Volume 3, Issue 3, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

# DRY EYE DISEASE AMONG ELECTRONIC GADGETS USERS WITH PROLONGED SCREEN TIME

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DOI:https://doi.org/10.5281/zenodo.17722001

**Keywords**
*Dry eye disease, digital screen use, occupational health, Ocular Surface Disease Index, tear film break-up time, Schirmer's test, healthcare professionals*

**Article History**
*Received: 20 March 2025*
*Accepted: 15 May 2025*
*Published: 27 May 2025*

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## Abstract

***Background:*** *Dry eye disease (DED) involves multiple factors affecting the eye's surface, frequently aggravated by prolonged digital screen use. Healthcare professionals are increasingly exposed to electronic devices for work, yet data on occupational DED prevalence remain limited.*

***Methods:*** *A descriptive cross-sectional study was conducted at the Ophthalmology Department, Bacha Khan Medical College and Mardan Medical Complex, Pakistan. Hospital staff aged 18–65 years using electronic devices for ≥3 hours/day were included. Exclusion criteria were ocular pathology, prior ocular surgery, or contact lens use. DED diagnosis was based on tear film break-up time (TBUT <10 sec) and Schirmer's test (<5 mm). Severity was assessed using the Ocular Surface Disease Index (OSDI). Data on demographics, occupational role, device type, and screen duration were collected. Statistical analysis was performed using SPSS v22, with $p \leq 0.05$ considered significant.*

***Results:*** *Ninety-six participants (mean age 28.4 ± 7.4 years; 75% male) were enrolled, with average daily screen use of 7.5 ± 2.7 hours. Overall, DED prevalence was 13.5%, predominantly mild. Prevalence increased with age and among administrative staff, but no significant associations were observed with gender, socioeconomic status, staff role, device type, or timing of use.*

***Conclusion:*** *Clinically confirmed DED affected roughly one in eight hospital staff with prolonged screen exposure. Although lower than in student populations, DED remains an occupational concern. Routine eye examinations, ergonomic adjustments, and scheduled visual breaks following the "20-20-20 rule" are advised to minimize digital eye strain. Longitudinal studies are needed to establish causal links and develop targeted preventive strategies.*

## INTRODUCTION

Dry eye disease (DED) involves multiple factors affecting the eye's surface, mainly due to disturbance in tear balance. It commonly presents with irritation, blurred vision, and unstable tear film caused by inflammation or sensory changes.[1,2] Clinically, patients experience ocular discomfort—such as burning, stinging, and foreign-body sensation—along with visual disturbances, reduced tear break-up time, increased tear osmolarity, ocular surface staining, and decreased tear production.[3,4]

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Worldwide, reported rates of DED vary widely, generally between 5% and 50%, with a pooled mean estimate of approximately 11.6%, and higher rates observed in East Asian populations (16.7–33.4%).[5-7] The condition is more common in women and tends to increase with advancing age due to hormonal, environmental, and behavioral influences.[8,9]

Among modifiable risk factors, extended use of digital devices has now become one of the main preventable triggers of DED. Long hours on screens make people blink less often and less completely, exposing the eye surface for longer periods and speeding up tear evaporation, often disturbing the oil glands at the lid margin.[8,10–12] Experimental studies have demonstrated a significant reduction in tear break-up time following computer use, even without a reduction in tear volume, suggesting predominantly evaporative pathology.[10,11]

Additional factors such as improper screen positioning, suboptimal lighting, low ambient humidity, blue-light exposure, and failure to adopt visual-rest strategies further exacerbate ocular surface stress.10 Behavioral interventions, including the "20-20-20 rule," which encourages short breaks to focus on distant objects regularly, can help relieve symptoms related to screen-related eye strain.[13]

Recent epidemiological data underscore the rising burden of DED among digital device users. Cross-sectional studies have reported prevalence rates of 56.3% among medical students in Jordan and 74.6% among university students in Saudi Arabia, with symptom severity correlating with screen duration.[14,15] In Pakistan, DED symptoms were observed in 47.7% of IT students, while research from India found symptoms in 59% of young women with prolonged screen exposure, highlighting gender and behavioral influences.[16,17] Previous regional data reported a prevalence of approximately 18.33% among digital device users, which served as the reference for sample size estimation in this study.[18]

