Original Research Article

A study of computer vision syndrome at a Medical College in Surendranagar district, Gujarat

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Abstract

Background: This study was carried out at a medical college in Gujarat state to know the incidence and prevalence of computer vision syndrome and associated factors in medical students and faculties. **Materials and Methods:** It was a cross sectional questionnaire based study. Data was collected after written consent from the medical/internship students and medical college/hospital faculties to know their demographic profile, patterns of computers/mobiles and other visual display terminal usage, their symptoms regarding computer vision syndrome, and use of any specific precautions to reduce the effects of computer vision syndrome. Data was analysed using Microsoft Excel 2016 programme. **Results:** The sample size was 315 medical students and faculties. Mean age of the participants was 21.9 ± 4.5 years. The prevalence of computer vision syndrome was 71.75% in study population. Headache (23%), asthenopia (10%) and dry eyes (7%) were the most consistent features. VDT usage of more than 2 hours per day, dry eyes, previous refractive surgeries and not using protective measures were significantly associated with occurrence of CVS symptoms. **Conclusion:** This study revealed that more 71% medical students and faculties experienced one or more symptoms of Computer Vision Syndrome. Duration of mobile and Computer usage of more than 2 hour per day, pre-existing eye diseases, refractive surgeries/LASIK and not using specific protective measures were associated factors for the incidence of computer vision syndrome.

Key Words: Computer Vision Syndrome, Gujarat, Visual Hygiene, Gujarat

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INTRODUCTION

Nothing has affected our lives as much as technological advancements in the last 20 years. Initially Computers which later became laptops and then evolved into smart phones have made a tremendous impact upon our quality lives. Initially a luxury, and now a necessity, they are all around us in various unimaginable forms. We interact with a computer/mobile on a colour display mostly made up of LCD/LED technology. Computers have become so common to our life that it is estimated that almost 80% jobs in the year of 2017 required some form of computer knowledge.[1] With newer innovations and conveniences comes a newer set of side effects. This dependency isn't without any side-effects or disadvantages, it is estimated that computer or laptop usage even for 2 hours a day can lead to systemic, ocular and psychosomatic side effects. [2]The American Optometrist Association have given the definition of Computer vision syndrome as a "complex of systemic and visual conditions which results from excessive near work stress due to the use of digital screen and/or digital screen environment which includes all kind of displays like mobiles, tablets, computers and electronic book readers."[3] The visual symptoms are headache, eye strain, blurring of vision, redness burning and double vision. These conditions are due to individual visual conditions, poor habits as well as poor working

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conditions.[5,6,7] These symptoms are further exaggerated by inadequate lighting conditions or air blowing upon eyes in air conditioned climates in large corporate offices.[7] The systemic complaints are headaches, backaches, joint pains, wrist pain, neck pain, disturbed sleep etc. which are caused by sitting in front of computers/laptops for prolonged periods of time which are linked to increased stress on the back, neck, arms, and even legs as well as visual stress.[4] Some study have even revealed that psychosomatic disorders and depression are increased with computer usage, especially when operating time is more than 30 hours per week and usage of more than 10 years.[8] Among somatic and visual symptoms, the visual display terminal users are more prone for ocular symptoms.[3,4] Today computer vision is considered as an epidemic. The prevalence of CVS ranges from 64% to 90% among computer users in major cities.[3] Smart phones and recent rise of mobile phone applications are a major culprit for these symptoms, in addition the recent rise of mobile and internet revolution, the constant reduction of internet data prices and readily availability of large screen mobile phones/smartphone at an early age have created a specific type of ocular issues which are on rise. [4] The prolong use of smartphones as well as tablets especially at dark, dim lighting conditions like night time gives rise to specific complains like eyestrain, tired eyes, irritation, redness, blurred vision, and double vision, collectively referred to as computer vision syndrome. [5, 6] To know the scale of this condition in our context we need to be aware of that India is the biggest smart phone market after china. [9] There are almost 800 million registered mobile phone users in India among of them 60% are smartphones. India has the cheapest data plans in the world. [9, 10] The readily availability of internet and cheaper data plans also plays a major part in daily addiction/overuse to smart phones. Mobile phone overuse up to the level of addiction is noticeable in certain young age groups.[10] Mobile phone overuse is an addiction noticeable among certain mobile phone users. Overuse is defined as a "dependence syndrome" which is the term used by the World Health Organization (WHO Expert Committee, 1964) to displace the word addiction or habituation.[11] Overuse is classified under ICD-10 as a behavioural problem (mobile phone addiction). The overuse pattern varies between genders and age groups. In India it is stated to be around 39-44% in younger age groups.[12] A recent study from South Korea had identified more than 30% participants as having a risk for smartphone addiction according to smartphone addiction proneness scale, while a behavioural analytic study from Malaysia found to have more than 65% participants having some form of dependency. [13, 14]A person who is staring at a mobile phone constantly have reduced blinking rate, as he is trying to read from a smaller screen, the facial, neck and shoulder muscles are contracted. Also the muscles becomes fatigued and vision becomes blurred. Reading in the bed is proven to affect sleep cycles recently. The digital screen radiates blue lights which reduced melatonin levels, which is shown to be responsible for disturbed sleep cycles and lack of non REM sleeps. [15, 16]There is a lack of survey literature in young adults in this part of India especially medical students. This study was carried out to have glimpse of CVS in these students.

