

Prevalence of forward head posture and its' relationship with neck pain among sewing machine operators in two selected garment factories in Kaluthara district

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Abstract: Neck pain is one of the very common musculoskeletal symptoms among sewing machine operators. Sewing machine operation which is carried out in a forward inclined position over prolonged period makes them liable to develop faulty postures like Forward Head Posture (FHP) and the occurrence of neck pain. The objective of this study was to determine the prevalence of FHP among sewing machine operators in two selected garment factories in Kalutara district and to study the association of Craniovertebral angle (CVA) with neck pain intensity among sewing machine operators. A cross sectional study was carried out with a total of 167 sewing machine operators (156 females, 11 males) who worked in the sitting position. An interviewer administered questionnaire including Numerical Pain Rating Scale was used to assess the neck pain while photogrammetry was used to measure the CVA using KINOVEA app which is a motion analysis software. The mean values and the SD of age, BMI and work experience was 37.6 years \pm 13.4, 23.7 kgm⁻² \pm 4.9 and 10.0 years \pm 8.7 respectively. Out of the study sample, 64.67 % of sewing machine operators presented with FHP while the prevalence of FHP among sewing machine operators with neck pain were recorded as 77.45%. The test results revealed a significant weak negative correlation between CVA and neck pain intensity ($p=0.036$, $r= -0.208$). This study concluded a high prevalence of FHP among sewing machine operators and a significant weak

negative correlation between CVA and neck pain intensity.

Key Words: Forward Head Posture, Neck pain, Sewing machine operators

Introduction:

Neck pain is one of the very common musculoskeletal conditions in the general population (Fejer, Kyvik & Hartvigsen, 2006). Neck pain can vary from a small discomfort to severe disabling pain making it one of the major health problems that carries important economic costs (Mohankumar, 2018). Less severe neck pains occur due to poor posture, neck strains, occupational and sport injuries and mental state such as anxiety and depression, while mechanical and degenerative factors are more likely to develop chronic neck pain (Binder, 2007).

Forward head posture (FHP) is the most common postural deformity seen in the sagittal plane (Lee, Chung & Park, 2016). It can be defined as any alignment in which the external auditory meatus is positioned anterior to the plumb line through the shoulder joint (Kendall et al, 2005). In FHP, head moves anteriorly and the peak of the increased cervical lordotic curve is a noticeable distance away from center of gravity. FHP gradually leads to abnormal compression of zygapophyseal joint, posterior vertebral disks, narrowed intervertebral foramina and shortened posterior zygapophyseal joint capsule causing nerve root compression. Furthermore, functional changes occur in

temporomandibular joint due to these postural changes. The FHP could lead to muscle ischemia, muscle pain, fatigue, inflammation, reduced cervical range of motion and sometimes protrusion of nucleus pulpous, rotation of mandible which cause compression and irritation of retrodiscal pad (Levangie & Norkin, 2011). There are various methods to evaluate FHP but many studies have declared that Craniovertebral angle (CVA) is the best indicator to measure the FHP (Gadotti & Biasotto-Gonzalez, 2010). CVA is measured by the angle between the imaginary line which passes through C_7 and tragus and a horizontal line through C_7 (Physiopedia, 2019).

Over the years, postural evaluation has been conducted using various assessment methods such as observation, instrumental (Electronic Head Posture Instrument, Cervical Range of Motion Instrument), imaging using plain radiography and photography (Youssef, 2016). The use of photogrammetry to assess FHP has been proved to be a reliable and a sensitive method (Gadotti & Biasotto-Gonzalez, 2010) that correlates well with radiography (Grimmer-somers, Milanese & Louw, 2008). It is a non-invasive technique that requires capturing of photographs and then digitizing the photographs for further analysis with the use of a computer software (Youssef, 2016).

Work related musculoskeletal disorders are found to be high among sewing machine operators due to their long working hours with infrequent rest breaks and poor ergonomics making them liable to develop neck, back and shoulder symptoms (Lombardo et al, 2012). The sewing machine operation is executed in a static forward inclined sitting position with an uncomfortable knee and ankle angles creating a sustained load on neck muscles (Mehta, Gahlot & Singh, 2018). Previous researches have been implemented to find out the prevalence of neck pain among

garment workers globally (Jehan et al, 2015; Van et al, 2015; Wang et al, 2007; Anderson et al, 1993) and also in Sri Lanka (Silva & Ponnamparuma, 2017; Lombardo et al, 2012). But a review on literature suggests that studies on prevalence of FHP and its' associations among highly risked occupations are few and far in between while many of them have been implemented to study the association of neck pain with working postures but not with habitual postures. The purpose of this study was to evaluate the prevalence of FHP and establish the relationship between the craniovertebral angle and neck pain among sewing machine operators in two garment factories in the Kaluthara district.

