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Original Research Article

Prevalence of computer vision syndrome and associated ocular morbidity in a tertiary care hospital

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ABSTRACT

Background: This study was done to determine the prevalence of computer vision syndrome and associated ocular morbidity in a tertiary care hospital.
Methods: A cross sectional observational study was conducted on 673 patients based on the inclusion criteria. The patients were asked to fulfil the computer vision syndrome survey form 3 and OSDI questionnaire. Spontaneous eye blink rate, Schirmer's test 1, tear break up time, refraction were performed for these patients. Data was collected and analysed by SPSS software.
Results: The prevalence of computer vision syndrome was 73% with 294 males and 206 females. The mean age of the patients was 30.29 years. Most of the participants were between 21-30 years. The screen time for most of the study participants (59.80%) came out to be >6 hours/day on average. The chief complaint of majority patients was blurred vision and asthenopia whereas the secondary complaint was watering and headache. Maximum patients (38.20%) from our study were students and competitive exam aspirants followed by teachers and software engineers. The screen modality used by 34.20 % patients was mobile phones > laptops. The mean SEBR was 13.50 minutes. The mean OSDI was 17.44. The screen time was significantly correlated to SEBR ($p<0.0001$). Also the screen time and OSDI correlation came out to be significant ($p<0.0001$).
Conclusions: The present study revealed a significantly high prevalence of CVS among our patients. The ocular symptoms are predominantly affecting the convergence power of eyes and tear film instability causing blurred vision and dryness.

Keywords: Computer vision syndrome, SEBR, TBUT

INTRODUCTION

The Indian subcontinent in the last few decades has witnessed a rapid socio-economic development. Advancement in the field of technology, resulting in increased computer literacy and usage. Especially the COVID-19 era has witnessed an immense surge of patients suffering from the computer vision syndrome. The repetitive and prolonged usage of digital screen either for the online studies, work or for entertainment purposes has caused detrimental effects on the ocular health and quality of vision.

Computer vision syndrome, defined by the American Optometric Association as a complex of eye and vision problem related to activities which stress the near vision and which are experienced in relation to or during the prolonged use of digital screens.[1]

The symptoms experienced in computer vision syndrome are caused by three potential mechanisms: (i) extra ocular mechanism, (ii) accommodative mechanism, (iii) ocular surface mechanism.[2] Extra ocular mechanism causes musculoskeletal symptoms such as neck stiffness, pain, headache, back ache and shoulder pain.

Accommodative mechanism causes blurring of vision, double vision, presbyopia, myopia and slowness of focus change.

Ocular surface mechanism causes symptoms such as dryness of the eyes, redness, gritty sensation and burning after extended period of computer usage.

Prevalence of computer vision syndrome has not been studied in this north eastern part of India. Computer vision syndrome as such is highly under diagnosed disease since there is no standard criteria or any defining cut off limits is available to classify this syndrome as CVS. Prevalence of CVS can be highly variable and its dependent on whether we diagnose this syndrome based on only symptoms, only sign or based on both signs and symptoms.

This study thus adds, hospital-based prevalence of CVS in this north eastern India. Discusses about the spectrum of symptoms that come under CVS that could aid in better knowledge and understanding of this syndrome. Enlightens about distribution of CVS among various occupation and profession so that they can adapt preventive measures on time and work with better ergonomic conditions.

METHODS

This was a cross sectional, observational study conducted at our tertiary eye hospital, over a span of one year from December 2021-December 2022.

Based on the previous study conducted the prevalence of computer vision syndrome was 75% therefore by using relative margin error of 10% and fixing alpha error to be 0.05 and adding 10% non-responders, the total sample size was calculated to be 673 patients.

Considering the per day attendance in OPD of ophthalmology (R.I.O. Prayagraj) to be around 300 patients, it was decided to select 50 patients via systematic random sampling in one OPD every week to achieve the sample size of 673 patients over a period of one year.

Inclusion criteria

Patients greater than 10 years who gave consent who used digital screens >2 hours/day.

Exclusion criteria

We excluded the patients less than 10 years of age. Patients with keratoconus, amblyopia, corneal scarring, facial palsy, lid disorders, meibomian gland disorders, active keratitis and conjunctivitis were also excluded. Patients having history of previous use of any topical medications other than tear supplements were also excluded. Patients using any systemic medications like diuretics, beta blockers, oral contraceptive pills, antidepressants, antihistamines were excluded. We also excluded patients with previous history of ocular trauma, chemical injuries, refractive surgery, previously diagnosed case of dry eye, Steven Johnson syndrome, ocular cicatricial pemphigoid, trachoma, Riley-Dey syndrome.

