

# Effect of mechanical neck pain on neck disability with forward head posture during the COVID-19 pandemic among school teachers

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## Abstract:

**Introduction:** Neck pain is the most common issue influencing an endless number of individuals due to the broad utilization of computers or laptops at work or home. This defective pose causes misfortune of typical lordotic curvature of the upper cervical spine, which certainly increases muscle pressure and shortens. The posture of the head bending forward is one of the habitual abnormalities of the cervical region that put at risk individuals towards compulsive conditions, like headache, and neck pain disorders.

**Aim:** The study aimed to analyze the effects of mechanical neck pain on neck disability with forward head posture among schoolteachers.

**Method:** A google form survey questionnaire was distributed to 50 primary and secondary school teachers to collect data. Outcome measures were used to assess the effect of mechanical neck pain with a visual analog scale (VAS), neck disability index(NDI), and forward head posture (FHP) by measuring the CV angle.

**Results:** Pearson correlation test is used to find a correlation between mechanical neck pain and neck disability with forward head posture. The results observed that there is a significant positive correlation, between VAS, NDI, and CVA, (+1) which shows that all factors are directly proportional to each other. FHP was not significantly correlated neither with VAS ( $r = .005$ ,  $P = .971$ ) nor with NDI ( $r = .212$ ,  $p = .139$ ). Moreover, a significant strong positive correlation was found between VAS and NDI ( $r = .770$ ,  $P = .000$ )

**Conclusion:** The present study concluded that VAS shows a significant positive correlation (0.01 level) with NDI. Using the survey questionnaire in this study, 50% of supposedly healthy subjects were reported as therefore 'suffering to some extent of FHP' are very few subjects. Further research is needed with a high sample size to analyze the correlation between the causes and effects of neck pain on neck disability with head posture.

**Keywords:** Mechanical neck pain, forward head posture, visual analog scale, neck disability index, CV angle, school teachers

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## I. Introduction

Neck pain is the foremost common issue influencing an endless number of individuals due to the broad utilization of computers or laptops at work or home, which causes excessive weight on the musculoskeletal system of the neck and upper back. The daily use of computers exceeds 2-3 hours as a threshold for neck pain. This defective pose causes misfortune of typical lordotic curvature of the upper cervical spine, which certainly increases muscle pressure and shortens. Mechanical neck pain (MNP) is the pain in the cervical region, often limited by movement (ROM) and functionality [1]. Pranjali Gogoi et al., conducted research reported that MNP may be characterized as secondary to overuse, any injury, or disfigurement of a typical anatomic structure. MNP is complex in origin, together with one or additional of the destitute pose, uneasiness, discouragement, neck strain, and wearing or movement acquisition. Panjabi et al assessed that the neck musculature contributes 80 percent to the mechanical steadiness of the cervical spine whereas the Osseo ligamentous framework contributes the remaining 20 percent [2].

T.W. Chiu et al., did research on the neck pain prevalence through a questionnaire, the results have shown that three disciplines of factors have been linked that contribute to neck pain are individual factors (age, gender, and teaching experience), physical factors (working with a computer or visual display unit working posture and duration), and psychosocial factors (job stress, job satisfaction, work demand, and coworker support) were found to be significantly associated with neck pain since becoming a teacher [3]. Jyothi kat aria et al informed that Individuals in the teaching profession having neck pain show a changed postural behavior

when performing forward sitting tasks similar to during the computer use [4]. The common postural defect in the sagittal plane is forward head posture connected with neck pain and disability[5]. Furthermore, telecommunication has a big impact on skilled and private life (work-life balance). In addition, the rise in computerized advances at work has multiplied stress in staff (techno-stress), which is related to important psychosocial demands[4,6,7,8,15].

