Digital eye strain among undergraduate medical students in a tertiary eye care hospital of south India – A questionnaire based study

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Abstract

Purpose: To assess the frequency of digital eye strain (DES) among undergraduate medical students in a tertiary eye care hospital in South India and to correlate the optical correction and device usage factors with DES related symptoms.

Materials and Methods: A cross sectional questionnaire based study on undergraduate medical students was done in Yenepoya medical college over the period of 2 months after obtaining ethical clearance from institutional ethics committee, the filled questionnaire was collected, data was tabulated and analysed.

Result: In our study the male to female ratio was almost equal. Out of the total 120 participants, 55.83% had symptomatic DES females were more affected (53.7%). Headache was the most common symptom experienced (73.33%) followed by Dry eyes (63.33%), Eye strain (53.33%). 64 (84.21%) of 76 participants who used their digital devices for > 4 hours per day and, 33 (67.34%) of 49 participants who held their device approximately at < 33cm had symptomatic DES. 8 (80%) of 10 infrequent spectacle users had symptomatic DES. 22 of 43 using spectacles used antiglare and only 3 (13.63%) of these had symptomatic DES. All 3 frequent users of contact lens had symptomatic DES.

Conclusion: DES is more prevalent in females, and higher the hours of use of digital device, greater is the risk of DES. A greater viewing distance and high contrast reduce the chances of developing DES and hence is advisable. Frequent use of habitual refractive correction is recommended with antiglare, however, prolonged use of contact lens especially in air conditioned environment should be avoided.

Keywords: Asthenopia, Blurred vision, Computer vision syndrome, Digital eye strain, Questionnaire.

Introduction

Computer vision syndrome (CVS) is a well known entity and has been a recognised health problem for over 20 years.[1,2] CVS is caused by our eyes and brain reacting differently to characters on the screen than they do to printed characters. Our eyes have little problem focusing on most printed material, which is characterized by dense black characters with well-defined edges. Healthy eyes can easily maintain focus on the printed page. Characters on a computer screen or a digital device, however, don't have this contrast or well-defined edges. These characters (pixels) are brightest at the centre and diminish in intensity toward their edges. This makes it very difficult for our eyes to maintain focus and remain fixed onto these images. Instead our eyes drift out to a point called the "resting point of accommodation" or RPA. Our eyes involuntarily move to the RPA, and then strain to regain focus on the screen. This continuous flexing of the eyes focusing muscles creates fatigue and the burning, tired-eyes feeling that is common after long hours at the computer.[3]Terms such as digital eye strain (DES) and visual fatigue have been used before and are more descriptive to this condition as they represent a variety of digital devices in common use today, such as phones, tablets etc. There has been a significant rise in digital device usage in the recent past with an average use of 4-5 hours per day.[4] This increases the risk of digital eye strain and since the symptoms are usually transient, it is often overlooked by sufferers. Furthermore there is an inherent risk of increased errors among sufferers of this condition.[5]

Aim

This study aims to assess the frequency of digital eye strain (DES) among undergraduate medical students in a tertiary eye care hospital in South India and to correlate the optical correction and device usage factors with DES related symptoms. This would give an idea about the extent of the problem and also help in creating awareness and suggest recommendations to avoid this occupational hazard amongst the digital device users.

Materials and Methods

The study was a cross-sectional questionnaire based study. Undergraduate medical students of Yenepoya Medical College Hospital Deralakatte, over a duration of 2 months were enrolled in the study after obtaining ethical clearance from institutional ethics committee. Sample size was calculated using G power software with level of significance alpha = 5%, power 1-beta= 80%, effect size, d = 0.15 with 95% confidence interval, the minimum sample size required was 120. The participants was given the information sheet about the study and after obtaining written informed consent, validated questionnaire[11] (attached as annexure 1) was administered to the participant. The filled questionnaire was collected. Data was tabulated in an excel sheet. Descriptive statistics were used for frequency analysis and Chi square was used for analysis of correlation. The DES score was calculated and participants with a score 20 and above were taken to have symptomatic DES.

Results

A total number of 120 participant's responses were analysed. Mean age of total participants was 21.55 with a standard deviation of 0.91 (Ranging from 20-26 years of age). The male to female ratio was almost equal. Out of the total 120 participants, 67 (55.83%) had symptomatic DES and higher numbers of females were affected 36 (53.7%) as compared to males 17 (25.37%).

Table 1: Gender and DES severity score

Gender	DES score <20	DES score >20	Total
Male	44	17	61
Female	23	36	59
Total	53	67	120

Mobile phones were the most commonly used digital device (94.16%) and the most important reasons for usage of digital device were, social media (70%), communication (57.5%) and YouTube (50%).

Headache was the most common symptom experienced by participants 88 (73.33%), followed by dry eyes 76 (63.33%), eye strain 64 (53.33%), tired eyes 85 (48.33%) and irritated and burning eyes 56 (46.66%).

