Study of computer vision syndrome among medical undergraduates of Kumaon region, Uttarakhand

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ABSTRACT

Background: Activity on digital screen has increased so much during the COVID era that there is surge in persons complaining of symptoms of computer vision syndrome (CVS). **Aims and Objectives:** The aim of the study was to determine the prevalence of CVS among the medical students and its associated factors during COVID period and to compare it with pre-COVID period. **Materials and Methods:** A cross-sectional study was conducted among 337 undergraduate medical students at Government Medical College, Haldwani, Uttarakhand using pretested structured questionnaire which was filled through Google form for which link was circulated in class WhatsApp group. Data were analyzed using SPSS version 16. Frequency, percentage, binary logistic regression, and McNemar test was applied. $P < 0.05$ was considered significant. **Results:** The prevalence of CVS was significantly higher during COVID period, 54.9% (95% CI = 49.7–60.1) that was significantly higher than non-COVID period. Eye strain (16.6%) was the most common CVS symptom during both pre-COVID and COVID period. The prevalence of CVS was significantly associated with use of preventive measures. During COVID period, average hours spent in digital screen was significantly higher as compared to non-COVID period. **Conclusion:** This study showed that there was increase in CVS among the study participants during COVID era as there was increase in spending hours on digital screen and not or reduction in adopting preventive measures. It is important to increase awareness regarding the symptoms and precautions related to CVS.

Key words: COVID era; pre-COVID era; Computer vision syndrome; Undergraduate medical students; Kumaon

INTRODUCTION

With the advancement of modern technology, use of computer devices and gadgets has become necessity in all aspect of life. These devices are remarked as crucial entity of 21st century. They are used for different purposes as work places offices, academic institutions and also at recreational places and homes.[1] Hence, with increased use of screen lead to computer vision syndrome (CVS). It is defined by the American Optometric Association as "A complex of eye and vision problems related to the activities which stress the near vision and which are experienced in relation to or during the use of computers".[2,3] The most common ocular symptoms reported that among computer users are eye strain, irritation, burning sensation, redness, blurred vision, and double vision.[4] It was said that nearly 60 million people are suffering from CVS globally and 1 million new cases occurred each year.[5] As there is huge

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increase in use of computers or screen by young generation for personal and professional use, it is the high time to investigate and educate them regarding adopting ergonomic principles while using screen.[4] Recent studies have reported that CVS is now growing as a public health problem among computer or screen users.[2,3,6] To the best of our knowledge, there are no studies on CVS in our region.

Aims and objectives

The present study has been designed to determine the prevalence of CVS among the medical students and to compare it with pre-COVID conditions that would help in inculcating preventive measures among the students.

MATERIALS AND METHODS

A cross-sectional study was conducted among the undergraduate medical students at Government Medical College, Haldwani during February–March 2021 after approval from the Institutional Ethics Committee (GMC/IEC/2020/Reg. No. 528/IEC/R:17-12-2020). A total of 337 undergraduate medical students were surveyed using pre-tested structured questionnaire which include the demographic profile, practice of ergonomic principles while working on computer (viewing distance, positioning of screen, avoiding glare, frequent breaks, place of reference materials, posture check etc.), and symptoms of CVS experienced while on continuous computer work either at college or at home within the past 1-month duration and during pre-COVID period. Participants with amblyopia, high refractive error (>±6D), chronic inflammatory eye disease, strabismus, glaucoma, cataract, any other eye disease, history of eye surgery, any systemic disease, and not giving consent were excluded from the study. This questionnaire was designed based on the similar literature published in the past.[7] The questionnaire was as Google form and its link was circulated to undergraduate students through WhatsApp class group. The students got the explanation regarding the nature of the study and its consequences along with free voluntariness to participate or not during online lecture in each class. The ethical clearance was obtained from Institutional Ethics Committee, Government Medical College, Haldwani. Strict privacy confidentiality was assured. The data were analyzed with the help of SPSS version 16. The descriptive data were presented as mean (SD) and percentages whereas binary logistic regression was used to analyze associated factors and McNemar test was used to test paired data association. $P < 0.05$ was considered significant.

RESULTS

A total of 337 students participated in the study. The mean age of the study participants was 20.7±1.9 years.

Approximately equal participation was seen from females (50.4%) and males (49.6%). Maximum respondents were from 1st year students (28.5%). Approximately half of them (52.5%) were using glasses, very few (2.4%) were using both spectacles and contact lens (Table 1).