Forward head posture (FHP) is identified by measuring the craniovertebral angle [CVA]. Estimation of CVA is from the cervical bony projection (spinous process) of C7 vertebrae to the small pointed eminence of the external ear known as the tragus. FHP is common in all age groups, the normal craniovertebral angle is 49.9 degrees. Using a laptop virtually forces one into an unhealthy posture by creating a C-shaped spine. Long-term use of a laptop may cause neck, shoulder, and arms pain[9]. It has been proposed that the repetitive use of mobile phones, laptops, computers, and TVs, has forced the body to adapt to the forward head posture(FHP)[10]. Digital photogrammetry is an associate indirect methodology to gauge quantitative FHP; it records angles between the reference points on a digital image[8,9,10,11]. Although digital photogrammetry has demonstrated good validity and reliability, digital photogrammetry, software is simple, useful, and easy to operate without special training[12].

The COVID-19 pandemic created rapid change that affected teachers' work. Teachers' working pattern has changed to a greater extent concerning classes on PowerPoint presentations, conducting online classes, and assignments leading to increased computer use[13]. As people in modern society spend an increasing amount of time sitting in front of computers at work, forward head posture(FHP)has become quite prevalent in recent years[14]. Therefore, posture is important for maintaining proper blood flow, flexibility, good nerve conduction, and for muscles to perform their functions. People, who correct their posture or maintain their posture, experience fewer neck-related problems. Hence, the objective of the study is to find out the impact of mechanical neck pain on neck disability by evaluating the forward head posture in teaching professionals working online during the Covid -19 pandemic.

## **II. Material And Methods**

The ethical clearance was obtained before starting the study from the Institution ethical committee of Garden City University, Bangalore.

**Study Design:** This study is a correlation study

**Study Location:** Both Primary and secondary schools in East Bangalore.

**Study duration:** 6 months

**Sample Size:** 50 subjects

**Sample size calculation:** The sample size was estimated on basis of a single proportional study with randomized sampling in population according to the inclusion criteria with participants of 50, ensuring that the confidence interval of 95%.

**Subjects & Selection Method:**

**Inclusion Criteria:**

1. Age 25-45yrs
2. Gender: both females & males
3. Both primary & secondary school teachers
4. Teachers with mild to severe pain
5. Work for 6 or more hrs. per day

**Exclusion Criteria:**

1. The subjects were excluded if they had any history of spine injury or surgery.
2. If their neck pain was related to other conditions {including Neoplasm, neurological diseases, or vascular diseases}.
3. Postural deformity other than FHP.
4. Subjects have any infection or inflammatory arthritis in the cervical spine.
5. Subjects having the upper cross syndrome

**Procedure methodology:**

An organized self-administered questionnaire google form was distributed to collect the data. The questionnaire was prepared in English and Kannada (local language). For data, collection permission was obtained from the school authority to conduct the study, following which the data was collected from teachers who were willing to take part in the study. The subjects apart from FHP who were with history of fractures, myelopathy, upper cross syndrome, postural deformities, cervical spine infection or inflammatory arthritis, and neck pain including neoplasms, neurological disorders, or vascular diseases were excluded from the study. The purpose of the study and a consent form has given to participants along with the survey questionnaire form. The

google form was circulated to teachers through electronic media and e-mails. The questionnaire consists of sociodemographic data, work history and occupational stress-related details among teachers, comorbidities, physical activities, communication, time spent on smartphones/ computers for teaching or communication and to assess the neck pain with visual analog scale(VAS), neck disability with neck disability index(NDI) and forward head posture by uploading a photo to measure CV angle.

**Outcome measures:**

The instruments used to assess the neck pain and neck disability were taken from the Visual analog scale(VAS), Neck disability index(NDI) respectively. Participants rated their perceived pain on a 10- point scale (VAS) rated for “ no pain(0 points) and severe pain imaginable (10 points) ”. A digital imaging technique is used to evaluate head and neck posture in standing/sitting position. A picture of the sagittal view of the right upper body was taken and the image was subsequently processed digital photogrammetry method using Web Plot Digitizer (WPD) software to evaluate forward head posture(FHP) by measuring the cranial vertebral angle. The image was taken in the position of sitting or standing to assess FHP in lateral view considerably with the help of the CV angle. A line was drawn from the C7 spinous process to the pointed eminence of the external ear called the tragus, and the angle was measured. The higher the measured CVA value, the more ideal the alignment of the head and neck. Besides, the smaller the angle, the more severe the FHP grade.