After explaining the procedures, all patient included in the study, signed an informed consent and underwent a comprehensive history taking with emphasis on history pertaining to the computer vision syndrome e.g. history of usage of contact lens, visual display terminals including television, smartphone, laptops, desktop. Their average screen time hours per day. The mode of visual display terminal used like smartphone, tablet, laptop, desktop, television.

History pertaining to the computer vision syndrome via CVS survey form used in the previous studies is shown in Figure 1.

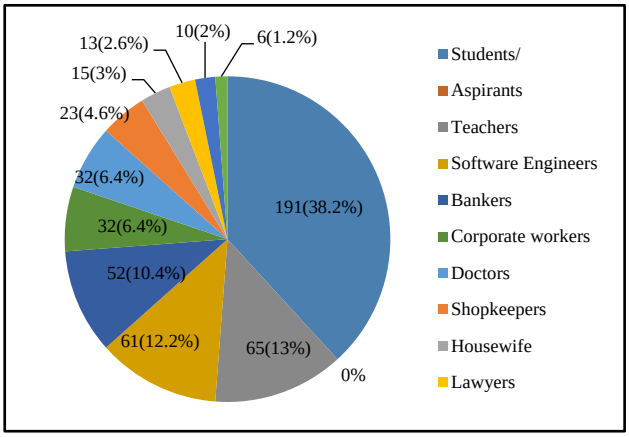

Figure 1: Number and percentage of patients under various occupations.

Patients who used screens >2 hours per day and were symptomatic were then asked to fill the OSDI Questionnaire.

Based on the CVS survey form and OSDI score, we shortlisted a total of 500 patients who were diagnosed with CVS and then these patient's symptoms were categorized and the patients suspected for dry eye were further undertaken for tear film stability tests (TBUT test) and Schirmer's tests.

RESULTS

In the present study group of 673 patients, we diagnosed a total of 500 patients to be suffering from CVS with 294 (58.80%) were males and 206 (41.20%) females as shown in the Figure 8.

Table 1: Number and percentage of patients with their TBUT range.

TBUT range (seconds)	No. of patients	%	Calculated χ^2 value	Critical χ^2 value	P value	Statistical inference
<10	38	07.60	219.179	3.841	<0.0001	Significant
≥10	462	92.40				

Table 2: Number and percentage of patients with their SEBR range.

SEBR range (seconds)	No. of patients	%	Calculated χ^2 value	Critical χ^2 value	P value	Statistical inference
<12	135	27.00	22.720	5.991	<0.0001	Significant
12-15	240	48.00				
>15	125	25.00				

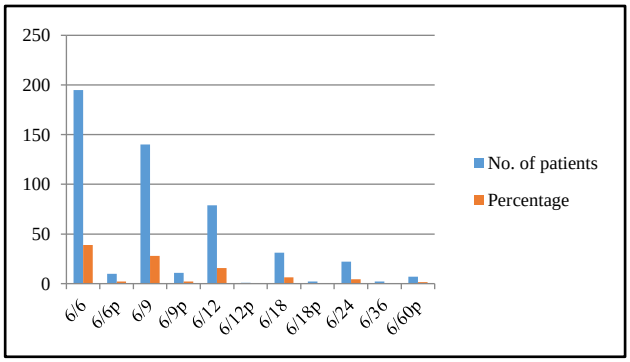

Figure 2: Number and percentage of patients with their visual acuity.

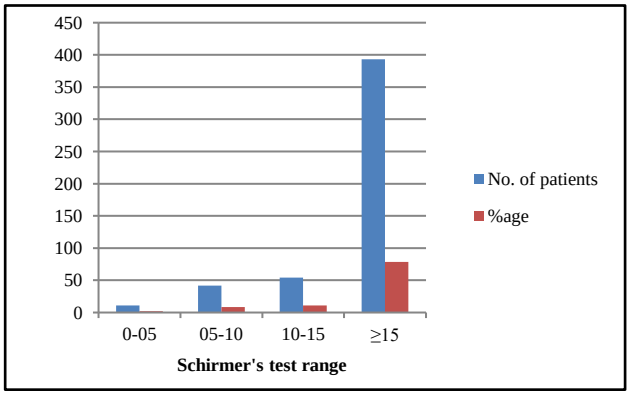

Figure 3: Number and percentage of patients with various Schirmer's test range.

