

## Effect of Smartphone Use and Prolonged Screen Time on Digital Eye Strain (DES), Visual Acuity and Refraction among Medical Students: A Cross Sectional Study

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### Abstract

**Aim:** To determine the effect of smartphone use and prolonged screen time on digital eye strain (DES), visual acuity, refraction and overall ocular health among medical students.

**Materials and Methods:** A cross-sectional study was conducted at Government Medical College Srinagar, Kashmir, India. This study included 225 students of 2<sup>nd</sup> year to 5<sup>th</sup> year MBBS, who consented to participate. Information regarding participants' bio-data, screen time, and DES symptoms was gathered through a meticulously crafted self-administered questionnaire. A Snellen's chart was used to assess the best corrected visual acuity and refraction of participants was noted. Chi-Square and Pearson Correlation were used and analysis conducted using SPSS software.

**Results:** Out of 225 participants, 186 (82.6%) reported at least one symptom of digital eye strain. Headache (n=96; 42.6%) and eye pain/discomfort (n=73; 32.44 %) were the most common reported symptoms. Refractive error was reported in 102 (45.33 %) students, including myopia (n=78; 34.66%), hyperopia (n=13; 5.77%), and astigmatism (n=11; 4.88 %). Mobile Phone (n=225; 100%), Laptop (n=175; 78.22%) and Tablet/Ipad (n=76; 33.77%) were the main electronic gadgets used by participants. Headache, ocular discomfort, redness, watering of the eyes, itching of the eyes and burning of eyes along with neck / shoulder pain were significantly associated with increased screen time and most common refractive error noted among the students having prolonged screen time was myopia (p<0.05).

**Conclusion:** This study reveals an alarming 82.6% prevalence of DES among medical students in GMC Srinagar as a direct result of increased screen time and smart phone usage and a strong association of prolonged screen-exposure with refractive errors especially myopia. Our study reveals a significant association between screen time and DES, with headache & eye pain/discomfort being the most common symptoms.

**Keywords:** Smartphone, Medical Students, Digital Eye Strain, Computer Vision Syndrome, Refractive Errors.

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### Introduction

The advent of modern technology has made the use of computer devices and gadgets an indispensable part of everyday life. These devices are considered as necessity of 21st century. The ubiquity of desktops, laptops, tablets, smart phones, electronic reading devices, and similar digital gadgets in the modern world is undeniable. [1]

Many studies have reported that digital technology users may spend up to 12 screen-hours daily and the American Optometric Association revealed that the average American individual spends an average of 7 hours a day on digital screens at work and/or home. [2] In the present scenario, prolonged and

rampant computer usage has led to rapid upsurge in computer related health problems. Prolonged exposure to Video Display Terminal's (VDT's) has been the cause of a visual and ergonomic disorder called "Computer Vision Syndrome" (CVS). [3]

Computer Vision Syndrome (CVS) is a mixture of visual ocular and extraocular manifestations that affect digital screen users. Visual symptoms involve blurred vision with an underlying mechanism that is not fully understood, visual fatigue or discomfort and diplopia [3,4]. Ocular symptoms include Dry Eye Disease (DED) [3], eye strain, redness, and irritation. Extraocular

symptoms include headache, neck, shoulder, and back pain and trigger thumb or wrist tendonitis or arthritis [5]. Globally, nearly 60 million people are suffering from CVS and approximately million new cases occur every year [6]. Owing to smartphones' close-viewing distance, related good resolution, entertainment and social applications, and 24 hour availability and internet connectivity, smartphones are believed to be responsible for the sudden rise in CVS prevalence and related sequelae worldwide by users of all ages, including the children [7].

A survey including 10,000 respondents in the US pointed out that 65% of people, the majority of females, had self-reported symptoms of DES, with people using two or more devices simultaneously affected more frequently [8]. Another study in Malaysia identified a prevalence of 89.9% amongst university students, with headache and eye strain being the most frequently reported [9].

The purpose of this study is to determine the effect of smartphone use and increased screen time on digital eye strain (DES), visual acuity, refraction and overall ocular health among undergraduate medical students. It will aid the public health professionals and all the stakeholders to take measures to reduce this public health issue and help to create awareness among public regarding health hazards of computers and digital electronic devices.

### Materials and Methods

This institution based cross-sectional study was carried out from 15 February 2025 to 15 May 2025 on undergraduate medical students at Government Medical College Srinagar, Kashmir. Second-year to fifth year MBBS students were enrolled using a convenient consecutive sampling technique. Based on prior published studies<sup>10</sup>, a sample size of 225 was calculated by taking a confidence interval of 95%, and a margin of error of 5%. Students who were free from any chronic ophthalmic diseases and consented to be included in the study were taken. Participants having any active ocular infection, glaucoma, retinitis pigmentosa or having any other pre-existing eye or systemic condition as well as those who declined to participate or give an informed written consent were excluded from study.