**Statistical analysis**

A total of 80 subjects responded from five schools out of which 13 subjects did not give consent and 17 responses were not complete. The collected data of 50 schoolteachers were analyzed in SPSS (statistical package for social sciences) version 26. The results were given by using frequency tables and graphs for descriptive analysis. Pearson’s correlation test was used to find out the correlation between neck pain and neck disability with forward head posture.

**III. Result**

Table-1 gives the details of sociodemographic data of school teachers. A total number of 50 questionnaires distributed to the subjects were included in this study. The majority of the study participants were females with 58% and 42% of male participants. It was observed that the participants in this study were between the age of 25-35 years with 46.3% the mean age of 28 years( SD±6.707). 29.4 % of teachers were from primary and 68.6% were secondary class school teachers. The Private and government working organization shows the percentage of 84% and 16% respectively. It has been found that 52% were married and 48% were unmarried school teachers.

**Table 1** Description of sociodemographic data of school teachers

Variables	Frequency	percentage
Female	29	58%
Male	21	42%
Age		
25-35	43	46.3%
35-45	7	13.7%
Married	26	52%
Unmarried	24	48%
Primary class	15	29.4%
Secondary class	35	68.6%
Government school	8	16.0%
Private school	42	84.0%

Table-2 shows the work-related characteristics of school teachers’ work patterns working 84.3% full-time and 15.7% part-time. 74% of teachers had 20-30 students in class and 26% of teachers had 30-40 students. The experience of the school teachers was 2 to 16 years of teaching experience which were included in the study. The majority of 76.4 % of teachers reported that they were in static head-down posture for more than 2h in a day while teaching students, 66.7% were not having comfortable back support, 74% showed the changes in daily living activities like reading, writing, sleeping, etc. during work from home situation.

**Table -2** work-related characteristics of school teachers

Variable	Frequency	Percentage
Work pattern		
Full time	43	84.3%
Part-time	7	15.7%
Students in one class		
20-30	37	74%
30-40	13	26%
Static head down posture/day		
Yes	38	76.4%
No	12	23.6%
Comfortable back support		
Yes	16	44.3%
No	34	66.7%
Changes in daily living activities		
Yes	37	74%
No	13	26%

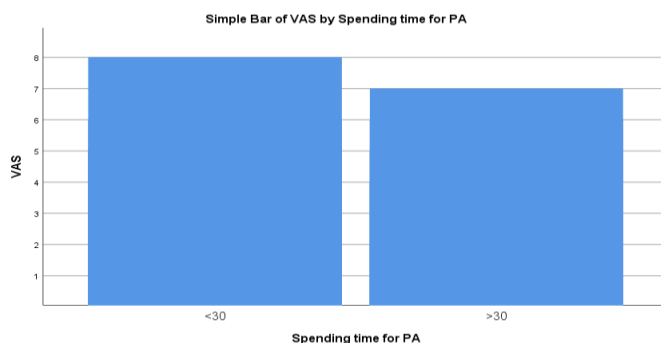
**Table -3** descriptive statistics of work-related stress and causing factors associated with NP. This table reports that the teachers faced work-related stress through online teaching from home or school. Mostly 42% of school teachers indicated that because of the network issues or technical glitches, 28% with time management, 16% with no control over students, 8% with distress due to the pandemic, and 6% with not able to give a proper lecture.

