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ASSESSMENT OF FREQUENCY OF DRY EYES AMONG DIGITAL SCREEN USERS AT ISRA UNIVERSITY ISLAMABAD CAMPUS

Original Research

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ABSTRACT

Background: Dry eye disease (DED) is a prevalent ocular surface disorder affecting 5% to 50% of the global adult population. Characterized by tear film instability and ocular surface inflammation, it significantly impairs visual function and quality of life. The modern reliance on digital devices has heightened the risk of DED, as reduced blink rate and incomplete blinking during screen use compromise tear film dynamics and ocular surface protection.

Objective: This study aimed to determine the frequency and severity of dry eye symptoms among digital screen users at PIRS Isra University Islamabad Campus and to evaluate tear film stability using non-invasive tear breakup time (NIBUT).

Methods: A quantitative, descriptive cross-sectional study was conducted over six months using non-probability purposive sampling. A total of 139 participants aged 18 years and older were recruited. Data collection tools included a self-designed performa documenting screen habits and clinical findings, and the validated Standard Patient Evaluation of Eye Dryness (SPEED) questionnaire. Tear film stability was objectively assessed through NIBUT using a keratometer.

Results: All participants (100%) reported mobile phone usage, and 43.1% (n=60) used screens for more than six hours daily. According to NIBUT, dry eye disease in the right eye was observed in 56.8% of participants (mild: 8.6%, moderate: 30.2%, severe: 18%), while the left eye showed 58.3% with dry eye (mild: 17.3%, moderate: 18.7%, severe: 22.3%). SPEED scores indicated that 89.2% of participants had symptoms of dry eye, with 28.8% classified as mild, 25.9% moderate, and 34.5% severe.

Conclusion: Dry eye disease was highly prevalent among digital screen users, emphasizing the need for routine screening and preventive measures, especially in populations with prolonged screen exposure.

Keywords: Dry Eye Syndromes, NIBUT, Ocular Surface, Screen Time, SPEED Questionnaire, Tear Film Stability, Visual Display Units.

INTRODUCTION

Dry eye disease (DED) is a prevalent ocular disorder affecting a significant proportion of the global adult population, with estimates ranging from 5% to 50% depending on diagnostic criteria and geographic region (1). More than a minor irritation, DED is a chronic and often debilitating condition that compromises visual function and diminishes overall quality of life. Patients frequently report difficulty with everyday tasks such as reading, screen use, and driving—activities that demand sustained visual focus. The condition is marked by a disturbance in the homeostasis of the tear film and ocular surface, leading to tear film instability, hyperosmolarity, inflammation, and, in some cases, neurosensory abnormalities (2). Symptoms of DED span a broad clinical spectrum. Patients may present with stinging, burning, foreign body sensation, excessive tearing, ocular pain, redness, photophobia, blurry or fluctuating vision, and even a sensation of ocular fatigue or heaviness. These symptoms may intensify with prolonged screen time or environmental exposure and are often exacerbated in contact lens users (3,4). Despite the seemingly paradoxical symptom of tearing, it often reflects reflex tearing due to ocular surface dryness rather than adequate lubrication. Anatomically, the tear film plays a critical role in preserving optical clarity and protecting the ocular surface. It is a complex, multilayered structure traditionally described as comprising a superficial lipid layer secreted primarily by the Meibomian glands, an intermediate aqueous layer secreted by the lacrimal glands, and a mucin-rich inner layer produced by conjunctival goblet cells and other accessory structures (5,6). These layers work synergistically to maintain surface wetness, reduce evaporation, and support ocular immunity and comfort (7,8). A balanced tear film is thus vital for eye health, and disruption in any layer can trigger or exacerbate DED (9).

DED is commonly categorized into two overlapping subtypes: aqueous-deficient and evaporative. Aqueous-deficient DED stems from insufficient tear production, often due to lacrimal gland dysfunction, systemic autoimmune diseases like Sjögren's syndrome, or side effects from medications such as antihistamines or beta-blockers. Evaporative DED, on the other hand, is largely driven by Meibomian gland dysfunction (MGD), where lipid secretion is inadequate or altered, resulting in rapid tear evaporation despite normal aqueous volume (10). MGD is widely recognized as a leading cause of DED, with up to 70%–90% of DED patients exhibiting signs of this condition, particularly in Asian populations where prevalence rates appear higher (11). The etiological landscape of DED is multifactorial, encompassing local ocular conditions, systemic diseases (such as thyroid disorders and connective tissue diseases), dermatological conditions involving the eyelids, environmental exposures, and iatrogenic factors including ocular surgeries and preservative-containing eye drops (10). In recent years, the digital era has emerged as a major contributor to DED prevalence. Escalating use of digital devices—smartphones, computers, tablets—has been linked to decreased blink rate and increased incomplete blinks, both of which disturb tear film dynamics and exacerbate ocular dryness (12,13). Studies have shown a significantly increased risk of DED in individuals who use digital screens for more than three hours daily. Blinking, a critical mechanism for tear film renewal, becomes irregular or incomplete during prolonged screen exposure, leading to unstable tear film and heightened evaporative loss (14,15).