Methodology:

A cross sectional study was carried out in two garment factories in the Kaluthara district. A total of 167 sewing machine operators who fulfilled the inclusion and exclusion criteria participated in the study. The inclusion criteria were sewing machine operators who worked in the sitting position for at least 20 hours per week and those who had a work experience as a sewing machine operator for more than one year. They were excluded if they had been diagnosed with a medical condition that would affect the cervical spine mobility including traumatic neck injury, rheumatoid arthritis, idiopathic scoliosis, cervical spondylosis and bone cancer and sewing machine operators with congenital neck problems or if they were having radiating neck pain.

Measurement of CVA, cervical flexion and extension:

Capturing of the photographs.

Prior to capturing of the photographs in order to measure the CVA, two points of the body was marked. They were the spinous process of the 7th cervical vertebrae and the tragus. The two points were marked using adhesive double sided tapes of 0.5cm x 0.5cm

and Styrofoam balls to make them visible on the photographs. In order to capture the images, the participant was asked to stand in front of a calibration board which was placed in order to make sure to align with the participant to allow referencing of horizontal and vertical axes of the photographs. The registration number given to the participant was displayed on the calibration board for identification. A foot mark was placed on the floor to ensure all the subjects stood in the same place. The position of the camera and the tripod was fixed for standardization throughout the data collection procedure. The position of the subject in front of the board and the distance between the subject and the tripod was marked by tapes using measuring tapes to avoid any changes affecting the measurements. The camera was setup on a tripod placed 100cm away from the lateral border of the footmark. The height of the camera was adjusted so that the tragus of the participant was the focus point (Youssef, 2016). The camera holder was adjusted until the bubble of the horizontal indicator and the central marking overlapped (Lau, Chiu and Lam, 2010).

In order to capture the CVA, the participant was asked to stand on the foot mark looking forward at a target on the wall. He/she was then instructed to stand with weight evenly distributed on both feet and arms resting on either sides of the body. The participant was asked to tilt their head forward and backward three times in order to make sure they assume a relaxed neutral position of the head and neck. Three photographs were taken with two minute rests in between in order to reduce bias that may occur due to tension (Yip, Chiu and Poon, 2007).

Analysis of CVA

All the photographs were transferred to computer running the Kinovea software. The CVA was measured by the angle formed between the horizontal line passing through the spinous process of 7th cervical vertebrae

and the line connecting the tragus and the spinous process of 7th cervical vertebrae.

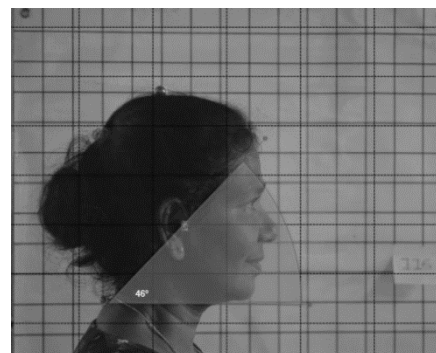


Figure 5: Measuring the CVA using Kinovea

Measurement of neck pain.

Measurement of neck pain was carried out using an interviewer administered questionnaire, which included personal details, working details, awareness on posture correction exercises and the presence and absence of neck pain. Under the presence of neck pain, the intensity was assessed using the NPRS. It was considered unlikely that the CVA measurement would affect the intensity of pain symptoms. The participants were clearly explained about the neck pain as the pain in the neck and/or the upper trapezius area which they feel while working or at the end of their shift due to working in the same position for a long period (Darivemula et al, 2016).

Results:

Table 1: Demographic characteristics of the study participants.

Variable	Minimum	Maximum	Mean	Std. Deviation
Age	16.0	65.0	37.57	13.41
Work experience	1.0	46.0	9.93	8.70
BMI	13.6	40.0	23.72	4.88
CVA	26.00	58.00	45.37	5.70

Demographic characteristics of the study participants.

