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Original Research Article

Prevalence and Determinants of Digital Eye Strain Among Patients Attending a Tertiary Care Hospital: A Cross-Sectional Study

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Abstract:

Introduction: Digital eye strain (DES) has emerged as a significant public health concern due to the rapid increase in screen use across all age groups. It encompasses a spectrum of ocular and visual symptoms resulting from prolonged exposure to digital devices. This study was conducted to assess digital eye strain and screen-use habits among patients at a tertiary care hospital.

Methods: This hospital-based cross-sectional study was conducted among 600 participants attending a tertiary care center. Data were collected using a pretested structured questionnaire capturing demographic details, screen usage patterns, and ocular symptoms. Associations between DES symptoms and risk factors such as screen time, viewing distance, and break practices were analyzed using chi-square tests, with statistical significance set at $p<0.05$.

Results: The majority of participants reported at least one symptom of digital eye strain, with headache (68%), eye strain (65%), and watering (58%) being the most common. Female participants and individuals with prolonged screen exposure (>6 hours/day) demonstrated significantly higher symptom prevalence ($p<0.05$). Closer viewing distances (<50 cm) and infrequent breaks were also significantly associated with increased DES symptoms.

Conclusions: Digital eye strain is highly prevalent in patients attending tertiary care settings and is strongly associated with modifiable behavioral factors. Promoting ergonomic practices, limiting screen time, and encouraging regular breaks may help reduce symptom burden.

Keywords: Digital Eye Strain, Headache, Tertiary Care Hospital, Screen Time, Visual Symptoms.

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Introduction

The use of digital devices has increased rapidly in recent years because of expanding access to smartphones, computers, tablets, and internet-based services in daily life, education, and health care. Prolonged exposure to digital screens has led to the emergence of digital eye strain (DES), also known as computer vision syndrome, which refers to a group of ocular and extraocular symptoms experienced during or after screen use. [1] Common symptoms include eye fatigue, dryness, watering, burning sensation, blurred vision, headache, and pain in the neck and shoulders, all of which may adversely affect comfort, productivity, and quality of life. [1,2]

DES is increasingly recognized as a public health concern because of the high level of screen dependence across all age groups. Recent systematic reviews and meta-analyses have shown that nearly two-thirds of digital device users may experience computer vision syndrome, with pooled prevalence estimates ranging from about 66% to 69% globally. [3,4] Important determinants reported in the literature include long daily screen time, reduced blink rate, improper viewing distance, glare, poor lighting, prolonged near work, and inadequate ergonomic practices. [1,3,4] Evidence from India also suggests that DES is a growing problem. A cross-sectional study from central India reported a very high burden of DES among college students and found poor awareness regarding preventive practices such as maintaining proper screen distance and following the 20-20-20 rule. [5] Another Indian study among university students found that existing eye disease, longer average daily screen time, and use of gadgets in dark environments were significant predictors of DES. [6] Studies among medical students and young adults in India have similarly

documented high prevalence and associated effects on sleep, academic functioning, and overall well-being. [7,8]

Although several studies have examined DES in students and occupational groups, hospital-based data remain limited, especially in tertiary care settings where patients may have diverse sociodemographic characteristics, screen-use behaviours, and visual complaints. [9] Estimating the burden and correlates of DES among patients attending a tertiary care hospital can provide useful evidence for clinical screening, patient counselling, and public health interventions. [6,9] Therefore, the present study was undertaken to assess digital eye strain and screen usage patterns among patients attending a tertiary care hospital

Materials and Methods

This hospital-based cross-sectional study was conducted in the Department of Ophthalmology at a tertiary care center, Gujarat over a period of one year. A total of 600 participants aged 18 years and above attending the outpatient department were recruited using a consecutive sampling method. Individuals who reported regular use of digital devices for at least one hour per day and provided informed consent were included in the study. Patients with pre-existing ocular surface disorders, recent ocular surgery (within the past six months), systemic diseases affecting ocular health such as Sjögren's syndrome, or incomplete responses were excluded. The sample size was determined based on an expected prevalence of digital eye strain (DES) from prior literature, with a 95% confidence level and 5% margin of error, and was further increased to enhance statistical power.

