effort was calculated by using 100mm visual analogue scale by self-rating based on subject's experience. An increased vocal effort denotes early vocal fatigue. The findings of this study favours that a decrease in craniovertebral angle, increases the forward head posture which inturn increases the vocal effort which eventually leads to early vocal fatigue.

It has been an evident fact that people with small craniovertebral angles have a greater forward head posture and the greater the disability [8]. The forward head posture is combined with a flexed upper thoracic and lower cervical spine and with an extended upper cervical spine and craniocervical region. This posture stretches infrahyoid muscles such as sternohyoid and omohyoid, which can create an inferior and posterior traction on hyoid bone alongwith shortened suprahyoid muscles [9].

On performing within the group correlation of craniovertebral angle & visual analogue scale, the correlation was found to be statistically significant. Thus it can be reported that participants having forward head posture have increased vocal effort thus induces early vocal fatigue.The possible mechanism behind this probable result which supports this evidence suggests that, the shortened suprahyoid muscles places larynx in relatively higher position allowing sound to become thin & hoarse. Altered lengths & tensions of both suprahyoid and infrahyoid muscles does not allows vocal folds to approximate properly results in distortion of vowels allowing the muscles to work more with an increased effort thus reach early fatigue [7]. The study lacked on the aspects of small sample size and more groups with controlled variables. Further studies are necessary to investigate about the objective analysis of electrical activity of muscles involved in forward head posture and phonation. Another future perspective for the study can be comparing between males and females for craniovertebral angles and vocal fatigue.

6. Conclusion

The study thus concludes by accepting experimental hypothesis and rejecting the null hypothesis, that forward head posture may increase vocal fatigue. By the virtue of this study, we can conclude that chronic forward head posture has disastrous effect on vocal consistency and may be a potential cause leading to vocal fatigue.

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