

Prevalence of Forward Head Posture in Electronic Gamers and Associated Factors

Kenneth Ashok¹, Vinosh Kumar Purushothaman^{1*}, Yughdtheswari Muniandy¹.

1. Physiotherapy Program, Faculty of Health and Life Sciences, INTI International University, Persiaran Perdana BBN, Putra Nilai, Malaysia

Corresponding author: Vinosh Kumar Purushothaman, MPT, Physiotherapy Program, Faculty of Health and Life Sciences, INTI International University, Persiaran Perdana BBN, Putra Nilai, 71800 Nilai, Negeri Sembilan, Malaysia. Email: vinoshmpt@yahoo.com

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Abstract

Background: Technology is a crucial component of our daily lives, whether it is job-related or even personal usage and only few who can imagine life without it. There are many advantage with technology such as improving work productivity and efficacy, however using technology for extended period of time can place substantial amount of load to the neck musculature leading to musculoskeletal disorder. It is observed that the posture of human body precisely cervical spine tends to shift forward on using electronic device. **Objective:** The objective of our current study is to identify the prevalence of forward head and the associated factors among electronic gamers. **Methods:** A cross sectional study design was adopted with total of 160 participants (88 females and 72 males) with the age range between 18 to 40 (22.8 + 30) were recruited using predefined inclusion and exclusion criteria. Forward head posture angles were measured using Photogrammetry method and were analyzed using postural software, web plot digitizer software (WPD). **Results:** A total of 97 participants (60.63%) were discovered to have forward head posture. The results of Pearson correlation demonstrate there is no correlation exist between the device used for gaming and FHP, $r(158) = 0.01$, $p = 0.97$ and the breaks taken in between the gaming with FHP, $r(158) = 0.08$, $p=0.31$. However, there is moderate correlation exist between the duration of gaming and forward head posture $r(158) = -0.73$, $p < 0.01$. These results suggest that individual who spend longer hours on their electronic gaming devices have a high risk of developing forward head posture due to the static loading that acts on the cervical spine. **Conclusions:** Correction and prevention of forward head is necessary in view of high incidence. Proper education and awareness on ill effects of prolonged usage of gaming devices may be beneficial in preventing FHP.

Keywords: Forward head posture; Head-Down Tilt; electronic gamers; Prevalence; Video Games.

INTRODUCTION

Computer games are a type of entertainment made by devices equipped with an electronic processor [1]. Electronic games have undergone significant revolutions that are currently defined as the “seventh” generation [2]. Researcher referred to modern technology innovation as ‘computer revolution’ and computer video games demonstrate these innovations [2]. Computer and electronic games have become an important part of everyday activities among children and adolescent of school age, and this is a global trend [3]. Nearly 1.82 billion video gamers worldwide existed in 2014, a figure that is anticipated to increase to more than 2.7 billion by 2021. According to department of statistics Malaysia reported that percentage of individuals using computer has increased from 68.7 percentage in 2015 to 69.8 percentage in 2017. The number of users in the Mobile gamers segment is expected to reach 5.7 million by 2023 in Malaysia. The mobile technology is rapidly evolving; over the years, its uses are becoming diverse and is gradually replacing some similar sources in the market that are also used for communication in most places in the world, even here in Malaysia [4]. Texting on a mobile device has been a common activity among the community nowadays, from the elderly aged 70 plus, to the young as early as 12 years. Texting on the mobile device requires the activation of many muscles in holding the phone at that static position, not forgetting the muscles responsible for maintaining the body posture. The movement initiated through key activation, mainly through thumb movement must be balanced equally by means of the use of finger flexors and wrist extensors. Accordingly, the posture of the human body precisely the cervical spine tends to shift forward. There are many advantage with technology such as improving work productivity and efficacy, however the development in technology also can give rise to development of musculoskeletal disorder. Study have reported maintaining head posture below the eye level for extended period of time can cause the head to move forward in which reduction in anterior curve and increase in posterior curve which is known forward head posture (FHP). Individual with FHP tends to experience craniofacial pain, cervicogenic headache, neck pain, and shoulder pain or altogether. They may present with reduced range of motion and muscle strength of neck and shoulder along with stiffness and tenderness of neck and shoulder [5]. Previous studies have also highlighted that kids and adolescent who used electronic games and computers tends to adapt to poor posture leading to development of musculoskeletal system pain syndromes and repetitive strain injuries [6,7]. Due to rising proportion of electronic gamers in Malaysia, the development of forward head posture among e-gamers may be more prevalent. Many studies are performed to identify the significant changes in posture and musculoskeletal impairments among computer users. Currently there is no studies has been conducted to find the prevalence of FHP among electronic gamers in Malaysia. Therefore, the objective of this study is to identify the prevalence of FHP among electronic gamers in Malaysia.