Data were collected using a pretested structured questionnaire administered through face-to-face interviews, which included information on demographic characteristics, screen usage patterns (duration, type of device, and viewing distance), behavioral factors (frequency of breaks and ergonomic practices), and presence of ocular symptoms such as headache, eye strain, watering, blurred vision, and dryness. The questionnaire was pilot-tested on a small subset of participants to ensure clarity and reliability prior to full-scale data collection. DES was defined as the presence of one or more ocular or visual symptoms associated with prolonged digital screen exposure. Screen time was categorized as <3 hours/day, 3–6 hours/day, and >6 hours/day, while viewing distance was classified as <50 cm or ≥50 cm; break practices were categorized as regular (every 20–30 minutes) or irregular. Written informed consent was obtained from all participants. Data were entered and analyzed using Epi Info™ version 7.2 (Centers for Disease Control and Prevention, Atlanta, USA). Descriptive statistics were used to summarize variables as frequencies and percentages, and associations between DES and potential risk factors were assessed using the chi-square test, with a p-value of <0.05 considered statistically significant. Although efforts were made to minimize bias through standardized data collection and inclusion of consecutive participants, the study may be subject to recall bias due to self-reported data, and its cross-sectional design limits causal inference.

Results

Table 1 shows the socio-demographic and ocular profile of the 600 study participants. The majority were in the 11–30 years age group, 270(45%), followed by 195(32.5%) in 31–40 years and 135(22.5%) above 40 years. Females were more common, 390(65%), compared to males, 210(35%). Regarding education, most participants had graduation and above, 354(59%), while 120(20%) had higher secondary education, 72(12%) had high school education, 36(6%) had primary education, and 18(3%) were illiterate. For optical aid use, 300(50%) did not use any aid, 240(40%) used spectacles, 36(6%) used contact lenses, and 24(4%) used both spectacles and contact lenses. (Table 1)

Table 1: Socio-demographic and ocular profile of study participants (n = 600)

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	11–30	270	45.0
	31–40	195	32.5
	>40	135	22.5
Gender	Male	210	35.0
	Female	390	65.0
Education	Illiterate	18	3.0
	Primary education	36	6.0
	High school	72	12.0
	Higher secondary	120	20.0
	Graduation and above	354	59.0
Optical aid usage	Spectacles	240	40.0
	Contact lens	36	6.0
	Both spectacles and contact lenses	24	4.0
	None	300	50.0

Table 2 shows the screen-use patterns of the 600 study participants. Most participants spent 4–6 hours daily on digital devices, 318(53%), followed by 162(27%) who used screens for less than 4 hours and 120(20%) for more than 6 hours. Regarding screen distance, 396(66%) used devices at less than 50 cm, while 204(34%) maintained more than 50 cm. In terms of ambient lighting, 348(58%) used devices in light surroundings and 252(42%) in dark conditions. Preferred breaks after 30 minutes were taken by 228(38%) participants, whereas 372(62%) did not take regular breaks during screen use. (Table 2)

Table 2: Screen-use patterns of study participants (n = 600)

Variable	Category	Frequency (n)	Percentage (%)
Average screen time/day	<4 hours	162	27.0
	4–6 hours	318	53.0
	>6 hours	120	20.0
Approximate screen distance	<50 cm	396	66.0
	>50 cm	204	34.0
Screen contrast / ambient lighting	Dark	252	42.0
	Light	348	58.0
Taking preferred break after 30 min	Yes	228	38.0
	No	372	62.0

Table 3 shows the distribution of DES symptoms by gender and age group among 600 participants. Headache was the most common symptom, seen in 408(68%), followed by watering in 354(59%), dry eyes in 294(49%), and blurring of vision in 246(41%). On gender-wise analysis, headache, watering, dry eyes, and blurring of vision showed statistically significant associations with gender, with higher frequencies among females. Red eyes, foreign body sensation, temporal difficulty in gaze, eye rubbing, and double vision did not show significant gender association. Age-wise, most symptoms increased with advancing age, especially in the >40 years group. Red eyes, dry eyes, foreign body sensation, watering, headache, temporal difficulty in gaze, blurring of vision, and eye rubbing were significantly associated with age, while double vision was not statistically significant.