Work-related Stress factors	Frequency	Percentage	Mean± SD
Yes	46	92%	3.870± 1.881
No	4	8%	3.750 ± 1.708
lecture quality	3	6%	
No control over students	8	16%	
Time management			
Network issues	14	28%	
	21	42%	
Distress due to pandemic	4	8%	

**Table 4** describes comorbidities, reported by teachers associated with NP. Few school teachers are having diabetes with a P-value of 0.653 and Teachers with hypertension show a P-value of 0.294.

Variable	Frequency	Mean± SD	P-value
Diabetes mellitus			
Yes	7	4.333 ±0.577	0.653
No	43	3.830 ± 1.903	
Hypertension			
Yes	2	2.500 ±3.536	0.294
No	48	3.917 ± 1.796	

**Graph -1** shows the time spent on physical activities associated with neck pain. 54% of the teachers spent about <30 minutes per day on physical activities and 46% of teachers are spending >30 minutes per day on physical activities.



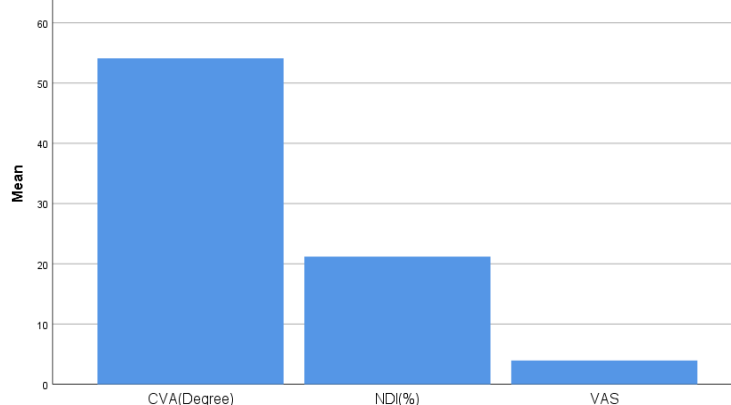
**Table 5** shows the mean and standard deviation of work experience, time spent before computer or phone for teaching online, and time spent on phone/computer for communication or entertainment

Variable	Minimum	Maximum	Mean± SD
Work experience	2	16	5.22±3.677
Time spent for teaching/hr.	6	9	6.62±0.855
Time spent for communication/hr.	1	5	2.58±0.992

**Table 6** The values of the mean and standard deviation of VAS, NDI, and CV angle of 50 subjects were given.

Outcome measures	Mean ±SD
VAS	3.86 ± 1.85175
NDI	21.2 ± 10.991648
CVA	54.09 ± 7.732610247

**Graph -2** shows the mean values of CVA, NDI, and VAS



**Table- 7** shows the correlation values of mechanical neck pain between VAS, NDI, and CV angle with r and p values.

r - value	P-value
.005	.971
.212	.139
.770	.000

The results observed that there is a significant positive correlation, between VAS, NDI, and CVA,(+1) which shows that all factors are directly proportional to each other. There is no significant relationship found between VAS& CVA as well as NDI&CVA.FHP was not significantly correlated neither with VAS( $r = .005$ ,  $P = .971$ ), nor with NDI( $r = .212$ ,  $P = .139$ ). Moreover, a significant strong positive correlation was found between VAS and NDI ( $r = .770$ ,  $P = .000$ ). That is higher VAS value corresponds to a higher NDI score. This is considered as if one domain will increase other two factors will also increase and vice versa.

