

## **COMPUTER VISION SYNDROME–A PERSPECTIVE ON ASSESSMENT AND INTERVENTION**

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### **ABSTRACT**

**Objective:** The aim of the study was to assess the common symptoms, and its associated factors and to identify its ocular morbidity among them due to prolonged use of digital devices.

**Methods:** A random sampling technique are used to calculate the sample size of 278. The questionnaire includes computer vision syndrome symptoms and factors associated with Computer Vision Syndrome development.

**Results:** A total of 278 health care students participated in this study. The mean age of health care students was 20.68 y±2.51 standard deviation and the range was between 18-25 y. 40.6% were males and 59.3% were females. Among digital devices, 85.9% of student's use mobile phones frequently, 61.8% spent continuously on digital devices and had a higher risk of developing Computer Vision Syndrome, 40.2% Students were aware of 20-20-20 rule, 37% were aware of using digital devices at 40-75 cm, in pre-assessment. Thereby providing awareness and knowledge by showing them awareness video helps to improve the results in post-assessment.

**Conclusion:** There was a high prevalence of Computer Vision Syndrome symptoms among health care students in pre-assessment which was reduced in post-assessment. Thereby health care students who have knowledge on their eye care helps to prevent vision problems and it is also helpful for the people who are already having symptoms and ergonomic practices. So, they may consult the doctor without neglecting their visual problems.

**Keywords:** CVS-Computer vision syndrome, VDT-Video display terminal

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### **INTRODUCTION**

“Computer Vision Syndrome” (CVS) is defined as a complex of eye and vision problems related to the activities which are experienced during the use of computers. It is usually due to focusing of eyes on a computer or other display device [1]. As printed books are replaced by electronic devices even in the medical field. The symptoms of CVS occur when the demand of the eye exceeds the abilities of the individual eye to perform the task [2]. The frequently occurring health-related problems among computer users are–wrist pain, neck pain, shoulder pain, back pain, etc., and the main ocular symptoms are eye strain, burning sensation, redness, irritation, blurred vision, double vision, headache, photophobia, dry eyes, etc., prolonged use of computers results in ocular and musculoskeletal discomfort.

The vision problems result from the activities which stress the near vision during the use of computers/digital screen. Interaction with digital screens/computers may affect the vision of the computer user. A video display terminal (VDT) is now considered a computer screen [3]. The possible pathophysiological mechanism of CVS is; there are three mechanisms: 1.) The extra ocular mechanism, 2.) The accommodative mechanism, 3.) Ocular surface mechanism. Ocular surface symptoms are–watering, irritation, dry eye; accommodation/visual symptoms are–blurred vision, double vision. The condition of a person experiencing one or more of the above symptoms as a result of operating a computer is generally referred to as “computer vision syndrome” [4]. CVS symptoms cause students to defer work, affecting their productivity (vision), efficiency, and time management; severe symptoms can reduce work productivity by up to 40% [5]. The increased use of digital screens not only increases the odds of developing CVS [6].

CVS affects the people who work more than 3 to 4 h on computers for prolonged period. Now, the newer terminology of Computer Vision Syndrome is “Digital Eye Strain”. In addition, CVS can also be explained by decreased blinking reflex while staring at the screen, leading to exaggerating dry eyes. Dry eyes have been proved to play a major contributor to CVS symptoms [7]. Sustained periods of close

screen work also results in visual fatigue symptoms such as sore eyes and increased glare sensitivity. Dry eyes and related symptoms are associated with reduce blink rate and horizontal gaze causing wider opening of the palpebral fissure that lead to increased evaporation through exposed area [8].

### **MATERIALS AND METHODS**

It was a questionnaire study that was conducted among health care students and the participants are explained before conducting the survey. The main tool used for the study was 20 self developed structured questionnaires. The random sampling technique was used a total sample of 278 participants (n=278), out of which 113 participants were males and 165 participants were females. The participants with ocular diseases, previous neck, back, and shoulder or wrist injuries were excluded. The participants using digital devices for long period are included in this study. The entry of data and its analysis was done using SPSS version 21.0. Descriptive statistics was used to evaluate the data. Ethical approval was received from Saveetha College of Allied Health Sciences. Informed consent was obtained from all the respondents.