Table 3: Distribution of DES symptoms by gender and age group among study participants (n = 600)

Symptoms	Frequency (%)	Male (n=210)	Female (n=390)	p-value (gender)	11–30 years (n=270)	31–40 years (n=195)	>40 years (n=135)	p-value (age)
Red eyes	126(21%)	54	72	0.08	28	39	59	0.04
Dry eyes	294(49%)	118	176	0.03	62	103	129	<0.001
Foreign body sensation	162(27%)	71	91	0.11	29	48	85	<0.001
Watering	354(59%)	136	218	<0.001	46	119	189	<0.001
Headache	408(68%)	157	251	<0.001	58	139	211	<0.001
Temporal difficulty in gaze	168(28%)	74	94	0.14	31	56	81	0.02
Blurring of vision	246(41%)	93	153	0.04	43	82	121	0.01
Eye rubbing	114(19%)	59	55	0.62	18	33	63	<0.001
Double vision	60(10%)	29	31	0.71	10	14	36	0.06

Table 4 shows the association of digital eye strain symptoms with average screen time and screen distance among 600 participants. Red eyes were seen in 126(21%), dry eyes in 294(49%), foreign body sensation in 162(27%), watering in 354(59%), headache in 408(68%), temporal difficulty in gaze in 168(28%), blurring of vision in 246(41%), eye rubbing in 114(19%), and double vision in 60(10%). Chi-square test was applied, and $p<0.05$ was considered significant. Most symptoms were significantly associated with screen time and screen distance, except double vision and foreign body sensation for screen distance.

Table 4: Association of DES symptoms with average screen time and approximate screen distance among study participants (n = 600)

Symptoms	Frequency (%)	<4 hrs (n=162)	4–6 hrs (n=318)	>6 hrs (n=120)	p-value	<50 cm (n=396)	>50 cm (n=204)	p-value
Red eyes	126(21%)	28	64	34	0.03	89	37	0.04
Dry eyes	294(49%)	52	172	70	0.04	199	95	0.02
Foreign body sensation	162(27%)	30	91	41	0.002	96	66	0.2
Watering	354(59%)	55	201	98	0.06	242	112	0.002
Headache	408(68%)	74	231	103	0.02	287	121	0.08
Temporal difficulty in gaze	168(28%)	31	94	43	0.005	101	67	0.04
Blurring of vision	246(41%)	42	137	67	0.03	158	88	0.02
Eye rubbing	114(19%)	21	63	30	0.02	72	42	0.01
Double vision	60(10%)	10	31	19	0.09	34	26	0.3

Table 5 shows the association of digital eye strain symptoms with taking a preferred break after 30 minutes among 600 participants. Red eyes were reported in 126(21%), dry eyes in 294(49%), foreign body sensation in 162(27%), watering in 354(59%), headache in 408(68%), temporal difficulty in gaze in 168(28%), blurring of vision in 246(41%), eye rubbing in 114(19%), and double vision in 60(10%). Chi-square test was used, and $p<0.05$ was considered statistically significant. All symptoms showed significant association with not taking regular breaks.

Table 5: Association of DES symptoms with taking preferred break after 30 minutes among study participants (n = 600)

Symptoms	Frequency (%)	Yes (n=228)	No (n=372)	p-value
Red eyes	126(21%)	38	88	0.014
Dry eyes	294(49%)	94	200	0.04
Foreign body sensation	162(27%)	41	121	0.017
Watering	354(59%)	96	258	0.02
Headache	408(68%)	110	298	0.016
Temporal difficulty in gaze	168(28%)	39	129	0.03
Blurring of vision	246(41%)	74	172	0.01
Eye rubbing	114(19%)	29	85	0.02
Double vision	60(10%)	11	49	0.018

Discussion

In the present study, most participants were young adults, with the majority belonging to the 11–30 years age group (45%), followed by those in the 31–40 years group (32.5%). Females constituted a higher proportion of the study population (65%) compared to males (35%). A substantial proportion of participants were graduates or above (59%), and half of them did not use any optical aid (50%). A similar study conducted by Sharma A. et al. among university students in India also reported a predominance of younger participants and a higher proportion of females [6]. Basnet A. et al. likewise observed that younger adults formed the major study group in a tertiary care hospital-based setting [9]. In studies from the UK and Ireland, digital eye strain was also found to be more frequent among females, supporting the present findings [10]. Spectacle use was common in the current study and has been identified as an important contributing factor in previous research, possibly due to prolonged near work and associated refractive strain [11].