METHOD

Participants and Study Design

A cross sectional study design was adopted. A total of 160 participants (88 females and 72 male) were recruited in this study. The inclusion criteria are participants between age between 18 to 40, irrespective of gender, who plays electronic games for minimum one hour per day. The electronic game device includes Xbox, play station, computer desktop and laptop games. Whereas, the exclusion criteria of this study are individual with known history of musculoskeletal spinal deformities, previous spinal fracture and congenital anomalies. Prior to data collection, all participants were given explanation about the study purpose and procedures, and written informed consent was obtained. This study was approved by Research and Ethics Committee of INTI International University.

Procedure

A digital imaging technique was used to measure the neck posture. A camera with a fixed base was fixed at a 1.5m distance so as the level of the camera was in level with the participant's shoulder. Landmarks were placed on the floor to ensure the same positioning of all participants in front of the camera. Prior to that, the participants were instructed to perform full flexion and extension of head for three times, and this is to ensure that the patient maintains his head at his usual position. The participant's landmark was identified and marked by the same trained physiotherapist using colored tape at the level of spinous process of C7, external corner of the eye and tragus of ear. This landmark is necessary to measure the forward head posture which is also known as craniocervical angle (CCA). Photographs were taken from the lateral view, using a computer web-camera (Logitech C310, HD, 1280 X 720). The computer webcam was linked via a USB cable transmission to a laptop. Photograph images were saved for further analysis. The image was further imported to the web plot digitizer software (WPDS) to calculate the CCA. The CCA was measured by constructing lines from the intersection of line that passes through the spinous process of seventh cervical vertebrae (C7) and to the line that run to the tragus of ear (as in Figure 1).



Figure 1: Measure of craniocervical angle.

Data analysis

Data was analyzed by using statistical software package SPSS (Version 22.0). Normality was tested using Shapiro-Wilk test, boxplots and skewness ranging between -1 to 1. Cross tabulation was used to analyze the prevalence of forward head posture among electronic gamers. Pearson's correlation coefficient was employed to investigate the relationship between forward head posture (CCA) and associated risk factors.

RESULTS

A total of 160 electronic gamers were recruited in this study. The socio demographic characteristics (gender, age, smoking, playing posture, duration and uses of posture chair) of these participants are shown in Table 1. The descriptive analysis showed that the highest percentage of electronic gamers with forward head posture are female. Majority of them are between the age of 21 to 25 years old. About 46% uses laptop for gaming, followed with play station and computer desktop. Almost 72% of gamers plays for more than 3 hours in a day.

The results of Pearson correlation demonstrate there is no correlation exist between the device used for gaming and FHP, $r(158) = 0.01$, $p = 0.97$ and the breaks taken in between the gaming with FHP, $r(158) = 0.08$, $p = 0.31$. However, there is moderate correlation exist between the duration of gaming and forward head posture $r(158) = -0.73$, $p < 0.01$.

Table 1: Sociodemographic characteristics of electronic gamers with forward head posture and normal neck posture.

Variables	Craniocervical angle (CCA)			
	Forward head posture		Normal neck posture	
	N	%	N	%
Gender				
Female	52	53.6	38	60.3
Male	45	46.4	25	39.7
Age				
Below 20 years	6	6.2	10	15.8
21 to 25 years	71	73.2	49	77.8
26 to 30 years	20	20.6	4	6.4
Smoking				
Yes	55	56.7	11	17.5
No	42	43.3	52	82.5
Device Used				
Play station	25	25.8	12	19.0
X-Box	2	2.0	9	14.4
Computer Desktop	25	25.8	14	22.2
Laptop	45	46.4	28	44.4
Playing Posture				
Sitting on sofa	4	4.1	11	17.5
Sitting on floor	10	10.3	11	17.5
Sitting on chair	56	57.8	34	54.0
Lying down	27	27.8	7	11.1
Playing Duration				
Less than 2 hours	10	10.3	31	49.2
2 hours	17	17.5	14	22.2
3 hours	36	37.1	10	15.9
4 hours	34	35.1	8	12.7
Breaks in between				
Yes	46	47.4	35	55.6
No	51	52.6	28	44.4
Use of posture chair				
Yes	9	9.3	12	19.0
No	88	90.7	51	81.0

