

Assessment of Digital Eye Strain and Its Associated Factors among Under-graduate Medical Students**Vandana Kumari¹, Neha Bharati², Nageshwar Sharma³**¹Senior Resident, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India²Senior Resident, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India³Professor and HOD, Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India

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Abstract:**Background:** Digital Eye Strain (DES), or Computer Vision Syndrome, is an emerging concern among students due to prolonged use of digital devices, leading to ocular and musculoskeletal symptoms. Medical students are particularly at risk owing to extended screen exposure for academic and recreational purposes.**Aim:** To assess the prevalence, severity, and associated factors of DES among undergraduate medical students.**Methodology:** A descriptive cross-sectional study was conducted among 90 medical students at Patna Medical College and Hospital, Patna, Bihar, India. Data were collected using a structured, self-administered questionnaire covering demographics, device usage patterns, screen time, break practices, and ocular symptoms. Statistical analysis was performed using SPSS v27.0, with significance set at $p < 0.05$.**Results:** DES was reported by 83.3% of participants, with eye strain (72.2%), dryness (55.6%), and headache (44.4%) being most common. Smartphones were the primary devices used (61.1%), and increased screen time (>4 hours/day) was strongly associated with DES ($p = 0.02$). Only 22.2% of students took regular breaks, highlighting poor ergonomic practices.**Conclusion:** DES is highly prevalent among medical students and is influenced by prolonged screen use and irregular breaks. Preventive strategies, including ergonomic education, regular breaks, and ocular hygiene, are essential to mitigate DES and promote student well-being.**Keywords:** Computer Vision Syndrome, Digital Eye Strain, Ergonomics, Medical Students, Screen Time.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Over the past several years, as the digital technology has entered into all aspects of academic and professional life, it has introduced several new issues related to human health one of the most obvious and discussed ones being Digital Eye Strain (DES) or Computer Vision Syndrome (CVS). The term refers to a set of eye and vision-related issues that are caused by excessive use of digital screens like computers, laptops, tablets, and smart phones. With the current growth in the use of digital devices, especially in the educational field, more students are becoming exposed to the dangers of DES. The most vulnerable of them are the medical students because of their large exposure to the screen due to academic learning, online lectures, maintenance of online records, online learning modules, and recreational activities [1]. The increased use of digital devices in medical education has necessitated the need to comprehend the occurrence, intensity and effects of digital eye strain among this group of individuals.

Digital Eye Strain is defined by both visual and physical expression of symptoms which comprise of eye fatigue, dryness, redness, irritation, blurred vision, headaches and pains in the neck or shoulders. Such signs are caused by the compound interaction of factors including the duration of activities near work, insufficient lighting, bad posture, glare, unfavorable viewing distance, and uncorrected vision issues [2] in nature. Human visual system is not programmed to perform near-focusing activities on a continuous basis at a fixed distance as it is the case with screen-based work. Constant adjustment and alignment to concentrate on screens exert further demand on visual muscles causing discomfort and fatigue. Also, regular use of digital devices, especially those emitting blue light, may destabilize the tear film and cause ocular surface disorders [3] only. The prices of the pandemic and the following widespread use of online learning have exacerbated the issue,

since students spend significantly more time at screens both studying and socializing [4].

The med students are especially vulnerable to the stressors that lead to the increased digital eye strain. Their academic schedule is rigorous, study time is lengthy, and they need to use digital sources like e-books, the Internet in search databases, and videos, which makes their screen time long. Moreover, the necessity to achieve academic success and the absence of proper education on the importance of ergonomic behaviors tend to result not only in wrong screen habits like using the screen constantly without taking a break but also in using it at the cost of poor sitting posture [5]. The visual fatigue and musculoskeletal discomfort not only have negative effect on the physical health of students but it also has an impact on their concentration, performance and well-being of the students. In others, the symptoms can be chronic in case preventive measures are not taken in early stages.

A number of researches have put forward digital eye strain as a new work-related risk among both students and employees. It has been found out that 50-90 percent of all people who spend a lot of time on digital screens have some CVS symptoms [6]. This prevalence is also cited to be exceptionally high among medical students, to whom electronic learning platforms are an academic dependence. The shift to virtual learning conditions, especially throughout the pandemic, has played a major role in increasing the frequency and hours of screen time. The medical students have been thus one of the most hit populations, with complaints usually being the most issued in relation to the eye compared to the medical students in other fields [7]. Furthermore, deficient in regular ophthalmologic examination and little awareness regarding preventive factors, like 20-20-20 rule (taking a 20-second break to look at an object 20 feet away in 20-minute intervals), makes them even more vulnerable.

