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Original Article



Association of Craniovertebral Angle with Non- Specific Neck Pain and Functional Limitations among IT Professionals

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ABSTRACT

There was a strong link between workplace ergonomics and occupational diseases. Work-related illnesses contribute significantly to the total burden of occupational diseases. Information Technology (IT) professionals were more likely to experience physical activity limitations and nonspecific neck pain. **Objective:** To determine the association of craniovertebral angle (CVA) with nonspecific neck pain and functional limitations among IT professionals. **Methods:** Total 377 IT professionals participated in an observational cross-sectional survey. Non probability convenience sampling technique was used. CVA was evaluated using a manual goniometer, non-specific neck pain was measured using NPRS, and functional limitation was assessed by using the Neck Disability Index (NDI) questionnaire. The association of CVA with non-specific neck as well as functional restrictions was then found. **Results:** The mean age of this study was 29.43 ± 5.081 . About 71.4% were males and 28.6% were females. The results showed that there was significant association of CVA with functional limitation (p value=0.01) and gender (p value =0.05). Also, a significant association was noted between functional limitations and non-specific neck pain (p value =<0.001). Contrastingly, no significant association of CVA observed with non-specific neck pain (p value =0.859) and with BMI (p value =0.721). **Conclusions:** The study concluded that there was no significant association of CVA with non-specific neck pain but recorded a significant association between CVA and functional limitation among IT professionals. Males were having a higher prevalence of forward head posture as compared to females.

INTRODUCTION

Work related musculoskeletal disorders are the main cause of occupational illness burden and are closely associated with workplace ergonomics among which neck pain are most prevalent [1,2]. Neck pain is a multifaceted issue that affects the overall population [3]. Neck pain can range in severity from mild to severe, and it is regarded as a major health concern with significant financial consequences. Neck problems can be caused by poor body alignment, discomfort in the neck area, injuries experienced while working or playing sports, and psychological illnesses such as anxiety and depression [4]. The majority of episodes of discomfort in the neck are classed as non-specific,

because their explanation is generally unknown [5]. Approximately 70% of people have neck discomfort at least once in their lives, and 10-15% of the population suffers from neck pain-related impairment. The incidence of neck pain among persons working in office settings ranges between 42% and 63% [6]. Extended use of desktop computers in adults while working has been associated to the development of forward head posture, a condition that leads to musculoskeletal pain or discomfort [7]. Forward Head Posture (FHP) is the most prevalent sagittal plane postural anomaly linked to neck pain [8]. Office workers with neck problems frequently have a marked forward head



posture. CVA is a commonly used method for assessing the head position [9, 10]. The term "FHP" refers to the head's anterior position in relation to the vertical line of gravity, as seen in the sagittal plane [11]. When the head is positioned forward, an inappropriate application of force of 30 pounds on the cervical spine occurs, which can induce spinal misalignment [9]. According to research, Forward Head Posture (FHP) is associated with changes in the Craniovertebral Angle (CVA). The CVA is the intersection of the line traveling through the C7 spinous process and the line that extends from the tragus of the ear to the skin of the spinous process. CVA, neck pain, and Forward Head Posture (FHP) are all related. The study also found that people with a smaller Craniovertebral Angle (CVA) were more likely to have forward head posture (as CVA of less than 48–50 degree is defined as Forward Head Posture) and more likely to have neck discomfort [8, 12]. Approximately 60 to 70 percent of individuals may experience discomfort at some stage throughout their professional career. Furthermore, a research examining the prevalence of neck discomfort revealed that 62.1% of those who use computers had experienced neck pain at some point [13]. Another contributing issue is that computer workers engage in less physical activity due to their job on computers. IT workers utilize laptops or desktop computers for extended durations on a regular basis in their workplaces. The prolonged use of desktops or laptops increases the susceptibility of IT professionals to develop forward head position, which in turn increases the likelihood of experiencing non-specific neck discomfort. This neck ache might hinder their productivity at work. This study aimed to determine the correlation between the craniovertebral angle and non-specific neck discomfort and functional limitations in IT workers.