### **RESULTS**

A total of 278 health care students were recruited among them 165 (59.3%) were females and 113 (40.6%) were males. The mean age and standard deviation (SD) are (20.6±2.51) On inquiring about their prevalence for digital devices 85% in pre and 85.9% in post-assessment were using mobile phones. 38.4% in pre and 72.6% in post were using digital devices on and off with 30.9% of the students use their digital devices with low illumination about less than 10% which improved to 28.4% in post-assessment, the number of hours spent with less brightness has a direct relationship with increased risk of CVS.

Among our participants 25.8% in pre and 33% in post were using mobile phones sine 4 y from which 28.7% in pre and 48.5% in post-assessment were reported to have clear vision after using their devices for prolonged time.

The health care students who consulted eye specialist for their problem had refractive errors i.e., 48.2% in pre and 46.5% in post assessment, among them only 18.7% were using topical eye drops in pre which improved to 28% in post assessment.

The seating position of the students using their devices must be up right with a straight back, but only 43.8% of students were using proper posture in pre-assessment and 69.3% in post-assessment. If the head, arms and legs are not positioned comfortably during computer usage, may leads to extra ocular problem which involve neck, shoulder and back pain which may become apparent. Based on our result 40.2% of students were aware of 20-20-20 rule in pre and 77.3% in post-assessment which helps to prevent the occurrence of CVS.

The working distance of about 40-75 cm should be maintained during digital device usage eg: (computer, mobile phones, laptop) in our study 35% of the students maintained their working distance in pre-assessment which improved to 74.4% in post-assessment taking regular break may relax the accommodation process of the eyes, thereby preventing eye strain, 88% of users in pre and 92.4% in post assessment were aware of this knowledge and average duration of breaks should be taken for every 15 min i.e., 14.3% users were aware in pre-assessment which improved to 54.6% in post-assessment.

The highest percentage from above questions in pre and post assessment are represented graphically in fig. 1.

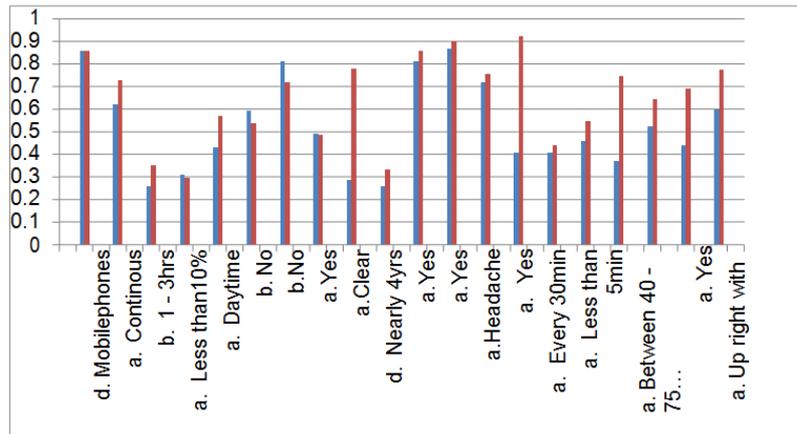


Fig. 1: Percentage of questionnaires

Table 1: Distribution statistics for age

|     | N   | Minimum | Maximum | Mean  | Std. deviation |
|-----|-----|---------|---------|-------|----------------|
| AGE | 278 | 17      | 24      | 20.68 | 2.51           |

From table 1, It is observed that a total of 278 Health care students were examined. The mean age and the standard deviation of the participated students is (20±2.51)

Table 2: Distribution statistics for gender

| Gender | No. of respondents | Percentage |
|--------|--------------------|------------|
| Male   | 113                | 40.64%     |
| Female | 165                | 59.35%     |
| Total  | 278                | 100%       |

It is observed that 40.64% of participants who participated in this study are males and 59.35% are females and the same is depicted in the fig. 1.