MATERIALS AND METHODS

A cross sectional study was conducted among the medical students and staff/faculty at a medical college situated in Surendranagar district, Gujarat. A pilot study was carried out among 20 medical students to understand the participants better and the survey form was edited later with suggestions from participants as well as senior ophthalmologists for better understanding of the questions. The questionnaires were also revised from our Social Medicine Department as well as Psychiatric Department for better composition of questionnaires. Following this, the questionnaires were distributed among the students and faculties. All the participants were given a pre-tested, pre-structured questionnaire which included their demographic profile, their daily usage pattern and preferences, hours of VDT (Video Display Terminal is a term used, especially in ergonomic studies, for the computer/mobile displays which are made of LCD or LED technologies) usage, common complaints regarding mobile and computer use, their knowledge an attitude about computer vision syndrome (CVS), complains regarding disturbed sleep and their willingness to counteract the computer vision syndrome and precautions taken to prevent further progression of computer vision syndrome. Inclusion criteria: All the MBBS/Internship students and medical collage/hospital faculties who were using mobile phones and computers for at least 1 months preceding the study were included in this study. Exclusion criteria: History of chronic systemic illness, students on medications for a current medical disease and those who do not consent to the study were excluded. Data Analysis: The data were analysed using the Microsoft Excel 2016. The outcome variable of this study was computer vision syndrome (CVS).

RESULTS

A total 500 questionnaires forms were distributed across the study participants based upon the inclusion criteria. 315 participants returned the forms filled and signed successfully. The response rate was 63%. Total number of male participants was 171 (54%) while the female

participants were 144 (46%). The male to female ratio was 1:0.8. The youngest participant was of 18 years of age, the oldest participant was of 62 years of age. Mean age of the participants was 21.9 ± 4.5 years (male 22.5 ± 4.3 and female 21.3 ± 4.7 years). Almost all of the participants (98%) were using mobile phone on the daily bases. 43% students were using tablets additionally. Around 25% students were using computers, while only 14% of the students were using electronic book readers (Amazon Kindle etc.). [Table 1, 2]Table 3.1 and 3.2 shows the frequency distribution of study participants based upon their digital screen time usage. 9% participants were using their digital screen for more than 6 hours while 40% participants were using their digital screen for 2 to 4 hours. More than 24% participants tends to keep screen illumination between 10 to 30 %. 5% participants used to keep their screen at maximum brightness. 26% users used to have auto-brightness enabled (table 4). Headache was the most common symptom observed throughout the study. The prevalence of symptoms ranges from headaches (23%), fatigue of eyes (7%) and dry eyes (6%). Disturbed sleep (11%) and waking up with headache (11%) the next morning was a characteristic finding (table 5).A total of 226 participants reported a history of one or more symptoms of CVS, so the prevalence of CVS was found to be 71% (table 6). Among the first year students the prevalence was 82% (78/104), while in interns it was highest 86% (39/46). The prevalence in the medical faculties was 74% (10/16) (table 6). 43 participants (14%) had a history of dry eye whereas 32 (11%) participants had a history of previous refractive surgery, mostly LASIK (table 7.1 and 7.2).Table 8 shows distribution based upon digital screen usage in years. 25% population has been using VDT (visual display terminal) for more than 5 years. In our study we didn't find statistical significant correlation of CVS symptoms with the duration of years of usage. Social media and multimedia were the most time consuming content upon their screens (table 9). 62% participants had described long time VDT usage at night having deteriorating effects upon sleep quality like morning headaches and reduced sleep quality (table 10). Almost three fourth of the study population had one or more above described symptoms of CVS. We didn't find statistical significance in the prevalence of CVS between male and female participants (p=0.938) (table 15). Majority of the participants (92%) were aware of harmful effects of mobiles and computer displays. Students who used mobiles/computers for more than 2 hours a day experienced symptoms of CVS significantly more (p<0.05) often than those who used mobiles/computers up to or less than 2 hours (table 11). Participants with a history of dry eye (p=0.002) and previous refractive surgery (p=0.0008) experienced symptoms of CVS more than those participants without above said conditions (table 12, 13). Dry eyes and previous refractive surgeries are a definite associated factors for CVS. Participants who were using any kind of filters devices/apps (Blue light filter, Lux light, BandW filter) to protect them were having significantly less symptoms of CVS compared to those who were not (p=0.035) (table 14).