The prevalence of CVS was significantly higher during COVID period, 54.9% (95% CI=49.7%–60.1%) as compared to pre-COVID period, 46.9% (95% CI=41.6%–52.2%) (Figure 1).

Eye strain was the most common CVS symptom during both pre-COVID (16.6%) and COVID period (19.3%) (Table 2).

The mean age of study participants was similar irrespective of presence or absence of CVS symptoms (OR=1.03, 95% CI=0.92–1.15). Males had similar odds of CVS as compared to females (OR=1.02, 95% CI=0.66–1.56). Second year students had highest odds of CVS prevalence (OR=1.60, 95% CI=0.87–2.97) followed by final year Part I (OR=1.55, 95% CI=0.83–2.89) and 1st year students (OR=1.45, 95% CI=0.81–2.60) as compared to final
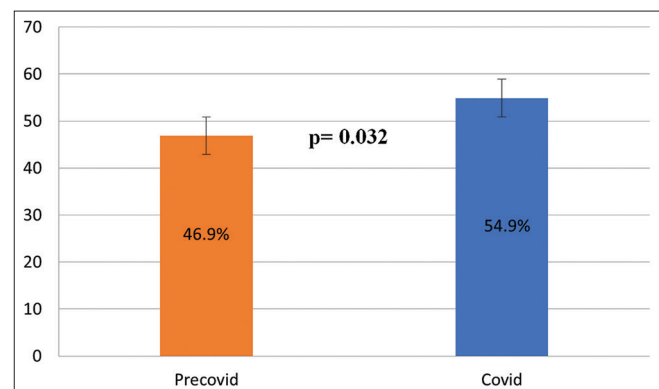

Figure 1: Comparison of prevalence of CVS during pre-COVID and COVID period (n=337)

Table 1: Profile of study participants (n=337)

Profile	n (%)
Age	
Mean±SD	20.7±1.9
Sex	
Male	167 (49.6)
Female	170 (50.4)
Batch	
1st year	96 (28.5)
2nd year	80 (23.7)
Final year part I	70 (22.6)
Final year part II	85 (25.2)
Eyewear used	
None	151 (44.8)
Glasses	177 (52.5)
Contact lens	1 (0.3)
Both	8 (2.4)
SD: Standard deviation	

Table 2: Distribution of study participants as per CVS symptoms during pre-COVID and COVID period (n=337)

Symptoms	Pre-COVID	COVID
	n (%)	n (%)
Headache	38 (11.3)	44 (13.1)
Eye strain	56 (16.6)	65 (19.3)
Eye ache	7 (2.1)	11 (3.3)
Blurring of vision	12 (3.6)	12 (3.6)
Itching	10 (3.0)	11 (3.3)
Dryness in eyes	11 (3.3)	11 (3.3)
Redness in eyes	5 (1.5)	6 (1.8)
Burning sensation in eyes	10 (3.0)	8 (2.4)
Watering from eyes	9 (2.7)	17 (5.0)

Table 3: Distribution of study participants as per factors associated with CVS (n=337)

Variable	CVS		Crude OR (95% CI)
	No	Yes	
Age			
Mean±SD	20.7±1.7	20.82.0	1.03 (0.92–1.15)
Sex			
Female	77 (45.3)	93 (54.7)	1
Male	75 (44.9)	92 (55.1)	1.02 (0.66–1.56)
Batch			
1st year	42 (43.8)	54 (56.2)	1.45 (0.81–2.60)
2nd year	33 (41.3)	47 (58.7)	1.60 (0.87–2.97)
Final year Part I	32 (42.1)	44 (57.9)	1.55 (0.83–2.89)
Final year Part II	45 (52.9)	40 (47.1)	1
Eyewear used			
None	76 (50.3)	75 (49.7)	1
Glasses	71 (40.1)	106 (59.9)	1.51 (0.98–2.34)
Contact lens	1 (100.0)	0 (0)	0
Both	4 (50.0)	4 (50.0)	1.01 (0.24–4.20)
Digital device most commonly used			
Laptop/desktop	6 (50.0)	6 (50.0)	1.67 (0.27–10.33)
Mobile	141 (44.5)	176 (55.5)	2.08 (0.49–8.86)
Tablet/iPad	5 (62.5)	3 (37.5)	1
Average hours spent on digital screen per day			
0–4 h	44 (53.7)	38 (46.3)	1
>4 h	108 (42.4)	147 (57.6)	1.58 (0.96–2.60)
Average hours spent on digital screen in dark/low light condition per day			
0–4 h	138 (46.9)	156 (53.1)	1
>4 h	14 (32.6)	29 (67.4)	1.83 (0.93–3.61)
Most common reason for using digital screen			
Work	8 (50.0)	8 (50.0)	1
Study	87 (45.3)	105 (54.7)	1.21 (0.44–3.35)
Entertainment	44 (43.6)	57 (56.4)	1.30 (0.45–3.72)
Communication	13 (46.4)	15 (53.6)	1.15 (0.38–3.95)
Average hours spent on digital screen for study			
0–4 h	111 (44.2)	140 (55.8)	1.15 (0.70–1.88)
>4 h	41 (47.7)	45 (52.3)	1
Use of preventive measures*			
Adjustable screen	15 (30.6)	34 (69.4)	3.72 (1.51–9.16)
Adjustable chair	2 (18.2)	9 (81.8)	7.39 (1.39–39.27)
Regular break	79 (49.1)	82 (50.9)	1.71 (0.82–3.55)
Antiglare glasses	33 (41.8)	46 (58.2)	2.29 (1.03–5.10)
Eye drop (artificial tears)	23 (62.2)	14 (37.8)	1