Given the expansive range of symptoms and causes, diagnostic precision is essential in DED management. Traditional tests like the fluorescein tear breakup time (TBUT) have faced criticism for poor reproducibility and invasiveness. To address this, noninvasive tear breakup time (NIBUT) methods have gained favor. These advanced techniques provide tear film stability assessment without altering ocular physiology and are considered more reliable for clinical use (8,12). Similarly, symptom-based tools such as the Standard Patient Evaluation of Eye Dryness (SPEED) questionnaire offer valuable insight into patient-reported outcomes. SPEED has shown strong correlation with both objective clinical findings and disease severity, outperforming other tools like the Ocular Surface Disease Index (OSDI) in differentiating symptomatic from asymptomatic individuals (15,16). In light of these developments, this study aims to investigate the relationship between digital screen exposure and the prevalence and severity of dry eye symptoms, with a particular focus on blink patterns and Meibomian gland dysfunction. By exploring this intersection, the study seeks to provide evidence-based recommendations for mitigating DED in the context of modern digital lifestyles.

METHODS

This quantitative, cross-sectional descriptive study was conducted at the Pakistan Institute of Rehabilitation Sciences (PIRS), Isra University, Islamabad Campus over a six-month period. The research aimed to assess the prevalence and severity of dry eye disease

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(DED) among screen users using both subjective and objective assessment tools. Ethical approval for the study was obtained from the Institutional Review Board and the Head of Department at PIRS, Isra University. All participants were briefed about the purpose of the study, and written informed consent was obtained prior to enrolment, ensuring adherence to ethical research standards. The target population consisted of 188 individuals affiliated with the PIRS department. Based on a reported DED prevalence of 51% among screen users (15), a 95% confidence interval, and using the Rao soft sample size calculator, an initial sample size of 127 participants was determined. To reduce selection bias and allow for potential dropouts, an additional 10% was added, resulting in a final sample size of 139. Participants were recruited using a non-probability purposive sampling technique.

Inclusion criteria comprised screen users of either gender aged 18 years and above. Exclusion criteria included individuals below 18 years of age, those with known hormonal imbalances, diabetes, active corneal or conjunctival diseases, anterior segment pathology, history of eye surgery within the preceding three months, significant refractive errors greater than ±2.00 diopters, and individuals already receiving treatment for DED. Data collection commenced in May following ethical clearance. All participants first underwent visual acuity testing and anterior segment examination to confirm eligibility. Participants who fulfilled the inclusion criteria completed two data collection instruments: a self-designed performa and the validated Standard Patient Evaluation of Eye Dryness (SPEED II) questionnaire. The self-designed performa captured demographic details, type of digital device used, daily screen time, visual acuity, findings from anterior segment examination, and non-invasive tear breakup time (NIBUT) results.

The SPEED II questionnaire assessed four core symptoms—dryness, grittiness or scratchiness; soreness or irritation; burning or watering; and eye fatigue—across three timeframes: at the time of the visit, within the past 72 hours, and over the past three months. Symptom frequency was rated on a 4-point scale (0=Never, 1=Sometimes, 2=Often, 3=Constant), while severity was assessed using a 5-point scale (0=No problem, 1=Tolerable, 2=Uncomfortable, 3=Bothersome, 4=Intolerable). The total SPEED score ranged from 0 to 28 and was graded as follows: 0 (Normal), 1–4 (Mild), 5–7 (Moderate), and >8 (Severe) (13,14). Objective evaluation of tear film stability was carried out using a keratometer to measure NIBUT. Participants were instructed to sit in front of the instrument with their chin positioned on the chin rest. The left eye was occluded while mires were focused on the right eye. The participant was then asked to refrain from blinking, and a stopwatch was started. The timer was stopped upon the first sign of mire distortion. This procedure was repeated for the left eye. NIBUT grading was defined as: >10 seconds (Normal), 7–9 seconds (Mild), 5–7 seconds (Moderate), and <5 seconds (Severe) (15). The final analysis was based on the SPEED scoring system and NIBUT values, allowing for comprehensive categorization of DED severity.