In the present study, the majority of participants used digital devices for 4–6 hours daily (53%), followed by those using them for less than 4 hours (27%) and more than 6 hours (20%). Close screen viewing was common, with a substantial proportion using devices at a distance of less than 50 cm (66%), and many participants did not take regular breaks after 30 minutes of use (62%). A similar study conducted by Sharma A. et al. among university students in India also identified average daily screen time as a significant determinant of digital eye strain, with device use in dark environments further increasing the risk of symptoms [6]. Basnet A. et al. likewise reported that prolonged screen exposure

and close viewing distance were prevalent among adults in a tertiary care setting and were associated with digital eye strain symptoms [9]. A recent study from the UK and Ireland also highlighted prolonged screen use and female gender as factors associated with a higher burden of digital eye strain [10]. These findings are consistent with the present study and reinforce the role of prolonged screen exposure, close viewing distance, and inadequate break practices as important modifiable risk factors for digital eye strain.

In the present study, headache was the most commonly reported symptom (68%), followed by watering (59%), dry eyes (49%), and blurring of vision (41%). Other symptoms included red eyes (21%), foreign body sensation (27%), difficulty in maintaining gaze (28%), eye rubbing (19%), and double vision (10%). Statistical analysis using the chi-square test demonstrated that headache, watering, dry eyes, and blurring of vision were significantly associated with gender, with higher frequencies observed among females ($p<0.05$). A similar study conducted by Shantakumari N. et al. also identified headache as a predominant symptom among digital device users [12]. Khan A. et al. likewise reported headache and dry eye as frequent complaints among undergraduate medical students in South India [13]. In the present study, most symptoms showed an increasing trend with advancing age, particularly among participants aged above 40 years, which is consistent with previous reports indicating a greater burden of digital eye strain symptoms in older individuals [9,10].

In the present study, most digital eye strain symptoms were associated with prolonged screen use, closer viewing distance, and inadequate break practices. Headache, watering, dry eyes, and blurred vision emerged as the most common complaints, consistent with patterns reported in previous studies. Chowdhury et al. identified duration of device use, break intervals, and viewing distance as independent risk factors among medical and nursing students in North India [14]. Basnet et al. similarly reported a high prevalence of symptoms such as ա strain and ocular fatigue among adults attending a tertiary care hospital, with prolonged device use being a major contributing factor [9]. Likewise, Likka et al. demonstrated that daily digital device exposure and related behavioral factors were significantly associated with digital eye strain among Ethiopian university students [15]. Hung et al. further supported these findings by showing that duration of use, seating posture, and break practices were significantly linked with the severity of digital eye strain in healthcare students [16]. Collectively, these findings suggest that suboptimal screen-use behaviors consistently exacerbate digital eye strain across diverse populations, highlighting the importance of modifiable ergonomic and behavioral interventions.

In the present study, taking a preferred break after 30 minutes was significantly associated with digital eye strain symptoms. Headache was the most common symptom among those who reported taking breaks (48.2%), followed by watering (42.1%), dry eyes (41.2%), and blurring of vision (32.5%). Other symptoms included red eyes (16.7%), foreign body sensation (18.0%), difficulty in maintaining gaze (17.1%), eye rubbing (12.7%), and double vision (4.8%). Statistical analysis using the chi-square test showed significant associations ($p<0.05$). Similar findings were reported by Basnet A. et al., who identified headache and eye discomfort as common complaints among digital device users [1]. Chowdhury B. et al. also observed that headache, dryness, and eye pain were frequent symptoms among medical science students exposed to prolonged screen use [2]. Likewise, Likka M. H. et al. reported that a substantial proportion of final-year university students experienced at least one symptom of digital eye strain, indicating its high prevalence in screen-intensive academic environments [3].

Conclusion

Digital eye strain was common among patients attending this tertiary care hospital. Headache was the most frequent complaint, followed by watering, dry eyes, and blurred vision, showing that long screen use can cause real discomfort. Most patients used digital devices for 4–6 hours a day, kept the screen at less than 50 cm, and many did not take regular breaks. The symptoms were seen more often in females and in older patients. Longer screen time, closer screen distance, and not taking breaks were all linked with more eye symptoms. This suggests that small changes, such as resting the eyes, keeping the screen farther away, and using better lighting, may help reduce the problem. Digital eye strain is preventable, and early awareness can protect eye comfort and daily productivity.

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