Despite the growing evidence, little is known about DED among healthcare workers, who face similar or higher screen exposure due to digital health records, imaging systems, and telemedicine platforms. These occupational risks may cause eye strain, fatigue, and reduced productivity.[12]

Considering the rising screen use in hospitals, it is important to estimate how common DED is among healthcare workers who rely heavily on digital devices. This study aimed to determine the frequency of DED among hospital staff with prolonged digital screen exposure. The results may guide ergonomic and preventive measures to improve comfort and ocular health in digitally active work environments.

## METHODS

This descriptive cross-sectional study was conducted at the Department of Ophthalmology, Bacha Khan Medical College / Mardan Medical Complex, Mardan, over six months following approval from the College of Physicians and Surgeons Pakistan (CPSP). Ethical approval for the study was obtained from the Institutional Review Board (IRB) of Bacha Khan Medical College / Mardan Medical Complex (Ref. No: 368/BKMC), and the study adhered to the principles outlined in the Declaration of Helsinki.

The study population included hospital staff—doctors, nurses, paramedics, and administrative personnel—who extensively used electronic gadgets such as mobile phones, laptops, or tablets. Participants of both genders aged 18–65 years were included if they had prolonged screen exposure, defined as the use of electronic screens for ≥3 hours per day, whether continuous or interrupted.

Individuals with ocular pathologies (e.g., keratitis, cataract, corneal ectasia, glaucoma, retinal disease, corneal opacity, or active ocular infection) or a history of ocular surgery or contact lens use were excluded to minimize confounding factors.

Sample size was calculated using the WHO sample size calculator, with a 95% confidence level, 8% absolute precision, and an expected DED prevalence of 18.33%, yielding a minimum of 90 participants. Non-probability consecutive sampling was used to recruit eligible subjects.

After obtaining written informed consent, baseline characteristics were recorded using a structured proforma. Collected data included age, gender, residence (urban/rural), socioeconomic

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

class (lower, middle, upper), staff category, predominant gadget used, timing of use (day, night, both), and average daily screen duration (hours).

DED diagnosis was based on two clinical tests: tear film break-up time (TBUT) and Schirmer's test. TBUT was defined as the interval between the last blink and the first appearance of a dry spot; <10 seconds was considered abnormal. Schirmer's test was performed by placing a filter paper strip in the lower eyelid for five minutes, with wetting <5 mm indicating an abnormal result. DED was diagnosed when both TBUT and Schirmer's test were positive.

The Ocular Surface Disease Index (OSDI) score was recorded only for patients clinically diagnosed with DED; data was not collected for non-diseased participants.

Severity was evaluated using the OSDI questionnaire. Scores of 13–22 indicated mild, 23–32 moderate, and ≥33 severe DED. All assessments were performed by the same investigator under standardized lighting to minimize inter-observer variability. Participant confidentiality was strictly maintained.

Data was analyzed using SPSS version 22. Quantitative variables (age, duration of screen use) were presented as mean ± standard deviation (SD). Categorical variables (gender, residence, socioeconomic status, staff category, gadget type, time of use, and DED presence/severity) were expressed as frequencies and percentages. Stratification was performed for age, gender, socioeconomic status, staff role, gadget type, and exposure duration. Post-stratification comparisons were conducted using chi-square test or Fisher's exact test, with $p \leq 0.05$ considered statistically significant.

## RESULTS

A total of 96 hospital staff members participated in the study. The mean age was 28.4 ± 7.4 years (range: 18–61), and the mean daily screen use duration was 7.5 ± 2.7 hours (range: 3–16). Among the 13 participants clinically diagnosed with Dry Eye Disease (DED), the mean Ocular Surface Disease Index (OSDI) score was 15.5 ± 3.1 (range: 13–23) (**Table 1**).

The overall prevalence of DED was 13.5% (n = 13). DED was more frequent in males (16.7%) than females (4.2%), although this difference was not statistically significant ($p = 0.174$, Fisher's Exact Test).