RESULTS

The study recruited 139 participants, with a gender distribution of 36% male (n=50) and 64% female (n=89). All participants reported mobile phone use (100%), while 63.3% (n=88) used desktop or laptop devices and 27.3% (n=38) reported television usage. Regarding screen exposure, 43.9% (n=61) reported using screens for more than six hours daily, followed by 27.3% (n=38) for 2 to 4 hours, 22.3% (n=31) for 4 to 6 hours, and 6.5% (n=9) for less than two hours. Assessment of dry eye disease using NIBUT revealed that in the right eye (OD), 43.2% (n=60) of participants had normal tear film stability, while 8.6% (n=12) had mild dry eye, 30.2% (n=42) had moderate, and 18% (n=25) exhibited severe dry eye. In the left eye (OS), 41.7% (n=58) were normal, 17.3% (n=24) had mild dry eye, 18.7% (n=26) had moderate, and 22.3% (n=31) were categorized as severe. Symptomatically, dryness or grittiness was never experienced by 52.5% (n=73), while 36% (n=50) experienced it sometimes, 7.2% (n=10) often, and 4.3% (n=6) constantly. Soreness or irritation was never reported by 48.9% (n=68), sometimes by 35.3% (n=49), often by 15.1% (n=21), and constantly by 0.7% (n=1). Burning or watering was reported sometimes by 46.8% (n=65), often by 20.1% (n=28), constantly by 3.6% (n=5), and never by 29.5% (n=41). Eye fatigue was reported by 12.2% (n=17) as constant, 10.1% (n=14) as often, 35.3% (n=49) as sometimes, and never by 42.4% (n=59).
The severity of dryness or grittiness was categorized as tolerable in 34.5% (n=48), uncomfortable in 7.9% (n=11), bothersome in 3.6% (n=5), and intolerable in 0.7% (n=1), while 53.2% (n=74) reported no issue. Soreness was rated as tolerable by 34.5% (n=48), uncomfortable by 14.4% (n=20), and bothersome by 2.9% (n=4), with no reports of intolerability. Regarding burning or watering, 46% (n=64) rated it as tolerable, 18% (n=25) uncomfortable, 5% (n=7) bothersome, and 1.4% (n=2) intolerable. Eye fatigue was similarly reported as tolerable by 36% (n=50), uncomfortable by 14.4% (n=20), bothersome by 5.8% (n=8), and intolerable by 2.2% (n=3). Final classification based on SPEED score revealed that 10.8% (n=15) had no dry eye symptoms, while 28.8% (n=40) had mild, 25.9% (n=36) had moderate, and 34.5% (n=48) had severe dry eye disease.

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Table 1: Gender Distribution of Study Participants (n = 139)

Gender	Frequency	Percentage%
Male	50	36%
Female	89	64%
Total	139	100%

Table 2: Distribution of Digital Device Usage Among Study Participants (n = 139)

Device Type	Usage	Frequency	Percentage (%)
Desktop/Laptop	Yes	88	63.3
	No	51	36.7
Mobile Phone	Yes	139	100.0
	No	0	0.0
Television	Yes	38	27.3
	No	101	72.7

Table 3: Duration of Screen time (n = 139)

Screen time	Frequency	Percentage%
Less than 2 hours	9	6.5%
2 to 4 hours	38	27.3%
4 to 6 hours	31	22.3%
More than 6 hours	61	43.9%
Total	139	100%

Table 4: Distribution of Dry Eye Severity and Symptom Frequency Among Study Participants (n = 139)

Category	Grading	Frequency	Percentage (%)
Dry Eye OD (NIBUT)	Normal	60	43.2
	Mild	12	8.6
	Moderate	42	30.2
	Severe	25	18.0
Dry Eye OS (NIBUT)	Normal	58	41.7
	Mild	24	17.3
	Moderate	26	18.7
	Severe	31	22.3
Dryness or Grittiness	Never	73	52.5
	Sometimes	50	36.0
	Often	10	7.2
	Constant	6	4.3
Soreness or Irritation	Never	68	48.9
	Sometimes	49	35.3
	Often	21	15.1
	Constant	1	0.7