CVS: Computer vision syndrome, OR: Odds ratio, CI: Confidence interval, SD: Standard deviation

year Part II students although not significant. Students using only glasses had higher odds of CVS prevalence (OR=1.51, 95% CI=0.98–2.34) as compared to those who were not using any eyewear although it was not significant. Students using mobile had highest odds of CVS prevalence (OR=2.08, 95% CI=0.49–8.86) followed by students using desktop/laptop (OR=1.67, 95% CI=0.27–10.33) as compared to students using tablet/iPad although not significant. Students using screen for >4 h in a day, >4 h in dark/low light, 0–4 h for the study had higher odds of CVS prevalence (OR=1.58, 95% CI=0.96–2.60), (OR=1.83, 95% CI=0.93–3.61), (OR=1.15, 95% CI=0.70–1.88) than students using screen for 0–4 h in a day, 0–4 h in dark/low light, >4 h for the study, respectively, although not significant. Students using digital screen for entertainment had highest odds of CVS prevalence (OR=1.30, 95% CI=0.45–3.72) followed using digital screen for study (OR=1.21, 95% CI=0.44–3.35), communication (OR=1.15, 95% CI=0.38–3.95) than students using digital screen for work although not significant. Students using adjustable chair had significantly highest odds of CVS prevalence (OR=7.39, 95% CI=1.39–39.27) followed by students using adjustable screen (OR=3.72, 95% CI=1.51–9.16) and antiglare glasses (OR=2.29, 95% CI=1.03–5.10) compared to students using eye drops (artificial tears) (Table 3).

The average hours spent in digital screen during COVID period were significantly higher as compared to pre-COVID period (Table 4).

DISCUSSION

In the present study, it was found that the prevalence of CVS was 54.9% during COVID period and 46.9% in pre-COVID period. Similar prevalence of CVS was observed among call center operators by Sa et al.,[8] in Sao Paulo, Brazil and among school children by Hashemi et al.,[9] in Iran with CVS prevalence of 54.6% and 49.4%, respectively. Some of the other studies reported higher prevalence of CVS than

Table 4: Comparison of average hours spent on digital screen per day during pre-COVID and COVID period (n=337)

Variable	Pre-COVID	COVID	Significance
Average hours spent on digital screen per day			
0–4 h	265 (78.6)	82 (24.3)	P<0.001
>4 h	72 (21.4)	255 (75.7)	

the present study such as the study done by Noreen et al.,[1] among undergraduate medical students in Pakistan, Dessie

et al.,[2] among computer users in Ethiopia, Abudawood et al.,[3] among undergraduate medical students in Saudi Arabia, Touma Sawaya et al.,[7] among university students in Lebanon, Sivapriya et al.,[10] among women IT professionals in Chennai, Reddy et al.,[11] among university students of an International medical university in Malaysia, Mekonnin et al.,[12] among secretary employees of a university in Ethiopia, Altalhi et al.,[13] among health science students in Saudi Arabia, Iqbal et al.,[14] and among medical students in Egypt showed prevalence of CVS to be 67.2%, 69.5%, 95%, 67.8%, 62.6%, 89.9%, 75.6%, 97.3%, and 86%, respectively.

