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ASSESSMENT OF DIGITAL EYE STRAIN AND DRY EYE SEVERITY AMONG STUDENTS AND PEOPLE INVOLVED IN ADMINISTRATIVE WORK: THE IMPACT OF SCREEN TIME USING OCULAR SURFACE DISEASE INDEX AND A CUSTOM DIGITAL EYE STRAIN QUESTIONNAIRE

Ophthalomology

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ABSTRACT

Aim: To assess the association between screen time, Digital Eye Strain (DES), and dry eye severity in students and administrative staff using the Ocular Surface Disease Index and a custom Digital Eye Strain questionnaire. **Methodology:** A cross-sectional study of 112 participants using digital devices ≥2 hours/day. Participants completed the OSDI and DES questionnaire. Data were analyzed using chi-square and Fisher's exact test. **Results:** Most participants were aged 25–35 years (51.8%), and 45.5% had high screen time (>6 hours/day). Severe dry eye symptoms were present in 41.2%, with significant correlations between screen time and OSDI (p = 0.017) and DES (p = 0.028). Major risk factors included glare (58%), lack of breaks (41.1%) and pre-sleep device use (94.6%). **Conclusion:** Excessive screen time significantly predicts DES and dry eye disease. Managing screen time, reducing glare and taking breaks can help alleviate symptoms.

KEYWORDS

Digital eye strain (DES), Dry Eye Disease (DED), Ocular Surface Disease Index (OSDI), Computer Vision Syndrome (CVS), Digital devices.

INTRODUCTION:

Digital eye strain, known as Computer Vision Syndrome (CVS), is a significant global health hazard in the 21st century. It affects around 70-75% of electronic device users globally[1].

Dry eye disease is an inflammatory, multifactorial ocular disorder that affects 5% to 50% of population and decreases quality of life. It's diagnosis is challenging due to varied symptoms[2].

Computer vision syndrome is recognized health issue for more than 20 years[3]. This is often referred to as visual fatigue or digital eye strain[4]. Given the rapid increase in digital gadget usage in recent years, millions of people of all ages are at risk of it[5].

Since it is important to determine the best management options for Dry Eye Disease in people who spend a lot of time looking at digital devices[3] ,this questionnaire (combines Ocular Surface Disease Index and custom-made Digital Eye Strain questionnaire) serves as a screening tool to identify an individual at risk of Dry Eye Disease. Eye care providers must educate patients about the link between Dry Eye Disease and digital screen use and preventive measures.

Objectives:

Primary Objective:

To evaluate the severity of dry eye symptoms using Ocular Surface Disease Index among students and administrative staff with varying screen times.

Secondary Objectives:

To assess the severity of digital eye strain using a custom made Digital Eye Strain Questionnaire.

To examine the correlation between screen time and dry eye severity, screen time and digital eye strain.

To analyze combined effect of screen time on both Digital Eye Strain and dry eye severity.

Methodology:

A hospital-based, cross-sectional study conducted at the Ophthalmology OPD, AJ Hospital, Mangalore, over 4 months. Participants included students from various colleges and administrative staff. Ocular Surface Disease Index and a customized Digital Eye Strain Questionnaire (based on CVS-Q) assessed ocular symptoms and screen time association. Ethical approval obtained by institutional ethics committee.

Inclusion Criteria:

Aged 18–55 years.
Students or administrative staff using digital screens for a minimum of 2 hours/day.

Exclusion Criteria:

History of ocular surgery.

Pre-existing ocular conditions such as glaucoma, diabetic retinopathy, severe allergies.

Questionnaires Used:

1. Ocular Surface Disease Index (OSDI) (Allergan Inc, Irvine, CA): A 12-question tool (score: 0-100) assessing Dry Eye Disease. Symptoms are classified as normal (0-12), mild (13-22), moderate (23-32), or severe (33-100).[4]

2. Custom Digital Eye Strain (DES) Questionnaire: Based on the Computer Vision Syndrome Questionnaire (CVS-Q), it scores symptom frequency (0-4) and intensity (0-3). The total score= frequency) + (intensity) : (0-63) categorizes eye strain as mild (0-21), moderate (22-42), or severe (43-63).[7]

Sample Size Estimation:

For the current study, the sample size was estimated using the prevalence of Digital Eye Strain based on the study conducted by Uwimana et al.

At 5% level of significance and absolute precision of 10%, the estimated sample size is **96.** This will be rounded off to **100.**

The formula used for calculating the sample:

$$n = \frac{Z_{\alpha/2}^2 \times P \times (1-P)}{l^2}$$

Where:
Zα/2=1.96 (for 95% confidence interval)

P = Prevalence of 50%

l = 10% (absolute precision)

Statistical Analysis:

Collected data was summarised by frequency and percentage, comparison and the association were established by chi-square and Fisher's exact test. Analysis was performed using SPSS 13 software and the level of significance was 0.05.