No statistically significant associations were observed between DED and age group, socioeconomic status, occupational role, device type, timing of use, or categorized screen duration (**Table 2**). Prevalence by age group was 9.3% for participants aged ≤25 years, 14.3% for those aged 26–35 years, and 27.3% for those aged >35 years ($p = 0.294$, Chi-square test). DED was most common in the middle socioeconomic class (17.8%), with no cases reported in the lower or upper classes ($p = 0.094$, Chi-square test). By occupational role, prevalence was highest among administrative staff (22.2%), followed by paramedical staff (16.1%), doctors (11.8%), and nurses (6.7%) ($p = 0.459$, Chi-square test). Regarding device use, DED prevalence was 16.0% among multiple-device users and 11.9% among mobile-only users ($p = 0.068$, Chi-square test). Similarly, no significant associations were found for timing of use ($p = 0.660$, Chi-square test) or categorized screen duration ($p = 0.192$, Chi-square test).

In summary, approximately one in eight hospital staff members with prolonged screen exposure had DED, with no statistically significant associations identified with the sociodemographic, occupational, or screen-related factors analyzed.

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ISSN: (e) 3007-1607 (p) 3007-1593

**Table I. Baseline Characteristics of Study Participants (N = 96)**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age (years) | Mean ± SD | 28.4 ± 7.4 | - |
| Gender | Male | 72 | 75.0 |
| | Female | 24 | 25.0 |
| Socioeconomic Class | Lower | 20 | 20.8 |
| | Middle | 73 | 76.0 |
| | Upper | 3 | 3.1 |
| Staff Category | Doctor | 17 | 17.7 |
| | Nurse | 30 | 31.3 |
| | Paramedical | 31 | 32.3 |
| | Administrative | 18 | 18.8 |
| Predominant Gadget Used | Mobile phone | 67 | 69.8 |
| | Laptop | 3 | 3.1 |
| | Tablet | 1 | 1.0 |
| | Multiple devices | 25 | 26.0 |
| Time of Gadget Use | Day only | 10 | 10.4 |
| | Night only | 3 | 3.1 |
| | Both day and night | 83 | 86.5 |
| Average Screen Time (hours/day) | Mean ± SD | 7.5 ± 2.7 | - |

**Table II. Association of Dry Eye Disease (DED) with Sociodemographic and Screen-Use Variables (n = 96)**

| Variable | Category | DED Present (n, %) | p-value |
|---|---|---|---|
| Overall DED Prevalence | - | 13 (13.5%) | - |
| Gender | Male | 12 (16.7%) | 0.174 (Fisher's Exact Test) |
| | Female | 1 (4.2%) | |
| Age Group (years) | ≤25 | 4 (9.3%) | 0.294 (Chi-square test) |
| | 26–35 | 6 (14.3%) | |
| | >35 | 3 (27.3%) | |
| Socioeconomic Status | Lower | 0 (0.0%) | 0.094 (Chi-square test) |
| | Middle | 13 (17.8%) | |
| | Upper | 0 (0.0%) | |
| Staff Category | Doctor | 2 (11.8%) | 0.459 (Chi-square test) |
| | Nurse | 2 (6.7%) | |
| | Paramedical | 5 (16.1%) | |
| | Administrative | 4 (22.2%) | |
| Gadget Used | Mobile only | 8 (11.9%) | 0.068 (Chi-square test) |
| | Multiple devices | 4 (16.0%) | |
| | Laptop | 0 (0.0%) | |
| | Tablet | 1 (100%) | |
| Time of Use | Day only | 2 (20.0%) | 0.660 (Chi-square test) |
| | Night only | 0 (0.0%) | |
| | Both day and night | 11 (13.1%) | |

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ISSN: (e) 3007-1607 (p) 3007-1593

## DISCUSSION

In this cross-sectional study of hospital staff with prolonged screen exposure, the prevalence of clinically confirmed dry eye disease (DED) was 13.5%, diagnosed using both TBUT <10 sec and Schirmer's test <5 mm. This prevalence is lower than rates reported in student and general adult populations exposed to digital screens, which often exceed 30%.[19] For instance, regional studies show high symptom/prevalence estimates among young and student populations — e.g. Mamoon et al. reported clinically assessed DED in IT students, and Waseem et al. reported eye dryness related to screen time in a Pakistani cohort.[16,21] Similarly, among medical students in Peshawar, digital eye strain—sharing symptoms with DED—was observed in 74.1%, strongly associated with screen duration.[19]