DISCUSSION

The findings of the present study reports that female accounted for higher percentage 53.6% of FHP. Our results agree with those of who reported that female students have FHP two times more when compared to male students [8]. The contributing factor for this higher percentage of FHP in female may be due to females typically adopt 2⁰ to 3⁰ neck flexion compared to male in standing analysis of cervical posture. Even in adult's significant CV-angle differences was found

with more FHP in female compared to male [9]. Contrary to the present results of high percentage of FHP in female, study by Nejati et al. (2015) has reported no significant difference found in both male and female in terms of FHP [10]. Our current study exhibits least percentage of FHP among the age group of below 20. These findings are compatible with earlier research that reports the prevalence of FHP among 12–16-year-old school going students [8, 11] The reason for the increase in FHP occur due to increases in thoracic kyphosis from adolescence to adulthood which predisposed to increase in FHP in males than females [12].

Our finding suggests that prevalence rate of FHP is more common among smokers when compared to non-smokers. Previous studies have highlighted that skeletal muscle damage caused by smoking can impair the muscle metabolism, increased inflammation and oxidative stress, over-expression of genes related to atrophy and activation of various intracellular signaling pathways [13]. Apart from that, smokers tend to present with significant reduction in endurance capacity of neck flexor and extensor [13]. This changes in the skeletal muscle give rise to the development of FHP. Holding the head in flexed position for long periods of time can lead to musculoskeletal disorders such as 'upper crossed syndrome' involving obliteration cervical lordosis in combination with upper thoracic vertebrae kyphosis [15, 16]. There is a strong connection between location of the cervical, thoraco-lumbar spine posture and motor movement with various sitting position and poses [17]. According to Lee (2013), the greater the distance between the trunk and the computer desk, the greater the risk of development of FHP [18]. Our study results reported that gamers using laptop device have higher percentage of developing forward head posture. Similarly, previous study has highlighted that laptop or computer users for long period of time can predispose to forward head posture and more muscle activity of neck [18]. Previous studies have highlighted, that standing height influences neck flexion during computer usage [19]. During laptop use, the younger and middle age students extended their atlantoaxial joints and flexion of lower cervical spine causing forward head posture. This has been identified as a risk for developing craniomandibular dysfunction, cervical spine disorders and the muscles and joints of the upper cervical spine [15, 20, 21]. The present study demonstrates the influence of duration in playing game as a risk of developing FHP. Prolonged muscle activity of 5% of maximum electromyography for more than one hour can leads to muscle fatigue indicated by increase in intramuscular pressure [22]. A potential explanation for the associated production of static low-level contractions in musculoskeletal disorders is considered to be due to increased tissue pressure and electrolyte homeostasis disruptions [23]. Maintaining fixed posture with neck flexion while using smartphones may induce muscle fatigue more easily than looking upward [24]. The degree of angulation of the chair's backrest support is an important factor that should be taken into account when considering seating adjustments that are likely to influence head and neck posture [25]. This report supports the present study in which the higher percentage of 90.7% of participants having forward head posture was identified with those are not using proper backrest or ergonomic chairs. Adding the lumbar roll didn't change head and neck posture considerably, unless the office backrest chair was in 110⁰ position

[25]. These investigation report on backrest adjustment may be considered in minimizing the risk of developing forward head posture while using gaming devices.

CONCLUSION

In summary, our present study reported higher prevalence of forward head posture among electronic gamers. Women are at higher risk for developing FHP because of anatomical changes that onset as early as puberty. Our findings also demonstrate an association between hours spent on electronic devices and FHP. Individuals who spend at 3 hours or more per day on their electronic gaming devices have a high risk of possessing a FHP due to the static loading that acts on the cervical spine.

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CONFLICT OF INTEREST:

The author(s) declare(s) that there is no conflict of interest.

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