RESULTS

Demographics

112 participants were included in our study with the majority aged 25–35 years (51.8%), followed by 18–25 years (31.3%). Participants were categorized based on their reported screen time: 45.5% had high screen time (>6 hours/day), 35.7% had moderate screen time (4–6 hours/day), and 18.8% had low screen time (2–4 hours/day).

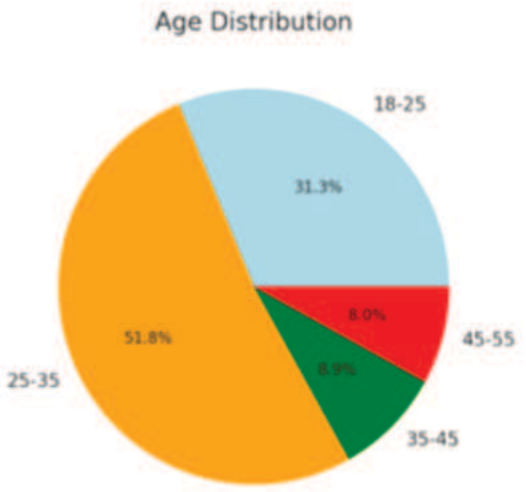

Fig 1: Pie chart showing age distribution

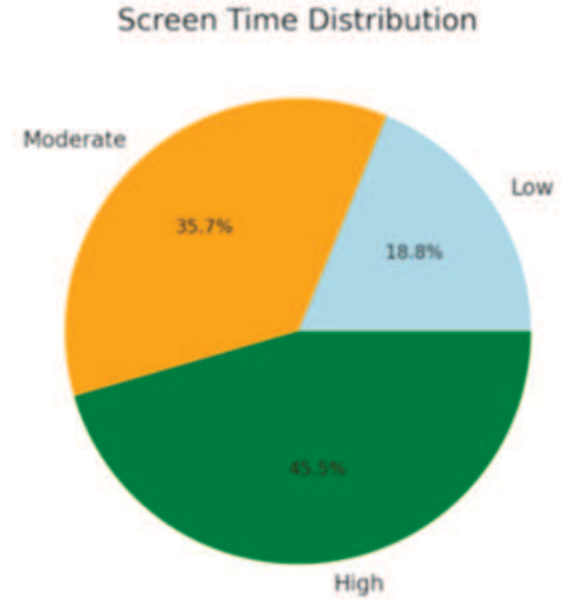

Fig 2: Pie chart with screen usage

Table1: Showing Categorization Of Severity Of Dry Eye And Digital Eye Strain

Severity Category	Frequency	Percentage
Dry Eye Severity (OSDI Scores):		
Normal (0 to 12)	46	41.1%
Mild dry eye (13 to 22)	22	19.6%
Moderate dry eye (23 to 32)	14	12.5%
Severe dry eye (33 to 100)	30	26.8%
Total	**112**	**100%**
Digital Eye Strain Severity (CVS-Q)		
Mild Eye Strain (0-21)	69	61.6%
Moderate Eye Strain (21-42)	33	29.5%
Severe Eye Strain (43-63)	10	8.9%
Total	**112**	**100%**

Table 2: Showing A Correlation Between Dry Eye Severity, Digital Eye Strain, Screen Time:

		Screen time					
		Low		Moderate		High	
		Count	Column N %	Count	Column N %	Count	Column N %
OSDI	Normal (0 to 12)	11	52.4%	17	42.5%	18	35.3%
	Mild dry eye (13 to 22)	4	19.0%	10	25.0%	8	15.7%
	Moderate dry eye (23 to 32)	1	4.8%	9	22.5%	4	7.8%
	Severe dry eye (33 to 100)	5	23.8%	4	10.0%	21	41.2%
DES SCORE	Mild Eye Strain (0-21)	15	71.4%	30	75.0%	24	47.1%
	Moderate Eye Strain (21-42)	3	14.3%	9	22.5%	21	41.2%
	Severe Eye Strain (43-63)	3	14.3%	1	2.5%	6	11.8%

A significant association was found between screen time and OSDI categories (p = 0.017). Severe dry eye was most common in high screen time users (41.2%), followed by low (23.8%) and moderate (10.0%) users. High screen time was also linked to more severe DES (p = 0.028), with 11.8% of high screen time users reporting severe DES, compared to 14.3% in the low and 2.5% in the moderate groups.