The mean age of the patients in the study group was 30.29±08.88 years. Maximum 202 patients were in the age group of 20-30 years (40.40%) followed by 183 patients in age group 30-40 years (36.60%) as shown in Figure 7.

Maximum 191 patients were students/aspirants (38.20%) followed by 65 teachers (13.00%), 61 software engineers (12.20%) and 52 bankers (10.40). Corporate workers and doctors contributed equal 32 patients (06.40%). 23 shopkeepers and 06 professors (01.20%), were other contributors to the patients population in decreasing order.

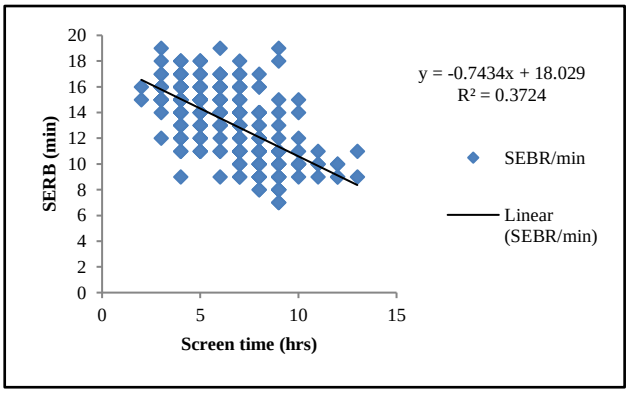

Figure 4: Correlation between screen time and SEBR.

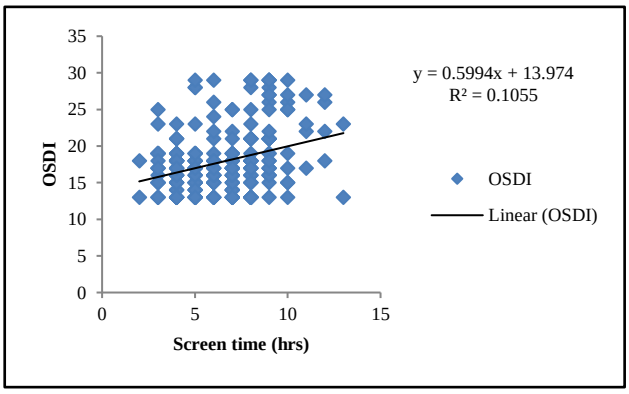

Figure 5: Correlation between OSDI and screen time.

Maximum 171 patients (34.20%) reported use of mobile phones followed by 136 patients with laptop (27.20%) and 116 patients with desktop computers (23.20%). Thus, Mobile phones appears to be the most exploited device for causing this syndrome. 50 patients used tablets/I-pads (10.00%) and 27 patients television (05.40%) for their screen time.

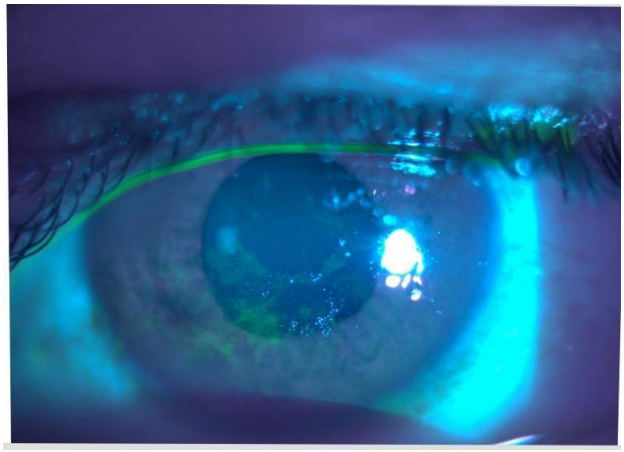

Figure 6: CVS patient with severe dry eye, OSDI score 27, TBUT < 8 seconds, Schirmer's test <5 mm.

Maximum 227 patients (45.40%) had vision of 6/6, followed by 92 patients (18.40%), 62 patients (12.40%), 39 patients (07.80%), 21 patients (04.20%), 15 patients (03.00%) with vision of 6/9, 6/12, 6/18, 6/36 and 6/24 respectively.