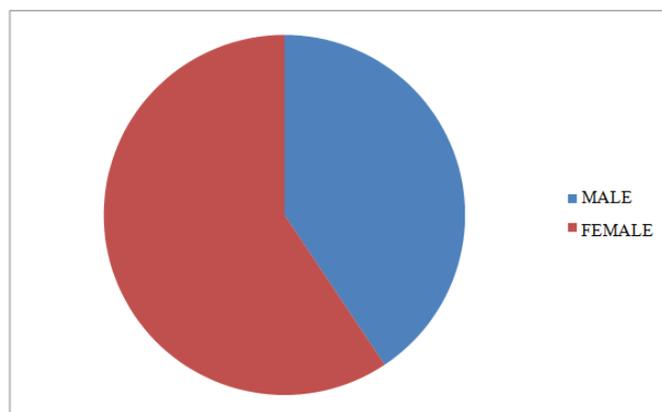


Fig. 2: Distribution of gender

**Table 3: Pre and post assessment questionnaire**

| S. No. | Questions  | Number and percentage |              |
|--------|--|-----------------------|--------------|
|        |  | Pre                   | Post         |
| 1      | The digital screen that you use frequently   |                       |              |
|        | a. Ordinary Computer   | (6) 2.15%             | (6) 1.79%    |
|        | b. Laptop  | (30) 10.79%           | (30) 10.79%  |
|        | c. Tablet/i-pad  | (4) 1.43%             | (4) 1.43%    |
|        | d. Mobile phones   | (239) 85.97%          | (238) 85.61% |
| 2      | The hours you spend on your digital screen are?  |                       |              |
|        | a. Continuous  | (172) 61.87%          | (80) 28.77%  |
|        | b. Interrupted   | (107) 38.48           | (202) 72.66% |
| 3      | How many hours you spend watching your screen in dark room ?   |                       |              |
|        | a. Less than 1 h   | (49) 17.62%           | (31) 11.15%  |
|        | b. 1-3 h   | (72) 25.89%           | (65) 23.38%  |
|        | c. 3-4 h   | (98)35.25%            | (60) 21.56%  |
|        | d. 4-6 h   | (24) 8.63%            | (18) 6.47%   |
|        | e. More than 6 h   | (15) 5.39%            | (8) 2.87%    |
| 4      | To what level you illuminate (brightness) your digital screen in room light ?                            |                       |              |
|        | a. Less than 10 %  | (86) 30.93%           | (82) 29.49%  |
|        | b. 11-25 %   | (91) 32.73%           | (69) 24.82%  |
|        | c. 26-50 %   | (85) 30.57%           | (67) 24.1%   |
|        | d. 51-75 %   | (9) 3.23%             | (42) 15.1%   |
|        | e. 76-100 %  | (7) 6.25%             | (18) 6.47%   |
| 5      | Are you spending most of your screen time during day or night time ?                                     |                       |              |
|        | a. Day time  | (180) 64.7%           | (98) 35.25%  |
|        | b. Night time  | (100) 35.97%          | (178) 64.02% |
| 6      | Do you have a previously diagnosed dry eye diseases?   |                       |              |
|        | a. Yes   | (128) 46.04%          | (113) 40.64% |
|        | b. No  | (165) 59.35%          | (150) 53.95% |
| 7      | Are you using any topical eye drops for dry eye ?  |                       |              |
|        | a. Yes   | (52) 18.7%            | (78) 28.05%  |
|        | b. No  | (226) 81.29%          | (200) 71.94% |
| 8      | Do you have any refractive errors ?  |                       |              |
|        | a. Yes   | (135) 48.56%          | (137) 49.28% |
|        | b. No  | (95) 34.17%           | (91) 32.73%  |
|        | c. I don't know  | (46) 16.5%            | (52) 18.7%   |
| 9      | Describe the details of objects you see after prolonged hours. I am having.                              |                       |              |
|        | a. Clear   | (80) 28.77%           | (135) 48.56% |
|        | b. Blurred vision  | (75) 26.97%           | (91) 32.73%  |
|        | c. Hazy  | (23) 8.27%            | (52) 18.7%   |
| 10     | How many years do you spend in this way on the screen ?  |                       |              |
|        | a. Nearly 1 y  | (48) 17.26%           | (29) 10.43%  |
|        | b. Nearly 2 y  | (48) 17.26%           | (40) 14.23%  |
|        | c. Nearly 3 y  | (44) 15.82%           | (51) 18.34%  |
|        | d. Nearly 4 y  | (72) 25.89%           | (92) 33.09%  |
|        | e. More than 5 y   | (66) 23.74%           | (66) 23.74%  |
| 11     | Do you feel that the digital screen affects your life style and eye health ?                             |                       |              |
|        | a. Yes   | (226) 81.29%          | (239) 85.97% |
|        | b. No  | (52) 18.7%            | (39) 14.02%  |
| 12     | Are you willing to decrease your screen hours to protect/guard your eyes from computer vision syndrome ? |                       |              |
|        | a. Yes   | (240) 86.33%          | (250) 89.92% |
|        | b. No  | (38) 13.66%           | (28) 10.07%  |
| 13     | Do you have any following symptoms ?   |                       |              |
|        | a. Headache  | (200) 71.94%          | (210) 75.53% |
|        | b. Blurred vision  | (40) 14.38%           | (38) 13.66%  |
|        | c. Neck/Shoulder/back pain   | (25) 8.99%            | (20)7.19%    |
|        | d. Fatigue   | (15) 5.39%            | (20) 7.19%   |
|        | e. Dry eyes  | (30) 10.79%           | (40)14.38%   |
|        | f. eye strain  | (50) 17.98%           | (28) 10.07%  |
|        | g. Double Vision   | (10) 3.59%            | (8) 2.87%    |
|        | h. Eye redness and irritation  | (10) 3.5%             | (8) 2.87%    |
| 14     | Do you take breaks during the use of electronic devices ?  |                       |              |
|        | a. Yes   | (247) 88.84%          | (257) 92.44% |
|        | b. No  | (31) 11.15%           | (21) 7.55%   |
| 15     | How often do you take breaks during the use of electronic devices ?                                      |                       |              |
|        | a. Every 30 min  | (113) 40.64%          | (122) 43.88% |
|        | b. Every 1 hr  | (58) 20.86%           | (67) 24.1%   |
|        | c. More than 1 hr  | (107) 38.48%          | (89) 32.01%  |
| 16     | What is the average duration of your breaks ?  |                       |              |
|        | a. Less than 5 min   | (127) 45.68%          | (48) 17.26%  |
|        | b. 5-10 min  | (68) 24.46%           | (47) 16.9%   |
|        | c. 11-15 min   | (40) 14.38%           | (152) 54.67% |