Our analysis revealed no statistically significant associations between DED and gender, age, socioeconomic status, or staff role, although prevalence tended to increase with age and among administrative personnel. This contrasts with prior studies where female gender and older age were consistent risk factors.[20] The discrepancy may reflect differences in study populations, exposure patterns, or diagnostic criteria. Notably, our use of both TBUT and Schirmer's test likely captured "definite" DED, whereas many studies rely on symptom questionnaires or TBUT alone, potentially inflating prevalence estimates.[21]

From a physiological perspective, looking at screens for long periods lowers blink frequency, which dries the eye surface and promotes evaporative-type DED.[10,11] Other contributing factors, such as blue-light exposure, suboptimal ergonomics, and environmental conditions, were not directly measured in this study but may modulate risk. The lack of association with night-time use or socioeconomic status in our cohort could reflect relatively homogeneous occupational exposures and environmental conditions.

These findings underscore the occupational relevance of DED among healthcare professionals, particularly in settings with high digital device use. Preventive strategies, including regular ocular assessments, ergonomic adjustments, scheduled visual breaks, and adherence to the "20-20-20" rule, may help maintain ocular surface health and reduce visual fatigue in high-screen-use environments.[13]

### Study Limitations and Strengths

**Strengths:**

Focused on hospital staff, an occupational group with consistent and high screen exposure.

Objective diagnostic criteria (TBUT and Schirmer's test) and standardized OSDI assessment enhanced reliability.

Single-investigator assessments under controlled lighting minimized inter-observer variability.

**Limitations:**

Cross-sectional design prevents causal inference between screen time and DED.

Sample size may limit detection of minor differences across subgroups.

Self-reported screen use may introduce recall bias.

Environmental factors (humidity, lighting, air conditioning) and ocular comorbidities (e.g., refractive errors) were not assessed.

Single-center study may limit generalizability to other healthcare settings.

## CONCLUSION

In this cohort of hospital staff with prolonged screen exposure, clinically confirmed DED was present in 13.5% of participants. Although lower than reported in student populations, DED remains an important occupational concern for healthcare workers. Prevalence tended to increase with age and among administrative personnel, but no statistically significant associations were observed with gender, socioeconomic status, or staff role. These findings highlight the importance of routine eye check-ups, better screen posture, and frequent short breaks following the 20-20-20 rule can help prevent and ease digital eye discomfort. Future longitudinal studies with larger and more diverse healthcare populations are warranted to clarify causal relationships and optimize preventive interventions.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge the Ophthalmology Department staff at Mardan

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ISSN: (e) 3007-1607 (p) 3007-1593

Medical Complex for their assistance in data collection and patient care during the study period.

## CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study.

## FUNDING

This research received no specific grant from any funding agency.

## AUTHOR CONTRIBUTIONS

**Critical Review and Final Approval:** All authors
All authors reviewed and approved the final manuscript.

## REFERENCES

Golden MI, Meyer JJ, Zeppieri M, et al. Dry Eye Syndrome. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024. http://www.ncbi.nlm.nih.gov/books/NBK470411/

Craig JP, Nichols KK, Akpek EK, et al. TFOS DEWS II Definition and Classification Report. Ocul Surf. 2017;15(3):276-83. DOI: 10.1016/j.jtos.2017.05.008.

Messmer EM. The pathophysiology, diagnosis, and treatment of dry eye disease. Dtsch Arztebl Int. 2015;112(5):71-82. DOI: 10.3238/arztebl.2015.0071.

Stapleton F, Velez FG, Lau C, et al. Dry eye disease in the young: A narrative review. Ocul Surf. 2024;31:11-20. DOI: 10.1016/j.jtos.2023.12.001.