The implications of digital eye strain (DES) have broader consequences than eye discomfort. Continuous stress on the eye and visual fatigue may also result in low academic achievement, global mental fatigue, and degradation of the quality of life. Additionally, the exposure to blue light emitted by screen devices is associated with sleeping disorders, which reduces melatonin release, which, in itself, reduces mental capabilities and stamina. This is a multifactorial condition that must be contemplated and for which, if possible, prevention should be implemented, especially for students engaged in intensive educational work, such as students in medical school. Education and prevention of ergonomic standards, optimal screen settings, usage of ambient light, and regular eye examinations may help diminish the prevalence of DES [8].

Considering these issues, there is urgency to engage in targeted research on digital eye strain in medical students in order to determine the prevalence, risk, and prevention of the same. The knowledge of the scale of the issue within this particular population will not only contribute to developing relevant health educational interventions but also inform institutional policies that would promote digital well-being. The results can be used to formulate measures of reducing screen-related health issues by interventions which include awareness creation, posture correction classes, and frequent eye testing. The study objectives are 'to determine a detailed evaluation of the prevalence and the type of digital eye strain in medical students and propose evidence-based preventive measures that have the potential to enhance their optical health, learning performance, and life quality.

Methodology

Study Design: The present study adopted a descriptive cross-sectional design to assess the prevalence of digital eye strain (DES) and its associated factors among undergraduate medical students. This design was chosen as it enables the collection of data from a defined population at a specific point in time to establish relationships between exposure to digital devices and ocular symptoms.

Study Area: The study was conducted in the Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India for six months. The institution was selected because it has a large population of undergraduate medical students extensively engaged in academic and clinical activities involving digital devices, making it an appropriate setting for such an assessment.

Study Participants: The study population consisted of undergraduate medical students enrolled at Patna Medical College. Participants were informed about the study objectives, and their voluntary participation was sought prior to inclusion.

Inclusion Criteria

- Undergraduate medical students currently enrolled in the medical course.
- Students who regularly used digital devices such as smartphones, laptops, tablets, or desktop computers for academic or recreational purposes.
- Participants who were able to read and comprehend English.
- Students who provided written informed consent and were willing to participate in the study.

Exclusion Criteria

- Students with pre-existing ocular conditions unrelated to digital eye strain, such as glaucoma, cataract, or chronic conjunctivitis.

- Students who had previously undergone ocular or refractive surgery.
- Students who were not willing to participate or did not provide informed consent.

Sample Size: A total of 90 undergraduate medical students were included in the study. The sample size was determined based on convenience sampling, considering the availability and willingness of participants during the study period.

Procedure: Data collection was carried out over a two-month period using a pretested, structured, self-administered questionnaire designed to evaluate the prevalence and associated factors of digital eye strain. The questionnaire comprised sections on sociodemographic information, patterns of digital device usage (including type of device, screen time duration, and working posture), and ocular symptoms such as eye strain, headache, dryness, blurred vision, and redness. A brief ocular examination was also performed to assess any refractive errors or ocular surface abnormalities among the participants. The questionnaire was distributed in classroom and hostel settings to ensure maximum participation. Prior to data collection, ethical approval was obtained from the Institutional Ethics Committee of Patna Medical College and Hospital, and written informed consent was obtained from all participants after explaining the purpose and nature of the study.

Participation was voluntary, and confidentiality of responses was strictly maintained.

Statistical Analysis: After collection, all questionnaires were checked for completeness and accuracy. The data were coded and entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. Associations between digital eye strain and various factors such as duration of screen exposure, device type, and ergonomic habits were examined using appropriate inferential statistical tests, with a p-value < 0.05 considered statistically significant.

Result

Table 1 presents the sociodemographic profile of the 90 study participants. The majority of participants (55.6%) were aged between 21 and 23 years, followed by 27.8% in the 18–20-year group, and 16.6% over 23 years. In terms of gender distribution, males slightly outnumbered females, accounting for 53.3% and 46.7%, respectively. Participants were relatively evenly distributed across the years of study, with 22.2% in the first year, 27.8% in the second year, 24.4% in the third year, and 25.6% in the final year or internship. Regarding residence type, two-thirds of the participants (66.7%) resided in hostels, while one-third (33.3%) were day scholars.