METHODS

This observational cross-sectional study was conducted on 377 IT professionals who were in 20–45 years of age. This sample size was calculated through Raosoft software by assuming the unknown population of 20,000 and setting the confidence interval to 95% and power 80% [14]. Non-probability purposive sampling technique was used. The inclusion criteria was IT professionals (including both junior IT clerks having Diploma in IT and professionals having formal university degree), both male and females and working for at least >3hrs/day on Desktop/laptop. An experience of IT work for at least 1 year was mandatory [12]. Cervical Vertebrae fracture from last six months, people with medical condition like vertigo, rheumatoid arthritis, congenital neck problems, radiating neck pain, tumor in cervical region, deformity of spine like scoliosis or kyphosis presence of acute neck pain history of traumatic neck injury, radiculopathy or neck myelopathy, disturbances of the vestibular system and auditory impairment were excluded [6, 15]. Data were collected from total 7 small

scale IT software houses, call centers, and from various hospitals' IT staff in Lahore from April 2024 to June 2024. The software houses were approached online and data were collected after the HRs approval and participant's consent. The rest of the data were collected from call centers and IT departments after permission from the relevant authorities. Following approval from the research committee, consent was obtained from each individual. A manual goniometer was utilized to quantify the Craniovertebral Angle (CVA). The Craniovertebral angle (CVA) was assessed while the individual was seated. This was done by determining the angle formed at the point where a line from the middle of the tragus of the ear to the skin overlaying the C7 spinous process intersects with a horizontal line going through the C7 spinous process. The typical Craniovertebral angle was within the range of 48–50 degrees. Forward head position was defined as any angle less than 48 degrees [16]. The NPRS scale was utilized to measure the severity of neck discomfort. The Numerical Rating Scale (NPRS-11) was an 11-point scale used for individuals to report their pain levels. This pain scale was often utilized in one-dimensional assessments. The participant chooses an integer between 0 and 10 that accurately represents the level of intensity. The interpretation was as follows: absence of pain was represented by the value 0, mild pain was represented by values ranging from 1 to 3, moderate pain was represented by values ranging from 4 to 6, and severe pain was represented by values ranging from 7 to 10 [17]. Subsequently, the Neck Disability Index questionnaire was delivered to the participants, who were then instructed to complete the form themselves. The Neck Disability Index (NDI) was employed to assess both the intensity of neck discomfort and the extent of functional impairments [18]. The NDI had 10 areas, with each category being assigned a score ranging from 0 to 5. This resulted in a total score range of 0 to 50. The categories were degree of pain, daily living, lifting, reading, headache, attention level, work, driving, sleep, and leisure activities. The disability levels were categorized as follows: 0–4 for no disability, 5–14 for a light disability, 15–24 for a moderate disability, 25–34 for a severe impairment, and >35 for a complete disability [19, 20]. The greater the degree of disability in the neck region, the higher the score [18]. Using SPSS version 25.0, quantitative data were presented by Mean \pm SD and qualitative with frequency and percentages. At the end the association of CVA with non-specific neck pain and functional limitation were analyzed through chi-square test. P-value < 0.05 was considered as significant.

RESULTS

The mean age of participants in this study was 29.43 \pm 5.081. About 71.4% were males and 28.6% were females (Figure 1).

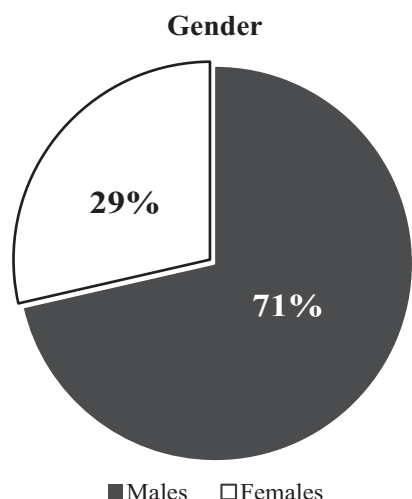


Figure 1: Gender Distribution of study participants

The percentage of single and married were described in (Table 1).

Table 1: Marital Status of study participants

Marital status	N (%)
Marriage	201 (53.3%)
Single	176 (46.7%)
Total	377 (100%)

There was significant association of CVA with NDI (functional limitations) having p-value=0.01 (Table 2).

Table 2: Association of CVA with NDI (Functional Limitation)

NDI Categories	CVA Categories		Total N (%)	p-Value
	FHP Present N (%)	FHP Absent N (%)		
Normal (0-4)	45 (11.9%)	8 (2.1%)	53 (14.1%)	0.01
Mild Disability (5-14)	204 (54.1%)	36 (9.5%)	240 (63.7%)	
Moderate Disability (15-24)	63 (16.7%)	16 (4.2%)	79 (21%)	
Severe Disability (25-34)	5 (1.3%)	0 (0%)	5 (1.3%)	
Total	317 (84.1%)	60 (15.9%)	377 (100%)	

The results showed non-significant association of CVA with non-specific neck pain with p value=0.859 (Table 3).