In the present study, eye strain was the most common symptom reported followed by headache and others, which is in accordance with the finding of the studies conducted by Sa et al.,[8] Thomas et al.,[15] and Ahmad et al.[16] The most common symptom of CVS varied in other studies, like the study done by Noreen et al.,[1] reported irritation of eyes, Dessie et al.,[2] Mekonnin et al.,[12] and Iqbal et al.,[14] showed blurred vision, Abudawood et al.,[3] showed neck, shoulder, or back pain, Logaraj et al.,[4] showed shoulder pain, Sawaya et al.,[7] Sivapriya et al.,[10] Reddy et al.,[11] Altalhi et al.,[13] Ranasinghe et al.,[17] and Singh et al.,[18] showed headache, Talwar et al.,[19] Shrivastav and Bobhate,[20] and Mowatt et al.,[21] showed pain/stiffness in neck, Shantakumari et al.,[22] burning sensation in eyes, and Hashemi et al.,[9] documented watering as the most common symptom.

In the present study, the prevalence of CVS was only significantly associated with use of eye wear. In the recent past, numerous other studies did find significant association of CVS prevalence like, with duration of screen time by Noreen et al.;[1] with income, occupation, screen time, taking regular breaks, knowledge of protective measures, and previous history of eye illness by Dessie et al.;[2] with sex, astigmatism, dry eye disease, duration of studying, distance from the screen, and brightness of the screen by Abudawood et al.;[3] with computer distance, screen viewing, use of antiglare screen, and frequent breaks by Logaraj et al.;[4] with age, time spent in communication, screen time, pattern of using the device, use of eye drops, taking regular breaks, and use of adjustable screens by Sawaya et al.;[7] with duration of computer use, use of spectacles, looking at far away object, eye massage, use of eye drops, and level of computer screen by Reddy et al.;[11] with duration of occupation, time spent on screen, awareness of preventive methods, adjustment of computer brightness by Mekonnin et al.;[12] with sex, use of glasses, observance of glare on the screen by Altalhi et al.,[13] with gender, duration of occupation, hours of computer use, pre-existing eye disease, use of VDT filter, use of contact lens, and use of ergonomics by Ranasinghe et al.[17]

CONCLUSION

Our study provides insight about the CVS, among medical undergraduate students of a medical institution of Kumaon region, in pre-COVID and during COVID era. A surge in CVS among study participants during COVID era was observed, as students spent more hours on the digital screen and also they either reduced taking preventive measures or were not taking at all. Hence, it becomes the absolute necessity to give more emphasis on this issue and spread awareness so that individuals especially the young ones, adopt preventive measures to curb the occurrence and prevalence of CVS.

REFERENCES

1. Noreen K, Batool Z, Fatima T and Zamir T. Prevalence of computer vision syndrome and its associated risk factors among under graduate medical students. Pak J Ophthalmol. 2016;32(3):140-146.

2. Dessie A, Adane F, Nega A, Wami SD and Chercos DH. Computer vision syndrome and associated factors among computer users in Debre Tabor town, Northwest Ethiopia. J Environ Public Health. 2018;2018:1-8.
    https://doi.org/10.1155/2018/4107590

3. Abudawood GA, Ashi HM and Almarzouki NK. Computer vision syndrome among undergraduate medical students in King Abdulaziz university, Jeddah, Saudi Arabia. J Ophthalmol. 2020;2020:1-7.
    https://doi.org/10.1155/2020/2789376

4. Logaraj M, Priya VM, Seetharaman N and Hedge SK. Original article practice of ergonomic principles and computer vision syndrome (CVS) among undergraduates. Natl J Med Res. 2013;3(2):111-116.

5. Al Tawil L, Aldokhayel S, Zeitouni L, Qadoumi T, Hussein S and Ahamed SS. Prevalence of self-reported computer vision syndrome symptoms and its associated factors among university students. Eur J Ophthalmol. 2020;30(1):189-195.
    https://doi.org/10.1177/1120672118815110

6. Agarwal S, Goel D and Sharma A. Evaluation of the factors which contribute to the ocular complaints in computer users. J Clin Diagn Res. 2013;7(2):331-335.
    https://doi.org/10.7860/JCDR/2013/5150.2760

7. Sawaya RI, El Meski N, Saba JB, Lahoud C, Saab L, Haouili M, et al. Asthenopia among university students: The eye of the digital generation. J Fam Med Prim Care. 2020;9(8):3921-3932.
    https://doi.org/10.4103/jfmpc.jfmpc_340_20