Information regarding participants' demographic profile, screen-time in hours per day, and DES symptoms was gathered through a meticulously crafted self-administered questionnaire. The pre-tested structured questionnaire was prepared after

expert opinion from consultant ophthalmologist and adapted from the literature research from previous studies [10]. The Best Corrected Visual Acuity of all participants was measured by a uniform Snellen Optometric Chart and refraction of participants was noted.

Data analysis was performed utilizing IBM SPSS Statistics software (Version 26.0), employing statistical tests such as Chi-square and Pearson correlation.

### Results

Out of 225 participants, 134 (59.5%) were males and 91 (40.4%) were females. Mean age of male and female students was  $22.00 \pm 1.40$  and  $21.93 \pm 1.42$  years. Most of the study participants were from 4<sup>th</sup> year of MBBS (n=96; 42.66%), followed by 5<sup>th</sup> year of MBBS (n=62; 27.55%), then 3<sup>rd</sup> year of MBBS (n=41; 18.22%) and 2<sup>nd</sup> year MBBS (n=26; 11.55%).

Mobile phones (n=225; 100%), Laptop (n=175; 78.22%) and Tablets/Ipads (n=76; 33.77%) were the main electronic gadgets used by participants. 57 (25.33%) participants out of 225 reported using smart phones and other VDT's for 4 hours, 92 (40.88%) reported using same for 5 to 8 hours while 76 (33.77%) participants had a screen-time of more than 8 hours.

Out of 225 participants, 186 (82.6%) reported at least one symptom of digital eye strain (DES). Headache (n=96; 42.6%) and eye pain/discomfort (n=73; 32.44%) were the most common reported symptoms. Itching of eyes was present in 20.89% participants, eye redness in 20.44%, watering of eyes in 14.22%, burning of eyes in 16.44% along with neck/shoulder pain in 16.89%.

Refractive error was reported in 102 (45.33%) students, including myopia (n=78; 34.66%), hyperopia (n=13; 5.77%), and astigmatism (n=11; 4.88%). Myopia was seen to have a significant association with screen time with prevalence increasing progressively with longer screen exposure.

Headache, eye pain, watering of the eyes, eye redness, itching of the eyes and neck/shoulder pain were significantly associated with screen time ( $P < 0.05$ ) (Table I). The frequency of DES symptoms was seen to be higher in students with prolonged screen time ( $> 4$  hours). However, no significant association was found between visual acuity and screen time ( $p > 0.05$ ) [Table II].

**Table 1: Screen-time association with DES symptoms**

Symptoms	Response	1-4 (n=57)	5-8 (n=92)	Above 8 (n=76)	Total (n=225)	Chi-Square P-value
Headache	Yes	5 (8.77%)	42 (45.65%)	49 (64.47%)	96 (42.6%)	<0.001
	No	52 (91.23%)	50 (54.35%)	27 (35.53%)	129 (57.4%)	
Eye pain/discomfort	Yes	3 (5.26%)	29 (31.52%)	41 (53.95%)	73 (32.44%)	<0.001
	No	54 (94.74%)	63 (68.48%)	35 (46.05%)	152 (67.56%)	
Itching of eyes	Yes	4 (7.02%)	19 (20.65%)	24 (31.58%)	47 (20.89%)	0.018
	No	53 (92.98%)	73 (79.35%)	52 (68.42%)	178 (79.11%)	
Eye redness	Yes	3 (5.26%)	18 (19.57%)	25 (32.89%)	46 (20.44%)	0.002
	No	54 (94.74%)	74 (80.43%)	51 (67.11%)	179 (79.56%)	
Watering of eyes	Yes	2 (3.51%)	12 (13.04%)	18 (23.68%)	32 (14.22%)	0.006
	No	55 (96.49%)	80 (86.96%)	58 (76.32%)	193 (85.78%)	
Blurring of vision	Yes	4 (7.02%)	26 (28.26%)	19 (25.0%)	49 (21.78%)	0.012
	No	53 (92.98%)	66 (71.74%)	57 (75.0%)	176 (78.22%)	
Burning of eyes	Yes	3 (5.26%)	20 (21.74%)	14 (18.42%)	37 (16.44%)	0.038
	No	54 (94.74%)	72 (78.26%)	62 (81.58%)	188 (83.56%)	
Neck/Shoulder pain	Yes	3 (5.26%)	19 (20.65%)	16 (21.05%)	38 (16.89%)	0.042
	No	54 (94.74%)	73 (79.35%)	60 (78.95%)	187 (83.11%)	
Double vision	Yes	0 (0%)	3 (3.26%)	2 (2.63%)	5 (2.22%)	0.412
	No	57 (100%)	89 (96.74%)	74 (97.37%)	220 (97.78%)	