Table 3: Association of CVA with NPRS (Non-Specific Neck Pain)

Forward Head Posture (FHP)	NPRS Categories				Total N (%)	p-Value
	No Pain (Grade 0) N (%)	Mild Pain (Grade 1-3) N (%)	Moderate Pain (Grade 4-6) N (%)	Severe Pain (Grade 7-10) N (%)		
FHP Present	43 (11.4%)	111 (29.4%)	115 (30.5%)	48 (12.7%)	317 (84.1%)	0.859
FHP Absent	8 (2.1%)	18 (4.8%)	23 (6.1%)	11 (2.9%)	60 (15.9%)	
Total	51 (13.5%)	129 (34.2%)	138 (36.6%)	59 (15.6%)	377 (100%)	

Another significant association was observed between functional limitations (NDI) and non-specific neck pain (<0.001) (Table 4).

Table 4: Association of Functional Limitation (NDI) with Non-Specific Neck Pain (NPRS)

Neck Disability	NPRS Categories				Total N (%)	p-Value
	No Pain (0) N (%)	Mild Pain (1-3) N (%)	Moderate Pain (4-6) N (%)	Severe Pain (7-10) N (%)		
Normal (0-4)	17 (4.5%)	19 (5.0%)	15 (4%)	2 (0.5%)	53 (14.1%)	<0.001
Mild Disability (5-14)	32 (8.5%)	93 (24.7%)	90 (23.9%)	25 (6.6%)	240 (63.7%)	
Moderate Disability (15-24)	2 (0.5%)	17 (4.5%)	30 (8.0%)	30 (8.0%)	79 (21%)	
Severe Disability (25-34)	0 (0%)	0 (0%)	3 (0.8%)	2 (0.5%)	05 (1.3%)	
Total	51 (13.5%)	129 (34.2%)	138 (36.6%)	59 (15.6%)	377 (100%)	

The correlation of age and NDI showed a significant association (p-value=0.01) and negative correlation (Table 5).

Table 5: Correlation of Age and NDI among study participants

Correlation	Age	NDI	p-Value
Age Pearson Correlation	0.9	-0.127	0.01
NDI (Functional Limitation) Pearson Correlation	-0.127	0.9	

DISCUSSION

As this study was conducted for the association of CVA with non-specific neck pain and functional limitations among IT professionals, the results showed significant association of CVA with functional limitation and non-significant association of CVA with non-specific neck pain. On the other hand, there was no association of functional limitation with non-specific neck pain among IT professionals. There was no significant association of CVA with BMI. Only 162 IT professionals out of 198 were having FHP with normal BMI. Similarly, the ratio of FHP among male's IT professionals was more than females. Out of 377 IT professionals, 232 males were suffering from FHP while only 85 females were having FHP. Worlikar AN et al., in 2022 undertook a study to investigate the correlation between the craniovertebral angle and neck pain in undergraduate students. The study indicated a weak negative association (r value=-0.157) which was similar to our study findings [12]. Wagachchi DT et al., in 2024 investigated the assessment of forward head posture in information technology employees experiencing neck pain. The results of this study showed that 84.3% of male participants and 92.91% of female participants had Forward Head Posture (FHP) [9]. The findings of this investigation differed somewhat from those of this study. Wagachchi DT et al., in 2020 study sought to determine the prevalence of Forward head posture among sewing machine operators in two specific clothing factories [9]. The study also aimed to investigate

the association between Craniovertebral Angle (CVA) and the severity of neck pain experienced by sewing machine operators. The prevalence of Forward Head Position (FHP) among sewing machine operators was determined to be 64.67%. FHP was shown to be prevalent in 77.45% of sewing machine operators who experienced neck pain. The study discovered a high prevalence of Forward Head Position (FHP) among sewing machine workers. Furthermore, there was a significant weak negative correlation between Craniovertebral Angle (CVA) and level of neck pain [8] which was consistent with this study. The key confounding factor was the existence of people who did not complete the NDI forms in a serious manner and instead opted for non-serious completion. Some women expressed ethical concerns about exposing their neck area for CVA measurement. Given these findings, it was crucial to conduct a thorough evaluation, diagnosis and treatment of FHP. Additionally, it was crucial to have understanding of good posture. This study emphasizes the importance for physical therapists to specifically target the correction of forward head position in addition to traditional treatment when treating patients with neck discomfort.

CONCLUSIONS

The study concluded that there was no significant association of CVA with non-specific neck pain and significant association of CVA with functional limitation among IT professionals. Males were suffering from forward head posture more than females.

Authors Contribution

Conceptualization: QHK

Methodology: AJ

Formal analysis: QHK

Writing, review and editing: HK, GA, MT, TN, AW, QHK, II

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

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