A total of 167 sewing machine operators participated in the study (156 females, 11

males). The demographic characteristics of the study sample are presented in table 1.

Based on the previous literature, participants with a CVA of 50 or more were considered as having correct head posture (Kim, Kim & Kim, 2015; Diab & Moustafa, 2011). Accordingly, a percentage of 64.67% sewing machine operators presented with forward head posture while 61.08% of sewing machine operators complained of work related neck pain. From the sample of sewing machine operators who complained of having neck pain, 77.45% of them presented with FHP.

The association of CVA and the intensity of neck pain among the participants who reported of having work related neck pain is presented in Table 2.

Table 2: Correlation between neck pain intensity and CVA

		CVA	Intensity
CVA	Pearson Correlation	1	-.208*
	Sig. (2-tailed)		.036
	N	102	102
Intensity	Pearson Correlation	-.208*	1
	Sig. (2-tailed)	.036	
	N	102	102

Discussion

This study was focused on finding the prevalence of FHP and the relationship between CVA and neck pain among sewing machine operators. The study utilized photogrammetry method in order to measure CVA which has not been previously used in field of physiotherapy in Sri Lanka.

Taking a CVA of 50° or more as the correct head posture a total of 103 (64.67%) sewing machine operators presented with forward head posture. This high prevalence of FHP among different occupations with similar postures like office workers, visual display terminal workers, dentists and call center operators are supported by several articles (Mamania & Anap, 2019; Worikar & Shah,

2019; Nas, Bashir & Noor, 2018; Verma et al, 2018; Vakili et al, 2016 and Nejati et al, 2014). Among the sample of 167 sewing machine operators, 61.08% of them had neck pain during working hours or at the end of their shift. This high prevalence of neck pain among sewing machine operators and garment workers are consistent with the findings of previous studies by Silva and Ponnampereuma (2017), Andersen et al (1993), Kaergaard and Anderson (1993) and Van et al (2015). While studies carried by Lombardo et al (2012), Thangaraj, Kannappan and Chacko (2015) and Jehan et al (2015) revealed a low prevalence of neck pain compared to our study.

Among the sewing machine operators who complained of having work related neck pain, 77.45% participants presented with FHP. This high prevalence of FHP among participants with neck pain is consistent with previous studies by Chiu et al (2002) who reported 60.5% of FHP among academic staff with neck pain while Ruivo, Pezarat-Corriea and Carita (2014) also revealed a high prevalence of FHP among adolescents with neck pain. A negative correlation was found between the neck pain intensity and CVA among the sewing machine operators with neck pain. These findings are consistent with earlier studies carried out among different occupational groups by Subbarayalu and Ameer (2017) and Abbbasi et al (2016). Other studies by Contractor, Shah and Shah (2018), Yip, Chiu and Poon (2008) and Lau, Chiu and Lam (2010) carried out among neck pain patients revealed similar results of a weak negative correlation between neck pain intensity and CVA. A negative correlation between CVA and neck pain intensity indicates that smaller CVAs lead to higher intensities of neck pain and supports our assumption that correction of FHP could lead to better outcomes of patients with neck pain. The correlation between CVA and neck pain intensity was moderate at best

according to our results which suggests it could be one of the factors related to neck pain and the other factors needs to be addressed through further studies. As this was a cross sectional study we were unable to establish the cause and effect relationship between head posture and neck pain and self-report of inclusion and exclusion criteria may not be the most ideal. We did not exclude or screen for psychological stress, balance disorders or visual deficiencies which may affect the head posture. Furthermore, we did not analyze the characteristics of the entire spine. This needs to be addressed in future studies as the changes in lumbar and thoracic spine may affect the head posture.

Conclusion:

In conclusion, the results of our study revealed a high prevalence of FHP and neck pain among sewing machine operators and a high percentage of participants with FHP among sewing machine operators with neck pain. The study revealed a significant weak negative correlation of CVA with neck pain intensity. Our study results reinforce the importance of developing better ergonomics in the work place as well as introducing sessions of posture correction and relaxation exercises among sewing machine operators during the rest breaks. The results also support the importance of assessing the cervical posture in patients with neck pain in the clinical setup and including posture correction exercises along with conventional treatments in the clinical set up for the treatment of neck pain.

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