Table 1: Male female distribution

Sex	n	%
Male	171	54.29
Female	144	45.71
Total	**315**	**100.00**

Table 2: Cadre wise distribution

Cadre	n	%
1st year	104	33.02
2nd year	80	25.40
3rd year	69	21.90
Intern	46	14.60
Medical Faculty	16	5.08
Total	**315**	**100.00**

Table 3.1: Frequency distribution based upon digital screen usage in hours

Spend time on digital screen daily (in Hour)	n	%
<1	14	4.44
1-2	65	20.63
2-4	130	41.27
4-6	78	24.76
>6	28	8.89
Total	**315**	**100.00**

Table 3.2: Frequency distribution based upon digital screen usage in hours

Spend time on digital screen daily (in Hour)	n	%
<6	287	91.11
>6	28	8.89
Total	**315**	**100.00**

Table 4: Frequency distribution based upon digital screen illumination

Level (in %)	n	%
<10	51	16.19
10-30	78	24.76
30-50	51	16.19
50-70	39	12.38
Max brightness	14	4.44
Auto brightness	82	26.03
Total	**315**	**100.00**

Table 5: Distribution according to symptoms (multiple responses); n=512

Symptoms	N (n=512)	%
Headache	118	23.05
Fatigue	36	7.03
Dry eye	33	6.45
Eye strain	52	10.16
Blurred vision	36	7.03
Double vision	16	3.13
Eye redness	36	7.03
Neck pain	28	5.47
Difficulty in refocussing	25	4.88
Finger pain	21	4.10
Disturbed sleep	59	11.52
Waking up with headache	52	10.16
Total	**512**	**100.00**

Table 6: Prevalence of CVS

CVS	N	%
Present	226	71.75
Absent	89	28.25
Total	**315**	**100.00**

Table 7.1: Distribution according to previously diagnosed dry eye

Previously diagnosed dry eye	n	%
Yes	43	13.65
No	272	86.35
Total	**315**	**100.00**

Table 7.2: Distribution according to history of previous refractive surgery

Having refractive surgery	n	%
Yes	32	10.16
No	283	89.84
Total	**315**	**100.00**

Table 8: Distribution according to usage of digital screen

Usage of digital screen (in Years)	N	%
<1	49	15.56
1-3	97	30.79
3-5	92	29.21
>5	77	24.44
Total	**315**	**100.00**

Table 9: Distribution of the content according to time spent on digital screen

Type of content	n	%
Social media	133	42.22
Emails and texts	15	4.76
Music and movies	151	47.94
News	16	5.08
Total	**315**	**100.00**

Table 10: Distribution according to perceived effect of digital screen on sleep quality

Effect perceived on sleep quality	n	%
Yes	195	61.90
No	120	38.10
Total	**315**	**100.00**

Table 11: Distribution according to time spent on the digital screen

	CVS			CVS		
Spend time on digital screen daily (in Hr)	Present(n)	Absent(n)	Total	Present (%)	Absent (%)	Total
<2	11	68	79	13.9	86.1	100
>2	215	21	236	91.1	8.9	100
Total	**226**	**89**	**315**	**71.7**	**28.3**	**100**

$\chi 2 = 173.9$; df = 1; p = 0.000 which is <0.05

Table 12: Distribution according to previously diagnosed dry eye

	CVS			CVS		
Previously diagnosed dry eye	Present(n)	Absent(n)	Total	Present (%)	Absent (%)	Total
Yes	41	2	43	95.3	4.7	100
No	185	87	272	68.0	32.0	100
Total	**226**	**89**	**315**	**71.7**	**28.3**	**100**

$\chi 2 = 13.68$; df = 1; p = 0.002 which is <0.05

Table 13: Distribution according to refractive surgery

	CVS			CVS		
Having refractive surgery	Present(n)	Absent(n)	Total	Present (%)	Absent (%)	Total
Yes	31	1	32	96.9	3.1	100
No	195	88	283	68.9	31.1	100
Total	**226**	**89**	**315**	**71.7**	**28.3**	**100**

$\chi 2 = 11.095$; df = 1; p = 0.00086 which is <0.05

Table 14: Distribution according to protective measures taken to prevent/reduce CVS

	CVS			CVS		
Using Protection	Present	Absent	Total	Present	Absent	Total
Yes	73	40	113	64.6	35.4	100
No	156	49	202	75.7	24.3	100
Total	**226**	**89**	**315**	**71.7**	**28.3**	**100**