#### **IV. Discussion**

The present study was conducted to examine the correlation between VAS, NDI (which represents pain and disability), and CV angle signifies the posture of the forward head in school teachers who worked from home or at school online during the COVID-19 pandemic situation. The present study used a semi-automatic tool that makes this process very easy which is a safe and valid program, to measure the head posture (CV angle). The correlation analysis results display a significant positive correlation between neck pain, neck disability, and craniovertebral angle in the subject. Furthermore, there is no notable correlation found between VAS and CV angle as well as in NDI and CV angle. In addition, a significant positive correlation was observed between VAS and NDI. The results above can be explained by different mechanisms in previous studies. Thus, numerous studies have been done to probe the correlation between the posture of forward head and neck pain, which shows the dropped length of muscle filaments and dropped capacity of muscles to induce pressure in encouraging head posture causes severe neck pain.[15]

In this study, the mean CV angle range was 54.098 degrees. Previous research said very extensive ranges of craniovertebral angles in normal populations (35– 60 degrees). According to craniovertebral angle values, individuals with mild FHP have near-normal posture, because a lot of the literature defines FHP as a craniovertebral angle less than 48–50 degrees. Using the survey questionnaire Here, 50% of supposedly healthy subjects were reported as therefore 'suffering from mild FHP' are very few subjects. Thus, as the accuracy of the CV angle plays an undeniable role in the detection of FHP, identifying a cut-off point for a craniovertebral angle is essential to diagnose it properly, and for this purpose, additional studies are required to evaluate a large sample size is needed.

Jyothi kat aria et al. informed that as compared with the other forms of musculoskeletal diseases, neck pain is most generally seen in teaching professions. The teachers have neck disability, altered position of the scapula, and their overall quality of life is affected due to their awkward position for the arrangements of notes, paper rectification and of assignments, and other responsibilities of work which leads to neck pain. [16]

Edrish Saifee et al., found that incorrect posture can lead to muscle imbalance in the relationships between different parts of the body. Participants with neck pain indicate a more forward head posture, indicating a significantly moderate to a good negative correlation between CV angle and neck pain.[17]

Anjali Suresh et al. conducted a cross-sectional study through a questionnaire and concluded that excessive usage of smartphones in college students leads to neck pain and disability. As it was found to have a moderate association between smartphone hookups and neck disorders and also suggested that proper guidance is in need for the usage of a smartphone with correct body posture to reduce neck disability.[18]

Dipti Vilas Kadu et al. described the anatomical inconsistencies in the c- spine, especially the atlas vertebrae, are relative ischemia of the brainstem circulation, as the c- the spine is closely associated with neural structure and the nervous system plays an important role in maintaining blood pressure. Even with a slight positional deviation of the atlas vertebrae, there are injury, disorder, and /or compression of neurological brain stages. The correlation between hypertension and circulation abnormality in the area around the atlas vertebrae and the rear fovea of the brain was detected. Changes in vertebral artery circulation due to atlas displacement may correlate with elevated blood pressure and worsening hypertension. Peripheral arterial blood pressure is analytically higher in people with forward head posture than in people without forward head posture.[19]

Nesreen Fawzy Mahmoud et al. confirmed that the effects showed that adults with pain in the neck have considerably extra forward head posture than adults with not having pain in the neck. In addition, an enormous correlation was found between the posture of the head and neck pain in adults and elders but not in the adolescent subjects.[20]

Leila Ghamkhar et al. found that FHP has no variance among groups and did not correlate with cervical neck pain strength or clinical features. Neck endurance was less in cervical neck pain patients but it was dissociated with pain/disability. In the existence of neck pain, the relationship between the size of the muscle and vitality seems to be more complex. Through deep muscle group seems to be affected differently in the existence of CNP, but changes in flexors and extensor muscle groups appear to be non-uniform[21]. Zahra Salah Zadeh et al. showed that the cranial vertebral angle method could more accurately identify women with moderate and non-FHP than the angle of head position and the angle of head tilt. Photogrammetry had excellent reliability for assessing the posture of the head and neck. [22]

## V. Conclusion

The current study showed that school teachers had a significant positive correlation between VAS, NDI, and CV angle. It shows that there is no significant correlation between CVA with VAS and NDI individually. In addition, found that VAS and NDI display a significant positive correlation (0.01 level). Further research is needed that can be investigated with a greater sample size to analyze the relationship between the causes and effects of neck pain on neck disability with forward head posture.

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