| S. No. | Questions   | Number and percentage |              |
|--------|---|-----------------------|--------------|
|        |   | Pre                   | Post         |
| 17     | d. More than 15 min<br>While using electronic devices the distance between your eye and the screen is approximately ? | (43) 15.46%           | (33) 11.87%  |
|        | a. Between 40-75 cms  | (99) 35.61%           | (207) 74.46% |
|        | b. More than 75 cms   | (20) 7.19%            | (152) 54.67% |
|        | c. I don't know   | (56) 20.14%           | (33) 11.87%  |
| 18     | d. Less than 40 cms   | (103) 37.05%          | (23) 8.27%   |
|        | Do you use monitor filters ?  |                       |              |
| 19     | a. Yes  | (132) 47.48%          | (179) 64.38% |
|        | b. No   | (146) 52.51%          | (99) 35.61%  |
| 20     | While using electronic devices, the seating position is   |                       |              |
|        | a. Up right with straight back  | (122) 43.88%          | (192) 69.06% |
|        | b. Bending my back  | (75) 26.97%           | (32) 11.51%  |
| 20     | c. Lying down   | (81) 29.13%           | (54) 19.42%  |
|        | Are you aware of 20-20-20 rule ?  |                       |              |
|        | a. Yes  | (112) 40.28%          | (215) 77.33% |
|        | b. No   | (166) 59.76%          | (63) 22.66%  |