Table 1: Sociodemographic Profile of the Study Participants (n = 90)

Variable	Category	Frequency (n)	Percentage (%)
Age (in years)	18–20	25	27.8
	21–23	50	55.6
	>23	15	16.6
Gender	Male	48	53.3
	Female	42	46.7
Year of Study	1st Year	20	22.2
	2nd Year	25	27.8
	3rd Year	22	24.4
	Final Year / Internship	23	25.6
Residence Type	Hostel	60	66.7
	Day Scholar	30	33.3

Table 2 presents the digital device usage patterns among 90 medical students. The majority of students primarily used smartphones (61.1%), followed by laptops (27.8%), while tablets and desktop computers were least used (5.6% each). Regarding average daily screen time, most students spent 2–4 hours (38.9%) or 4–6 hours (33.3%) on their devices, with fewer students using devices for less than 2 hours (11.1%) or more than 6 hours (16.7%). In terms of

taking breaks during screen use, more than half reported taking occasional breaks (55.6%), whereas only 22.2% took regular breaks, and an equal proportion (22.2%) did not take any breaks. Most students maintained a viewing distance of 30–50 cm from the screen (61.1%), while 27.8% sat closer than 30 cm, and 11.1% maintained a distance greater than 50 cm.

Table 2: Digital Device Usage Patterns among Medical Students (n = 90)			
Variable	Category	Frequency (n)	Percentage (%)
Primary Device Used	Smartphone	55	61.1
	Laptop	25	27.8
	Tablet	5	5.6
	Desktop Computer	5	5.6
Average Daily Screen Time	<2 hours	10	11.1
	2–4 hours	35	38.9
	4–6 hours	30	33.3
	>6 hours	15	16.7
Breaks During Screen Use	Regular	20	22.2
	Occasional	50	55.6
	None	20	22.2
Viewing Distance from Screen	<30 cm	25	27.8
	30–50 cm	55	61.1
	>50 cm	10	11.1

Table 3 presents the prevalence and severity of digital eye strain (DES) symptoms among the surveyed students. The overall prevalence of DES was high, affecting 83.3% of participants. Among specific symptoms, eye strain or fatigue was the most commonly reported, affecting 72.2% of students, followed by dryness or irritation in 55.6%, and headache in 44.4%. Neck or shoulder pain was reported

by 38.9% of students, while blurred vision affected 33.3%. Less frequently reported symptoms included redness of the eyes (22.2%) and burning sensation (16.7%). These findings indicate that a substantial proportion of students experience multiple ocular and musculoskeletal symptoms associated with prolonged digital device use.

Table 3: Prevalence and Severity of Digital Eye Strain Symptoms		
Symptoms of Digital Eye Strain	No. of Students Reporting Symptoms (n)	Percentage (%)
Eye strain or fatigue	65	72.2
Headache	40	44.4
Dryness or irritation	50	55.6
Blurred vision	30	33.3
Redness of eyes	20	22.2
Burning sensation	15	16.7
Neck or shoulder pain	35	38.9
Overall prevalence of DES	75	83.3

Table 4 presents the association between daily screen time and the occurrence of digital eye strain (DES) among students. The data indicate a clear trend: students with longer screen time are more likely to experience DES. Among those using screens for less than 2 hours daily, DES was observed in 5 out of 10 students, whereas with 2–4 hours of screen use, 25 out of 35 students reported

DES. Notably, all students using screens for 4–6 hours and more than 6 hours experienced DES, with none in these categories remaining unaffected. The association was statistically significant ($p = 0.02$), suggesting that increased daily screen time is strongly correlated with a higher prevalence of digital eye strain.

Table 4: Association between Screen Time and Occurrence of Digital Eye Strain				
Daily Screen Time	Students with DES (n)	Students without DES (n)	Total (n)	p-value
<2 hours	5	5	10	0.02
2–4 hours	25	10	35	
4–6 hours	30	0	30	
>6 hours	15	0	15	
Total	75	15	90	

Discussion

The current research evaluated the incidence of digital eye strain (DES) in 90 medical students and evaluated the related variables like the use of

devices, time spent on screens, and symptoms of the eyes. The results indicated that the prevalence of DES is high (83.3-percent of the participants), and the eye strain or fatigue (72.2-percent) and dryness

or irritation (55.6-percent) were also discussed. Otherwise, headache (44.4%), neck or shoulder pain (38.9%), blurred vision (33.3%), redness of the eyes (22.2%), and burning sensation (16.7), were less common but still significant, indicating the proximity of DES to other disorders, including ocular, visual, and musculoskeletal pain. The results are generally aligned with those of Agarwal et al. (2022) [9] who found that the prevalence of DES in medical undergraduates during the COVID-19 pandemic was 80% in India, with the majority of them (75%) having headaches, 68% experiencing eye fatigue, and 52% with ocular dryness. On the same note, Iqbal et al. (2018) [10] found that 78 percent of medical students in Egypt reported having one or more symptoms of DES, with eye strain, headache, and blurred vision as the most prevalent symptoms. These are consistent findings indicating that DES is an extremely common phenomenon among medical students worldwide underscoring the universality of the effects of intense screen use on the visual and musculoskeletal health.