8. Sa EC, Ferreira Junior M and Rocha LE. Risk factors for computer visual syndrome (CVS) among operators of two call centers in São Paulo, Brazil. Work 2012;41(Suppl 1):3568-3574.
    https://doi.org/10.3233/WOR-2012-0636-3568

9. Hashemi H, Khabazkhoob M, Forouzesh S, Nabovati P, Yekta AA and Ostadimoghaddam H. The prevalence of asthenopia and its determinants among schoolchildren. J Compr Pediatr. 2017; 8:1-6.
    https://doi.org/10.5812/compreped.43208

10. Sivapriya KR, Shah PB and Sathiyasekaran BW. Evaluation of visual problems among women IT employees in Chennai. Int J Community Med Public Health. 2018;5(10):4327-4330.

https://dx.doi.org/10.18203/2394-6040.ijcmph20183968

11. Reddy SC, Low CK, Lim YP, Low LL, Mardina F and Nursaleha MP. Computer vision syndrome: A study of knowledge and practices in university students. Nepal J Ophthalmol. 2013;5(2):161-168.

https://doi.org/10.3126/nepjoph.v5i2.8707

12. Mekonnin TL, Mohammed IS, Yohannes M, Ashete AG and Leyla TA. Computer vision syndrome and its predictors among secretary employees working in Jimma University, Southwest Ethiopia. J Environ Occup Health. 2021;11:27-36.

13. Altalhi AA, Khayyat W, Khojah O, Alsalmi M and Almarzouki H. Computer vision syndrome among health sciences students in Saudi Arabia: Prevalence and risk factors. Cureus. 2020;12(2):e7060.

https://doi.org/10.7759/cureus.7060

14. Iqbal M, El-Massry A, Elagouz M and Elzembely H. Computer vision syndrome survey among the medical students in Sohag university hospital, Egypt. Ophthalmol Res An Int J. 2018;8:1-8.

https://doi.org/10.9734/OR/2018/38436

15. Thomas J, Vasudha K, Sankar N and Jacob GP. Prevalence of ocular symptoms among computer professionals in a university setting in South India. J Evol Med Dent Sci. 2014;3(69):14777-14786.

https://doi.org/10.14260/jemds/2014/3985

16. Ahmad A, Alshehri B, Almalki A, Albaradi A, Almalki M and Alattas K. Eyeing computer vision syndrome: Awareness, knowledge, and its impact on sleep quality among health sciences students during the COVID-19 pandemic in Taif, Kingdom of Saudi Arabia. Int J Med Dev Ctries. 2021;5(9):1647-1654.

https://doi.org/10.24911/IJMDC.51-1627643005

17. Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, et al. Computer vision syndrome among computer office workers in a developing country: An evaluation of prevalence and risk factors. BMC Res Notes. 2016;9:150.

https://doi.org/10.1186/s13104-016-1962-1

18. Singh H, Tigga MJ, Laad S and Khan N. Prevention of ocular morbidity among medical students by prevalence assessment of asthenopia and its risk factors. J Evid Based Med Healthc. 2016;3:532-536.

19. Talwar R, Kapoor R, Puri K, Bansal K and Singh S. A study of visual and musculoskeletal health disorders among computer professionals in NCR Delhi. Indian J Community Med. 2009;34(4):326-328.

https://doi.org/10.4103/0970-0218.58392

20. Shrivastava S and Bobhate P. Computer related health problems among software professionals in Mumbai: A cross-sectional study. Int J Health Allied Sci. 2012;1:74-78.

https://doi.org/10.4103/2278-344X.101684

21. Mowatt L, Gordon C, Santosh AB and Jones T. Computer vision syndrome and ergonomic practices among undergraduate university students. Int J Clin Pract. 2018;72(1):e13035.

https://doi.org/10.1111/ijcp.13035

22. Shantakumari N, Eldeeb R, Sreedharan J and Gopal K. Computer use and vision-related problems among university students in Ajman, United Arab Emirate. Ann Med Health Sci Res. 2014;4(2):258-263.

https://doi.org/10.4103/2141-9248.129058

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MM and MM- Concept and design of the study, data collection, and reviewed the literature. **P-** Statistical analysis and manuscript writing. **MNAK-** Statistical analysis and interpretation and preparation of manuscript. **SA-** Preparation of manuscript. **SP-**Preparation of manuscript.

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