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Table 5: Distribution of Burning, Watering, and Eye Fatigue Frequency Among Study Participants (n = 139)

Symptom	Frequency Level	Frequency	Percentage (%)
Burning or Watering	Never	41	29.5
	Sometimes	65	46.8
	Often	28	20.1
	Constant	5	3.6
Eye Fatigue	Never	59	42.4
	Sometimes	49	35.3
	Often	14	10.1
	Constant	17	12.2

Table 6: Severity of Dry Eye Symptoms Among Study Participants (n = 139)

Symptom	Severity Level	Frequency	Percentage (%)
Dryness, Grittiness, Scratchiness	Never	74	53.2
	Tolerable	48	34.5
	Uncomfortable	11	7.9
	Bothersome	5	3.6
	Intolerable	1	0.7
Soreness or Irritation	Never	67	48.2
	Tolerable	48	34.5
	Uncomfortable	20	14.4
	Bothersome	4	2.9
	Intolerable	0	0.0
Burning or Watering	Never	41	29.5
	Tolerable	64	46.0
	Uncomfortable	25	18.0
	Bothersome	7	5.0
	Intolerable	2	1.4
Eye Fatigue	Never	58	41.7
	Tolerable	50	36.0
	Uncomfortable	20	14.4
	Bothersome	8	5.8
	Intolerable	3	2.2

Table 7: Frequency of Dry Eyes according to SPEED Score (n = 139)

SPEED Score	Frequency	Percentage%
Normal	15	10.8%
Mild	40	28.8%
Moderate	36	25.9%
Severe	48	34.5%
Total	139	100%

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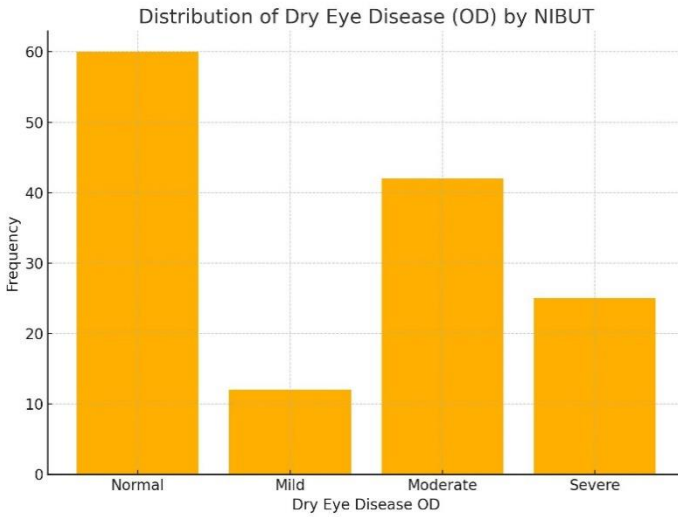