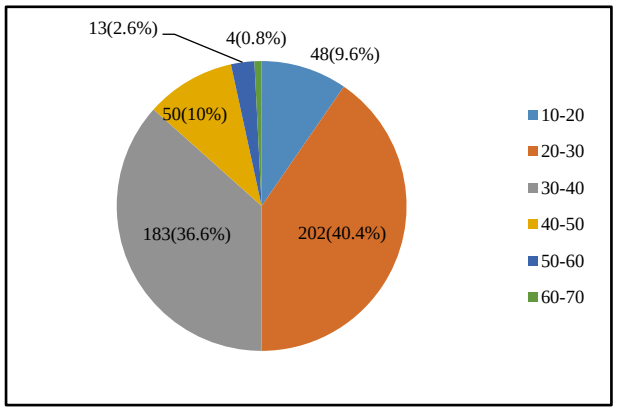

Figure 7: Age related distribution of the patients diagnosed as CVS.

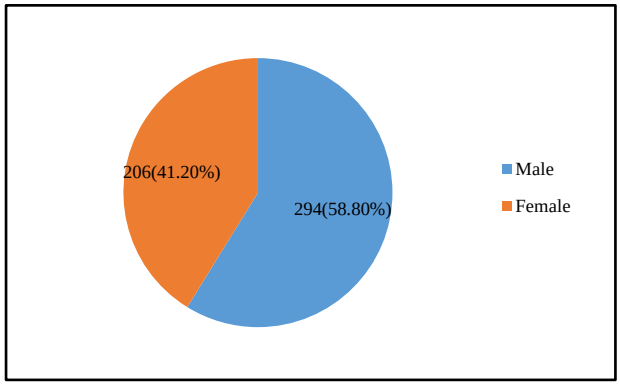

Figure 8: Gender profile of study group.

Maximum 299 patients (59.80%) spend ≥06 hours in front of screen, followed by 197 patients (39.40%) who spend 03-06 hours. Only 04 patients (00.80%) used screen time for 01-03 hours.

Maximum 87 patients (17.40%) had blurred vision as main complaint, followed by 55 patients (11.00%), 47 patients (09.40%) with asthenopia and grittiness as chief complaints. Watering and eye strain was reported by 42 patients (08.40%). Headache, redness, itching, dryness and double vision was claimed by 41 (08.20%), 39 (07.80%), 36 (07.20%), 28 (05.60%), 26 (05.20%) patients respectively. Eye ache and foreign body was reported by 21 (04.20%) patients each. 15 (03.00%) patients reported burning as chief complain.

Maximum 122 patients (24.40%) had watering as secondary complain, followed by 88 patients (16.00%) reported headache.

Maximum 305 patients (61.00%) had complaint from 01-04 weeks, followed by 101 patients (20.20%) from 04-08 weeks.

Maximum 388 patients (77.60%) claimed none medical/treatment history.

Mean Schirmer's test I value for right eye was 21.29±7.92 mm. Maximum 391 patients (78.20%) had range of ≥15 mm followed by 55 (11.00%), 39 (07.80%) and 15 (03.00%) with range of 10-15, 05-10 and 0-05 mm respectively. Mean Schirmer's test I value for left eye was 21.76±11.35 mm. Maximum 393 patients (78.60%) had range of ≥15 mm, followed by 54 (10.80%), 42 (08.40%) and 11 (02.20%) with range of 10-15, 05-10 and 0-05 mm respectively.

Tear breakup time for right eye was 20.94±7.33 seconds. Maximum 462 patients (92.40%) had range of ≥10 seconds. Only 38 (07.60%) had range <10 seconds. Maximum 461 patients (92.20%) had range of ≥10 seconds. Only 38 (07.80%) had range <10 seconds.

Mean spontaneous eye blink rate was 13.50±2.86 minutes. Maximum 240 patients (48.00%) had range of 12-15 seconds followed by 135 (27.00%) patients in the range in <12. Mean ocular surface disease index score was 17.44±3.79 (mode 13). Maximum 447 patients (89.40%) had range of 13-22.

Screen time was insignificantly correlated to the Schirmer's test value for both right eye (r=-0.052 p=0.245) and left eye (r=-0.062 p=0.166). Screen time was insignificantly correlated to the TBUT for both right eye (r=-0.072 p=0.077) and left eye (r=-0.079 p=0.077).

Screen time was significantly correlated to the spontaneous eye blink rate (SEBR) (r=-0.416 p<0.0001) Screen time was significantly correlated to the ocular surface disease index (r=0.245 p<0.0001).