Out of the 120 participants, 76 (63.33%) used their digital devices for more than 4 hours per day, of these 64 (84.21%) participants had symptomatic DES. 49 (40.83%) participants held their digital device at less than 33cm, 33 (67.34%) of these participants had symptomatic DES, both parameters were statistically significant ($p<0.01$).

Of the total participants, 29 (24.16%) used low contrast settings, of which 20 (68.9%) had symptomatic DES and 99 (82.5%) spent > 4 hours in air conditioned environment and 75(75.57%) of these had symptomatic DES. Both parameters were statistically significant. ($p<0.01$)

Out of the total 120 participants, 49 (40.83%) used habitual refractive correction. Among 43 spectacle users, 10 (23.25%) used their optical aid infrequently and 8 (80%) of these had symptomatic DES. Also, of 43 spectacle users 22 used antiglare and only 3 (13.63%) of these had symptomatic DES. Both parameters were statistically significant with $p<0.01$

Of the 49 participants using habitual refractive correction, only 6 were using contact lens when using optical device, 3 (50%) of which were frequent users and all 3(100%) had symptomatic DES, this was statistically significant with $p<0.01$.

Table 2: Symptoms of DES and percentage of responses by participants

Symptom	Response : None - Mild	Response : Moderate - Severe
Blurred vision at near distances	111 (92.5%)	9 (7.5%)
Blurred vision at intermediate distances	111 (92.5%)	9 (7.5%)
Blurred vision at far distances	89 (74.16%)	31 (25.83%)
Difficulty in refocusing eyes from one distance to another	113 (94.16%)	7 (5.83%)
Irritated or burning eyes	64 (53.33%)	56 (46.66%)
Dry eyes	44 (36.66%)	76 (63.33%)
Eye strain	56 (46.66%)	64 (53.33%)
Headache	32 (26.66%)	88 (73.33%)
Tired eyes	35 (29.16%)	85 (48.33%)
Sensitivity to bright lights	77 (64.16%)	43 (35.83%)

Table 3: Digital device related parameters and DES score

Digital device related parameters	Response	Participants with DES score <20	Participants with DES score >20
Average hours of use per day	>4 hours	12	64
	<4 hours	31	13
Distance of holding device	>33 cm	10	1
	33cm	49	11
	<33cm	16	33
Contrast settings	Low	9	20
	Medium	70	14
	High	5	2
Hours spent in air conditioned environment	< 4hours	13	8
	>4 hours	24	75

Table 4: Optical device related parameters in participants using habitual refractive correction and DES score

Optical device related parameters in participants using habitual refractive correction	Response	Participants with DES score <20	Participants with DES score >20
Use of spectacle with power	Yes	22	11
	Sometimes	2	8
Use of contact lens	Yes	0	3
	Sometimes	2	1
Use of Antiglare	Yes	19	3
	No	5	16

Discussion

According to the American Optometric Association, the most common symptoms associated with DES are eyestrain, headaches, blurred vision, dry eyes and pain in the neck and shoulders.[6] Our study showed similar results with headache being the most common symptom experienced by participants (73.33%), followed by Dry eyes (63.33%), Eye strain (53.33%).

Our study found a prevalence of DES of 55.83% comparable to a study in 2016 of digital eye strain which found prevalence of self reported symptoms of 65%. The same study showed females (69%) were more affected than males (60%)[4] Another study[7] found a similar finding in that, females had a higher prevalence of DES symptoms among 250 office workers. Our study showed similar results with females more affected (53.7%) as compared to males (25.4%), this may be due to gender difference in dry eye prevalence.[8,9]

Digital eye strain symptoms were found to be significantly higher in higher hours of computer use according to Hayes et al[11] Which was similar to our study which showed, participants using digital devices more than 4 hours per day had higher DES (84.21%) than participants who used their digital device for less than 4 hours (15.79%)

Our study showed, participants with lower viewing distance (<33cm) had higher DES symptoms (67.3%) which was similar to findings in a study in 2016[12] where it was found that greater the viewing distance, lesser was the reported eye strain. Our study also assessed contrast used in digital device and hours of spent in air conditioned environment, and it was found that participants using low contrast (68.9%) and those who spent more than 4 hours per day (75.57%) in air conditioned environment had higher incidence of DES.

With optical correction related parameters, we analysed the effect of spectacles with and without antiglare and also contact lens use with relation to DES. We found that, participants with infrequent use of spectacle had high incidence of DES (80%) and that participants using antiglare had low percentage of symptomatic DES (13.63%). Contact lens users, had higher incidence of DES (100%) which was similar to a study done in 2016 where it was found that prolonged use of digital device with contact lens had higher prevalence of DES.[13]

Drawback of our study was a very small sample size. A prospective community-based study, especially where long hours of digital device usage is required will bring out the true prevalence rate and factors associated with digital eye strain.

Conclusion

DES is more prevalent in females, and higher the hours of use of digital device, greater is the risk of DES. A greater viewing distance and high contrast reduce the chances of developing DES and hence is advisable. Frequent use of habitual refractive correction is recommended with antiglare, however, prolonged use of contact lens especially in air conditioned environment should be avoided.

Conflict of Interest: None.

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