Figure 1 Distribution of Dry Eye Disease (OD) by NIBUT

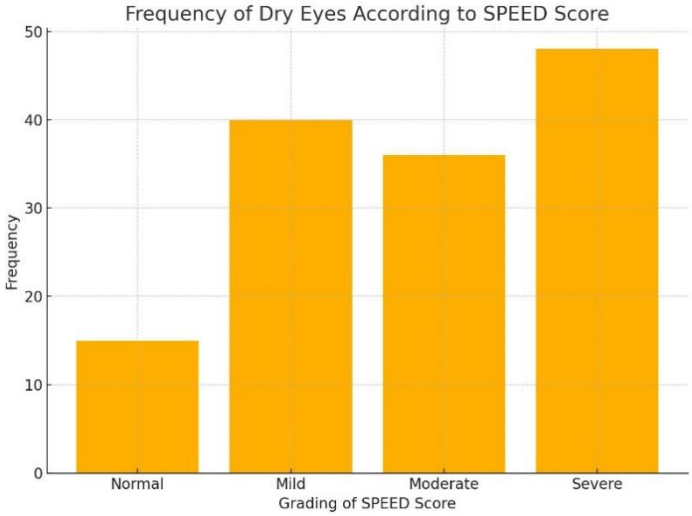

Figure 2 Frequency of Dry Eye According to SPEED Score

DISCUSSION

The findings of this study provide compelling evidence that screen use is significantly associated with the prevalence and severity of dry eye disease (DED) among a young adult population. With 43.9% of participants reporting more than six hours of daily screen time and 34.5% presenting with severe DED symptoms based on SPEED scores, the results corroborate a growing body of literature suggesting that prolonged digital device exposure plays a critical role in the exacerbation of ocular surface dysfunction. These findings are consistent with previous research that has demonstrated a positive correlation between digital screen usage and tear film instability, often due to reduced blink rate and increased incomplete blinking patterns during screen engagement (16,17). Objectively measured tear film stability through non-invasive tear breakup time (NIBUT) further reinforced the subjective findings, with a notable percentage of participants exhibiting moderate to severe dry eye indicators in both eyes. In the right eye, 48.2% fell into moderate to severe categories, and in the left eye, this group constituted 41%. This alignment between subjective symptoms and objective markers enhances the internal validity of the study and highlights the reliability of combining SPEED scoring with NIBUT for comprehensive DED assessment. The prominence of symptoms such as dryness, eye fatigue, burning, and grittiness—especially among those with higher screen time—strengthens the causal narrative linking screen exposure with ocular surface stress (18,19).

In comparison to global trends, the prevalence of dry eye symptoms in this study mirrors figures reported in Asia, where prevalence among young adults using digital devices is estimated to range between 40% and 60% (20). Furthermore, a multicenter observational study in China similarly reported that individuals engaging in more than four hours of screen time daily were at higher risk of developing evaporative dry eye due to Meibomian gland dysfunction and reduced tear film stability (21). This consistency across diverse populations supports the hypothesis that digital behavior patterns significantly modulate tear film physiology. Importantly, the findings also underscore the importance of incorporating symptom-based tools such as the SPEED questionnaire in routine screening practices, particularly in occupational health and educational institutions. Compared to other tools like the OSDI, the SPEED questionnaire has demonstrated superior sensitivity in distinguishing between symptomatic and asymptomatic individuals and offers the additional advantage of capturing symptom fluctuations over different timeframes (22,23).

One of the key strengths of this study lies in its combined use of both subjective and objective diagnostic measures, which provides a robust and multidimensional perspective on DED. Furthermore, the use of a validated symptom scoring system, standardized grading of NIBUT, and a structured, ethically approved research framework add to the methodological rigor. The purposive sampling strategy allowed for targeted recruitment of screen users, ensuring relevance to the study objective. Nevertheless, some limitations merit acknowledgment. The study's cross-sectional design restricts the ability to establish temporality or causation. While a strong association

was observed between screen time and dry eye symptoms, longitudinal data would be necessary to confirm causal relationships. Another limitation lies in the lack of analysis regarding the type of digital device used in relation to symptom severity, which could have yielded nuanced insights—especially since mobile devices are held closer to the eyes than desktops, potentially intensifying ocular strain. Additionally, the absence of data on ambient lighting, blink rates, work posture, or screen ergonomics limits the environmental contextualization of the findings. These variables have been shown in previous research to modulate the risk of DED in digital device users (23).

Another area that remains unexplored in this study is the potential influence of hormonal, dietary, or lifestyle factors, which have been implicated in tear film dysfunction and ocular surface inflammation in past literature (24). Further research could benefit from a more comprehensive participant profiling that includes such systemic variables. Similarly, it would be advantageous to examine the impact of preventive interventions—such as artificial tears, omega-3 supplementation, or workplace ergonomics—on DED prevalence among high-risk groups. In conclusion, the study substantiates the growing concern regarding screen-associated DED, particularly in academic and occupational populations. The findings contribute to the evolving understanding of how modern digital lifestyles affect ocular health and reinforce the need for early detection and proactive management. Future research should consider multicentric, longitudinal, and interventional designs to explore the dynamics of screen-induced dry eye and to develop standardized preventive strategies that can be integrated into routine health promotion initiatives.

CONCLUSION

This study concludes that dry eye disease is a prevalent concern among individuals who frequently use digital screens, with the majority of participants experiencing symptoms ranging from mild to severe. The findings underscore the growing impact of prolonged screen exposure on ocular surface health and highlight the need for early identification and preventive strategies. Incorporating regular eye assessments and promoting screen-use hygiene in academic and professional environments may play a crucial role in reducing the burden of dry eye symptoms and preserving visual well-being in today's digitally driven lifestyle.

AUTHOR CONTRIBUTION

Author	Contribution
Aqsa Nawaz*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Iqra Habib	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Maha Arshad	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Hamza	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Saman Zaheer	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Saima Ghufran	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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