Cai Y, Wei J, Zhou J, et al. Prevalence and Incidence of Dry Eye Disease in Asia: A Systematic Review and Meta-Analysis. Ophthalmic Res. 2022;65(6):647-658. DOI: 10.1159/000525696.

Papas EB. The global prevalence of dry eye disease: A Bayesian view. Ophthalmic Physiol Opt. 2021;41(6):1254-1266. DOI: 10.1111/opo.12888.

Britten-Jones AC, Wang MTM, Samuels I, et al. Epidemiology and Risk Factors of Dry Eye Disease: Considerations for Clinical Management. Medicina (Kaunas). 2024;60(9):1458. DOI: 10.3390/medicina60091458.

Al-Mohtaseb Z, Schachter S, Shen Lee B, et al. The Relationship Between Dry Eye Disease and Digital Screen Use. Clin Ophthalmol. 2021;15:3811-3820. DOI: 10.2147/OPTH.S321591.

Jakhar F, Rodrigues GR, Mendonca TM, et al. Dry eye symptoms and digital eyestrain - Emerging epidemics among university students due to online curriculum amid the COVID-19 pandemic. A cross-sectional study. Indian J Ophthalmol. 2023;71(4):1472-1477. DOI: 10.4103/IJO.IJO_2760_22.

Kaur K, Gurnani B, Nayak S, et al. Digital Eye Strain- A Comprehensive Review. Ophthalmol Ther. 2022;11(5):1655-1680. DOI: 10.1007/s40123-022-00540-9.

Akkaya S. The Effect of Long Term Computer Use on Eye Dryness. North Clin Istanb. 2018;5(4):319-322. DOI: 10.14744/nci.2017.54036.

Moon JH, Kim KW, Moon NJ. Smartphone use is a risk factor for pediatric dry eye disease according to region and age: a case control study. BMC Ophthalmol. 2016;16:188. DOI: 10.1186/s12886-016-0364-4.

Talens-Estarelles C, Cerviño A, García-Lázaro S, et al. The effects of breaks on digital eye strain, dry eye and binocular vision: Testing the 20-20-20 rule. Cont Lens Anterior Eye. 2023;46(1):101744. DOI: 10.1016/j.clae.2022.101744.

Alkousheh H, Alkousheh Y, Qawaqzeh R, et al. The hidden cost of digital learning: a cross-sectional study assessing the prevalence of computer vision syndrome (CVS) among medical students in Jordan. BMJ Open. 2025;15(1):e093939. DOI: 10.1136/bmjopen-2024-093939.

Zarban NA, Alammari OB, Abu Sabah S, et al. Prevalence and Risk Factors of Dry Eye Disease in Association With the Increased Use of Electronic Devices Among University Students in Western Saudi Arabia. Cureus. 2024;16(1):e51554. DOI: 10.7759/cureus.51554.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Mamoon I, Ayub F, Sarwat S. Prevalence of dry eye disease among IT students in Pakistan. Int Ophthalmol. 2024;44(1):204. DOI: 10.1007/s10792-024-03142-5.

Gupta PC, Rana M, Ratti M, et al. Association of screen time, quality of sleep and dry eye in college-going women of Northern India. Indian J Ophthalmol. 2022;70(1):51-58. DOI: 10.4103/ijo.IJO_1691_21.

Reshma BKS, Iram S. Prevalence of dry eye in computer users. IP Int J Ocul Oncol Oculoplasty. 2020;6(2):95–98. DOI: 10.18231/j.ijooo.2020.020.

Haider I, Osama M, Gul N, Khattak AR. Impact of screen time on digital eye strain and visual acuity among medical students in Peshawar, Pakistan. Khyber Med Univ J. 2023 Dec;15(4):229–34. DOI: 10.35845/kmuj.2023.23402.

Yasir ZH, Sharma R, Kesarwani D, et al. Digital eye strain and its determinants among medical staff and medical students: a cross-sectional study. D Y Patil J Health Sci. 2023;11(1):12–18. DOI: 10.4103/DYPJ.DYPJ_67_22.

Waseem M, Hussain M, Mengal M. Effect of Screen Time on Eye Dryness. Pak J Ophthalmol. 2023;39(3). DOI: 10.36351/pjo.v39i3.1616.