In terms of the usage of the device, most of the subjects in the current study used smartphones (61.1) and laptops (27.8). The mean number of hours watching screens were high, with 38.9 percent of students spending 2-4 hours, 33.3 percent spending 4-6 hours, and 16.7 percent spending more than 6 hours on screens. Notably, all students with screen time above 4 hours reported DES, establishing a clear dose-response relationship between screen exposure and symptom prevalence ($p = 0.02$). This finding aligns with Al Rashidi and Abou (2022) [11], who reported that Saudi university students using screens for more than 4 hours daily had significantly higher DES prevalence (approximately 82%) compared to those with lower exposure. Contrastingly, Aschalew et al. (2020) [12] observed a slightly lower prevalence of DES (68%) in students with similar screen durations, suggesting that regional, cultural, or academic workload differences may influence the severity and reporting of symptoms.

The study also explored ergonomic practices and break patterns. Most participants maintained a viewing distance of 30–50 cm (61.1%), while 27.8% sat closer than 30 cm, increasing accommodative stress and risk of eye fatigue. Only 22.2% reported taking regular breaks, whereas 55.6% took occasional breaks, and 22.2% took none. These behavioral patterns are critical, as intermittent breaks have been shown to reduce ocular fatigue. Parrey et al. (2023) [13] reported that students who adhered to frequent screen breaks had a significantly lower prevalence of DES (56%) compared to those with irregular breaks (76%), highlighting the importance of preventive practices. Our findings, showing a high prevalence despite recommended viewing distances in most students, underscore that screen time

duration and break irregularity are stronger determinants of DES than distance alone.

Comparisons with other regional studies demonstrate both similarities and contrasts in DES symptomatology. Azrak et al. (2023) [14] reported that 90% of Jordanian medical students experienced at least one DES symptom, with headache (78%) and eye fatigue (70%) being most common, closely mirroring our findings for headache and eye strain prevalence. On the other hand, Assefa et al. (2017) [15] found slightly lower DES prevalence (63) in the bank workers in Ethiopia, even with the same amount of time having the screen on, which indicates that the occupational environment, age groups, and the characteristics of the visual activity affect the development of symptoms. These comparisons substantiate the notion that though DES is common among student groups, the severity of academic achievement, screen type, and compliance with ergonomic guidelines also add to the disparity in the prevalence of the symptoms.

The effect of DES on the everyday life of the students and their achievement is worth considering. The headache, tiredness in the eyes, and blurred vision may negatively affect the concentration, efficiency of learning, and musculoskeletal problems, which may affect the academic performance in general. The need to prevent using interventions such as ocular hygiene education, application of the 20-20-20 rule, frequent breaks, and knowledge of due viewing distances is supported by our results (Talens-Estarells et al., 2023) [16]. These measures should be integrated into medical curricula to reduce the impact of DES since the use of digital platforms to deliver education is on the rise, which was particularly emphasized during and after the COVID-19 pandemic (Sysoieva, S. 2022) [17].

The present research proves that the prevalence of DES is significant in medical students, and its development is closely linked to the increased screen time, inadequate break habits, and misuse of the devices. The findings are generally compatible with more or less the same studies that are done in India, Saudi Arabia, Egypt, and Jordan, and indicate the difference in prevalence and the severity of the symptoms. The results support the importance of specific prevention measures and educational interventions that can be used to ensure that the visual comfort and the adverse effect of DES on the well-being and academic performance of students are minimized.

Conclusion

The current research finds that digital eye strain (DES) is very common among undergraduate medical students and that 83.3% of the respondents identified one or more symptoms of digital eye strain with most symptoms being eye strain, dryness, and headache. These data confirm the fact that there is a

close linkage among the duration of screen time and higher levels of DES prevalence as all students spending over four hours a day using digital devices reported experiencing symptoms. Although the majority of the students kept the recommended viewing distances, ocular and musculoskeletal discomfort was aggravated by infrequent or no pauses during screen time. The results emphasize the multidimensionality of DES which depend on the type of devices, length of a screen, ergonomic behaviours, and academic workload. In turn, preventive strategies, including frequent breaks, correct posture, and ocular hygiene are necessary to decrease DES and protect the visual health and improve academic performance and general well-being of medical students.

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