Table 3: Showing Significance Of Screen Time With OSDI And DES Score

Screen time with the following	Fisher exact test: p-value	
OSDI	.017	Significant
DES SCORE	.028	Significant

Combined Analysis Of OSDI And DES

A strong association between OSDI and DES severity was observed (Fisher's exact test, p < 0.001). Severe DES was predominantly seen in participants with severe dry eye (30.0%), while mild DES was most common in participants with normal OSDI scores (91.3%).

Table 4: Showing Combined Analysis Of OSDI And DES

		DES SCORE								
		Mild Eye Strain (0-21)			Moderate Eye Strain (21-42)			Severe Eye Strain (43-63)		
		Count	Row N %	Column N %	Count	Row N %	Column N %	Count	Row N %	Column N %
OSDI	Normal (0 to 12)	42	91.3 %	60.9 %	4	8.7%	12.1 %	0	0.0%	0.0%
	Mild dry eye (13 to 22)	15	68.2 %	21.7 %	7	31.8 %	21.2 %	0	0.0%	0.0%
	Moderate dry eye (23 to 32)	6	42.9 %	8.7 %	7	50.0 %	21.2 %	1	7.1%	10.0 %
	Severe dry eye (33 to 100)	6	20.0 %	8.7 %	15	50.0 %	45.5 %	9	30.0 %	90.0 %

Table 5: Showing Statistical Analysis Of Behavioral & Environmental Factors Using Fisher Exact And Chi-square Test:

Parameter	Screen Time (Test, p-value)	OSDI (Test, p-value)	DES Score (Test, p-value)	Significance
Lighting in work area	F (0.859, NS)	F (0.442, NS)	F (0.745, NS)	Not Significant
Glare on screen	F (0.033, Sig)	F (0.031, Sig)	F (0.002, HS)	Significant
Screen distance	F (0.122, NS)	F (0.089, NS)	F (0.223, NS)	Not Significant
Break frequency	F (0.013, Sig)	C (0.680, NS)	F (0.129, NS)	Significant (Screen Time)
Brightness adjustment	C (0.158, NS)	F (0.685, NS)	F (0.184, NS)	Not Significant
Consulted eye specialist	C (0.347, NS)	C (0.220, NS)	C (0.041, Sig)	Significant (DES Score)
Pre-existing eye conditions	C (0.267, NS)	C (0.926, NS)	C (0.942, NS)	Not Significant

Contact lens use	C (0.624, NS)	F (0.500, NS)	C (0.358, NS)	Not Significant
Device use before sleep	F (0.213, NS)	F (0.440, NS)	F (0.340, NS)	Not Significant

F- Fisher's exact, C-Chi-square test, NS- Not significant, Sig-Significant

Glare on screen is significantly associated with screen time ($p = 0.033$), OSDI ($p = 0.031$) and DES score ($p = 0.002$).Break frequency is significantly associated with screen time ($p = 0.013$).Consulting an ophthalmologist is significantly associated with DES score ($p = 0.041$).Other parameters showed no significant associations.Use of digital eye protection was low, with anti-glare screens/glasses being the most common (54.5%).

Descriptive Statistics:

Mean OSDI score: 22.79 ± 20.12, ranging from 0 to 100. Mean DES score: 17.71 ± 14.63, ranging from 0 to 60. Participants answered an average of 11.79 ± 0.91 questions on the DES questionnaire.

DISCUSSION:

This study found a significant link between high screen time, digital eye strain (DES) and dry eye symptoms. Participants with prolonged screen use reported more severe symptoms, aligning with findings from Uwimana et al. They observed that 26.5% of students with DES had mild to moderate dry eye disease (DED). Similarly, Hikichi et al. reported a higher prevalence of dry eye among screen users and contact lens wearers.

However, some studies present conflicting results. Al Mohtaseb et al. found no significant correlation between screen time and DED diagnosed clinically. Waseem et al. also did not establish a direct link, but emphasized the importance of proper screen use habits. Preventive measures like regular blinking, reducing screen time and following the 20-20-20 rule remain crucial.

Strengths And Limitations

This study focuses on a high-risk group frequently exposed to screens. However, its cross-sectional design and reliance on self-reported data limit accuracy. Future research with objective screen time measurements and clinical assessments is recommended.

CONCLUSION

Screen time plays a key role in DES and DED severity, with glare, lack of breaks and bedtime gadget use as contributing factors. Awareness campaigns should promote screen time management, protective eyewear, and proper lighting adjustments. A combination of behavioral changes and environmental adjustments is essential for prevention and management.

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