DISCUSSION

From our study conducted on a total of 673 patients, we found that the prevalence of computer vision syndrome among the patient to be 73%. Similar results were obtained by Talwar et al, Iwakiri et al who reported 76% and 72% prevalence in their study group.[3,4] A study performed by Sanjeev et al who observed prevalence of CVS among computer operators to be 74%.[5]

In our study male patients were comparatively greater (58.8%) than female patient (41.2%), showing male preponderance. Reason behind this could be the dominance of males over females in corporate jobs and education. This result is similar to the study done by Anjila et al in which male patients turned out to be 64% and female, 36%.[6] Also the study conducted by Ranju et al showed male preponderance of 76.2% over females 23.8%.[7]

About 40.4% of our patients having CVS where in age range of 21-30 years. Similar results were found by Talwar et al in their study 58.5% of individuals where in the 21-30 years.[3] Since most of the patients who visited our hospital for their CVS symptoms, belonged to the students & competitive exam aspirants group therefore they fall under this age group. Also, mobile phones and technical devices are more exploited by the people of age 20-30 years, who are sort of addicted and very dependent on these digital devices for their day to day activities in addition to their academic needs.

The patients who were mostly affected by CVS were college students, exam aspirants (38.20%) followed by software engineers (12.2%), bankers and people working as technicians. Figure 1 depicts the same. These people were more prone to develop CVS since they are being exposed to digital screens almost 9-10 hours per day on an average either for academic studies or either job and work related.

The screen modality that was most exploited and responsible for causing CVS was mobile phones and cell phones. With the recent technology advances, our mobile phones have replaced Television, radio, calculator, watch and alarm clocks. With the emergence of social media, the youth especially people 10-30 years have developed an addiction for social media use like Facebook, Instagram, YouTube. Not just it is affecting our youth, even our old age population, in order to pass their leisure time have started turning towards mobile phones, which keeps them entertained.

Vision remained 6/6 in 45.40% patients still some of them had mild blurring of vision as compliant because of the decreased contrast sensitivity, due to constantly using digital screens as shown in Figure 2. Since in our study Pelly Robertson chart was not used for determining this decrease in contrast sensitivity responsible for blurred vision as compliant even after having a 6/6 vision, this can be our limitation. Blurring of vision is also majorly due to decrease in accommodation and convergence owing to the long hours usage of digital devices.

Screen time correlation with computer vision syndrome was found to be significant and most of the patients 59.8% used digital screen for more than 6 hours. We found that computer users who worked for 4-8 hours per day were found comparatively more symptomatic than the ones who used digital screen less than 3 hours. Talwar et al concluded the same results.[3] Similar results were observed in studies conducted by Shrivastava and Bobhate that ocular symptoms experienced by the patients increased with working hours on computer screens.[8]

In our study, most common ocular complaint was blurred vision 17.4% and watering 24.4%.

In study conducted by Talwar et al, the prevalence of blurred vision was 13.2%.[3] Other studies also support the symptom of blurred vision associated with computer use. Rosenfield in his study, has demarcated a significant difference in the median score with regard to blurred vision during the computer task compared to a hard copy print out of the material.[9]

On the basis of OSDI, 89.4% had mild dry eye and 10.6% patient had moderate dry eye. Similar results were obtained by Rosenfield et al.[9] They reported 21% mild, 12% moderate and 18% severe, according to SDI data.

On the basis of Schirmer's test dry eye was present in 21.8% shown in Figure 3.

On the basis of TBUT, dry eye was present in 7.6%. Overall dryness was present in approximately 8% patient which again corresponds to the percentage of patient who came with dryness as main complaint (6.8%) as shown in Table 1.

The mean spontaneously eye blink rate was 13.5 second. Only 27% patient had SEBR <12 second as shown in Table 2.

TBUT and Schirmer's test where insignificantly correlated with screen time while the spontaneous eye blink rate (SEBR) should show positive correlation with screen time with p value <0.001 shown in Figures 4 and 5. This shows that CVS reduces our blink rate patters causing for evaporative dry eye like symptoms. Also OSDI score showed positive correlation with screen time with p value <0.001 proving that longer the screen time, the more symptomatic the patient is going to become.

Our study has limitations since it was a cross sectional study therefore this limits the study to deduce causality and risk factors associated with computer vision syndrome. The other limitation is it was a "hospital-based study" and thereby it cannot represent the exact prevalence of the disease at the community level.

CONCLUSION

This study proves that the computer vision syndrome is a highly prevalent and highly under diagnosed disease. Due to high cognitive demand and continuous gazing the eye blink rate get gets affected causing dry eye and grittiness like symptoms. More the screen time more is the symptomatology of the patient. These results denote a need for improved awareness about CVS so that better methods of diagnosis and precautionary management can be followed to prevent or delay the onset of this disease.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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