$\chi 2 = 4.437$; df = 1; p = 0.035 which is <0.05

Table 15: Distribution according to Gender

	CVS			CVS		
Sex	Present(n)	Absent(n)	Total	Present (%)	Absent (%)	Total
Male	123	48	171	71.9	28.1	100
Female	103	41	144	71.5	28.5	100
Total	**226**	**89**	**315**	**71.7**	**28.3**	**100**

$\chi 2 = 0.006$; df = 1; p = 0.938 which is >0.05

DISCUSSION

Now a days the revolution of mobile and computer technology had lead the world into a constantly connected lifestyle where our mobile and computer displays are the gateways to internet/world wide web and constantly updating world around us. We interact the world with these tiny windows of our mobiles/computers. The smartphones have become so common that now each and every teen and adult owns a smartphone. In addition the emergence of social media platforms like Facebook, Twitter and YouTube have revolutionised the way we spend our spare time. Mobile and computer gaming as well as gaming consoles like PlayStations are also on rise. Unfortunately this time comes at the expanse of a person's own social and family time. This might be consequential in the long term. [17]In this study the authors were trying to get a good overview of CVS symptoms in young MBBS students as well as senior faculties in a medical college at Gujarat state. Not so surprisingly more than 90% of students were using their smartphones for more than 2 hours a day, most of them were touch screen smart phones that made them prone to the effects of CVS. More than 65% of students were accustomed to watch multimedia content like movies and tele-series upon their smartphones. The prevalence of CVS in our study was 72%. Eye strain was recorded in 11% participants. The prevalence of headache in our study participants was 24%.Much higher prevalence of CVS is recorded in developed countries. Mutti and Zadnic reported the prevalence of CVS to be 75% in USA. [18] Similar higher incidence has been reported in European countries. Mocci *et al* from Italy reported the prevalence of asthenopia to be 31.9%. Sanchez and Roman from Spain reported the prevalence of asthenopia 68.5%. Another study from India by Bhandari *et al* reported 46.3% prevalence of asthenopia. The symptoms of like asthenopia, heaviness and watering of eyes are reported higher with increased duration of VDT usage. [19, 20, 21] Many studies have described female gender as having significant association with CVS. Individual symptom wise description by Lograj *et al*, males were more prone to redness, blurred vision and dry eyes whereas females were prone to headaches and watering. [22] In our study we didn't find any such specific gender difference among the symptoms. Lograj *et al* also reported a CVS prevalence of 80.3% in a study conducted upon 416 medical and engineering students at Chennai. 81.9% of engineer students and 78.6% engineering students were affected by CVS symptoms. 43% medical students and 45% engineer students reported headaches, the prevalence of headache was 24% in our study.[22] Talwar *et al* reported 29% prevalence of headaches where as Sen and Richardson reported 61% prevalence of headaches while another study by Kelwarson *et al* reported the prevalence of headache to be 17%. [23, 2, 24] A 795 university student survey in Malaysia by Reddy *et al* found the prevalence of CVS to be 89.9%. 18% of them were having headaches and 17% students reported eye strain. Reddy mentioned daily 3 hours of daily usage as the start of complaining CVS symptoms. [25] In a nationwide survey from Sri Lanka by the one year prevalence was 67.4% that was closer to our results of 72%. This study also reported the frequency of headaches 45%, dry eyes 31% and pain around eyes 28%. This study also described pre-existing eye disease and contact lens wear as a statistical risk factor. [26] In our study mobiles/computer usage of more than mere 2 hours was significantly associated with occurrence of CVS symptoms. Respondents who spent less than 1 hour upon mobile and computer have lowest visual symptoms. Shrivastava and Bhobhate reported the visual complaints to increase with increase working hours of mobile and computer. [27] Rehman and Sanip described CVS symptoms to be on the higher side in participants using VDT for more than 7 hours a day. [28] Mutti and Zandic from Italy reported pronounced visual symptoms in participants using VDT for more than 8-9 hours whereas Stella *et al* reported higher prevalence of symptoms in participant using more than 8 to 9 hours. [18, 29]

CONCLUSIONS

We concluded that CVS is a syndrome that is commonly ignored or misdiagnosed. Based on the data collected in the present study we concluded that more than three forth of the medical students and faculties experiences one or more symptoms of CVS. Headache was the most common symptom (24%) which was followed by eye strain (11%). Dry eye, eye strain, blurring of vision, were the common symptoms. Those students using mobiles/laptops for more than 2 hour a day were more prone to develop symptoms of CVS compared to those who were using less than 2 hours and using protective measures like display filters etc. Participants with history of dry eye and previously done refractive surgeries had statistically significant visual symptoms of CVS. However further follow-up studies are recommended to know the identifiable risk factors of CVS.

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