## DISCUSSION

Computer Vision Syndrome is a complex of eye and vision problems related to activities experienced during the use of computers. The common symptoms are eye strain, burning sensation, redness, irritation, blurred vision, double vision, headache, dry eyes, etc., and the main health problems for computer users are wrist pain, neck pain, shoulder, back pain, etc. these may occur due to abnormal sitting posture. The prolonged use of computers results in ocular and musculoskeletal discomfort. The prevalence of Computer Vision Syndrome ranges from 64–90% among computer users, with nearly 60 million people affected globally.

In our study on 278 health care students found that a.)Headache (71.9%); b.) blurred vision (14.3%); c.)Neck/Shoulder/Back pain (8.9%); d.)Fatigue (5.3%); e.)Dry eyes (14.3%); f.)Eye strain (17.9%); g.)Double vision (3.5%); h.) Eye redness and irritation (3.5%) were the most common symptoms associated with computer use. Proper ergonomic positioning of the computer device is important screens are recommended to be 10-20 degree below eye level, as higher than this position requires a chin-up posture with resulting muscular strain on the trapezium and neck muscles. If the viewing angle is greater there is an increase in blurred vision, because of the effect on the amplitude of accommodation. Computer use can lead to CVS affecting the eyes and the rest of the body because of improper positioning between the eye level and the screen of handheld tablets or typing with the wrists at an inappropriate angle, which can result in musculoskeletal discomfort because of poor ergonomics. Modification of the study environment and user education and knowledge are the best strategy for the prevention of CVS; hence we need to educate our health care students about the importance of good computer devices and ophthalmologists can work together in reducing the prevalence of CVS by working with ergonomists, in designing computer work stations and guidelines for smartphone and electronic devices uses for students and the workplace. As students are frequent users of electronic devices, health care students should address this issue and its prevalence by providing guidelines for the prevention of the potential health issue.

Anadi Khatri *et al.* had undergone a study on knowledge, attitude, and practice of Computer Vision Syndrome among medical students and its impact on ocular morbidity. This study is a questionnaire the study was conducted among 299 students, but the response was received from 236 students of 299 students among the age group of 19–22 y, and the response rate is 80% at the department of ophthalmology at Maharajgunj medical campus, Tribhuvan University, Katmandu, in Nepal2018.

Mohammed Iqbal *et al.* had undergone a study on a Computer Vision Syndrome survey among medical students in Sohag University Hospital, Egypt in the year 2018. This is a questionnaire study among 100 medical students in the department of ophthalmology, faculty of medicine, Sohag University, Egypt. The survey was

performed among 100 medical students and the response rate is 86% of medical students were complaining of one or more Computer Vision Syndrome manifestations.

Sreedharan. J *et al.* had undergone a study on Computer use and vision-related problems among universities in Ajman, United Arab emirate in 2014. A valid questionnaire form was given to 500 students with a set of questions and asked them to fill the forms. In this survey nearly more than half of the students had mentioned having some-related eye problems like headache, eyestrain, dry eyes, burning sensation were the most common vision-related problems associated with usage of computers, and the response rate is.

## CONCLUSION

In our survey more than half of the students had mentioned having some computer-related eye problems like headache, burning sensation, dry eyes, eye strain, etc., were the most common vision-related problems associated with the usage of computers. After showing them video on Computer Vision Syndrome they were aware of the symptoms which are used to prevent their visual problems. Looking at an object in between work, viewing the monitor below the level, massage of eyes, and use of eye drops helped in reducing the CVS symptoms. Thus, this study suggests that it is very essential that everyone should have the knowledge on their eye care which helps to prevent vision problems and it is also helpful for the people who are already having symptoms may consult the doctor without neglecting their visual problems.

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Nil

## AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

## CONFLICT OF INTERESTS

Declared none

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