**Table2: Screen-time association with Visual Acuity**

Visual Acuity	Category	1-4 hours (n=57)	5-8 hours (n=92)	Above 8 hours (n=76)	Total (n=225)	Chi-Square P-value
Right Visual Acuity	Low (<6/6)	10(17.54%)	25(27.17.25%)	8 (10.52%)	43 (19.11%)	0.521
	Normal (6/6)	47(82.45%)	67(72.82%)	68 (89.47%)	182 (80.89%)	
Left Visual Acuity	Low (<6/6)	10(17.54%)	26 (28.26%)	8 (10.52%)	44 (19.55%)	0.551
	Normal (6/6)	47(82.45%)	66 (71.73%)	68 (89.47%)	181 (80.44%)	

**Table 3: Screen-time association with Refractive Error**

Refractive Error	Category	4 hours (N=57)	5 to 8 hours (N=92)	>8 hours (N=76)	Total (N=225)	Chi-Square P-value
Myopia	Yes	12 (21.05%)	26 (28.26%)	40 (52.63%)	78 (34.67%)	<0.001
	No	45 (78.95%)	66 (71.74%)	36 (47.37%)	147 (65.33%)	
Hyperopia	Yes	6 (10.52%)	4 (4.34%)	3 (3.94%)	13 (5.78%)	0.2045
	No	51 (89.47%)	88 (95.65%)	73 (96.05%)	212 (94.22%)	
Astigmatism	Yes	2 (3.51%)	4 (4.35%)	5 (6.58%)	11 (4.89%)	0.684
	No	55 (96.49%)	88 (95.65%)	71 (93.42%)	214 (95.11%)	

The majority of study participants 127 (56.44%), indicated that they preferred to close their eyes and take brief rest when they experienced these symptoms. Among the participants, 42 students (18.66%) had consulted an ophthalmologist due to DES symptoms only, and 156 students (69.33%) regarded these symptoms as problematic and causing interference in day to day activities.

### Discussion

The present study conducted on the undergraduate medical students of Kashmir showed the prevalence of DES symptoms to be a staggering

82.6%. Study conducted on medical students of Chennai reported similar prevalence of 78.6% as our study [11]. According to a study conducted among health students in Saudi Arabia, 97.3% of them had at least one symptom of DES [12]. In our study, headache (n=96; 42.6%) and eye pain/discomfort (n=73; 32.44 %) were the most common reported symptoms. A study conducted by Haider Iqbal et al [10.] also reported headache (35.6%) as being the most common symptom reported by students. Diverse factors have been found in the causation of headaches and ocular discomfort. As per some studies prolonged and

recurrent adjustments made by the eyes and extraocular musculature result in muscular stress and ocular fatigue, eventually leading to headaches and eye pain [13]. The duration of using VDT devices is directly related to eye symptoms, longer duration tends to result in long-lasting complaints which persist even after the work on screen is completed. In our study duration of screen-time is found to be directly associated with symptoms of computer vision syndrome and DES. The hypothesized mechanisms are a reduction in blink rate and deterioration in tear film quality [13]. Screen-time more than 4 hours is found to be significantly associated with visual and extra-ocular symptoms.

This study did not find significant impact between screen time and visual acuity. One of the studies conducted in China also denied any significant association between these two variables [14].

Moon JH et al [7] in their study reported that people with myopia have higher screen time relative to those who don't have myopia. This finding is consistent with our study in which we found that 34.66% (n=78) study participants having high screen time had myopia. The association of prolonged near-vision work with increased risk of myopia has been well-established in numerous previous studies including one by French AN et al [15]. Also it was seen in our study that myopia was more common (52.63%) in participants with screen-time more than 8 hours, followed by 28.26% in participants having screen time of 5 to 8 hours.

A paper in Lancet Digital Health reported that Foreman J et al [16] conducted a systematic review and meta-analysis that looked into smart device exposure and myopia in children and young adults. The investigators found smart device screen time alone or combined with computer use had a significant association to myopia which is consistent with our study.

Our study has fairly highlighted this public health issue which has become a budding menace especially among student population who mostly prefer to read from and take class notes on smart phones, tablets and laptops as well as spending most hours in a day on screen for gaming, socializing and other recreational purposes as well. However, there are certain limitations to our study. This study was conducted among medical students of a single medical college which may limit the generalizability of the findings to a broader population and limit the applicability of the findings to different demographic groups. DES symptoms were self-reported which may introduce subjective bias. In future, prospective studies with follow ups should be designed to establish the causal inference.

DES is surfacing as serious concern among medical students due high screen time and increasing refractive errors. The need of the hour is to address the problem and raise awareness especially among the younger generations. It is recommended to follow the rule of 20/20/20 to reduce the symptoms of computer vision. Rule of 20/20/20 states that one should sit 20 feet away take 20 seconds break after 20 minutes of computer use [17].

### Conclusion

This study concludes that there is a staggering 82.6 % prevalence of digital eye strain symptoms (DES) among undergraduate medical students and a strong association of prolonged screen-time with refractive errors especially myopia. Screen related health problems have now become a significant public health issue and there is an immediate need to address the same by organizing awareness lectures in order to educate younger generation about detrimental health effects of overusing computer and smartphones.

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