e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.10.35

International Journal of Pharmaceutical Quality Assurance 2025; 16(10); 214-219

Original Research Article

Impact of Prolonged Computer Use on Dry Eye Disease: An OSDI and Schirmer's Test Study

Abhishek Kumar[1], Manish Kumar Karn[2], Isha[3], Yugesh[4]

[1]Senior Resident, Department of Regional Institute of Ophthalmology (RIO), IGIMS, Patna, Bihar, India
[2]Senior Resident, Department of Regional Institute of Ophthalmology (RIO), IGIMS, Patna, Bihar, India
[3]Senior Resident, Department of Regional Institute of Ophthalmology (RIO), IGIMS, Patna, Bihar, India
[4]Assistant Professor, Department of Regional Institute of Ophthalmology (RIO), IGIMS, Patna, Bihar, India

Received: 10-08-2025 / Revised: 13-09-2025 / Accepted: 24-10-2025
Corresponding Author: Dr. Manish Kumar Karn
Conflict of interest: Nil

Abstract:

Background: Dry eye disease (DED) is a multifactorial ocular surface disorder, often exacerbated by prolonged digital screen use. Medical students, due to extended computer exposure, are at increased risk of developing DED.

Aim: To evaluate the prevalence and severity of DED in medical students using Ocular Surface Disease Index (OSDI) scores and Schirmer's test, and to assess the relationship with daily computer usage.

Methodology: A hospital-based, cross-sectional study was conducted on Department of RIO, IGIMS, Patna, Bihar, India for one year. 90 participants aged 20–40 years. Participants were grouped based on daily computer use: Group A (>2–4 hours), Group B (>4–6 hours), and Group C (>6–8 hours). DED was assessed subjectively via OSDI and objectively via Schirmer's test, tear film break-up time (TBUT), and tear meniscus height (TMH). Data were analyzed using SPSS v27, with $p<0.05$ considered significant.

Results: DED prevalence increased with computer use: Group A (9.3%), Group B (18.2%), Group C (45.7%). OSDI scores and ocular surface parameters worsened with higher screen time. Schirmer's test, TBUT, and TMH showed progressive reduction across groups, indicating impaired tear production and stability.

Conclusion: Prolonged computer use is strongly associated with DED in medical students. Combining subjective and objective assessments enables early detection and preventive interventions, including ergonomic adjustments, conscious blinking, and regular breaks.

Keywords: Dry Eye Disease, OSDI, Schirmer's Test, Computer Vision Syndrome, Medical Students.

Introduction

Dry eye disease (DED) is an ocular surface, multifactorial, disease that is associated with loss of ocular surface tear film homeostasis, with ocular symptoms of irritation, burning, foreign body sensation, photophobia and variable visual acuity [1]. It has become a major health issue in the masses because it is much prevalent and affects the quality of life. Pathophysiology of DED is complicated, in the DED, the tear film is not stable, ocular surface is inflamed, and neurosensory abnormalities are observed. The disease is developed and advances as a result of environmental factors, systemic conditions, lifestyle habits, and aging. In the group of lifestyle factors, long-term exposure to digital screens, particularly in computer users, has increasingly been considered the primary risk factor in the development of DED. This commonly-known condition is known as a computer vision syndrome or digital eye strain, and is linked to slowed blink rate, incomplete blinking, and extended visual tasks, which cumulatively lead to the instability of the tear film and the ocular surface stress [2].

Use of computers and other digital devices in the contemporary society, especially in work and learning institutions has resulted in a rising number of complaints in regard to eye discomfort and visual fatigue [3]. Research has illustrated that the incidence of DED among computer users is between 25-50 per cent indicating the enormous weight of this disease among the working population. The pathomechanism of DED in computer users is a complex of mechanical, environmental and behavioral factors [4]. Minimum frequency of blinking and partial closure of eyelids during screen utilization causes high tear evaporation and eye desiccation. Also, prolonged exposure to artificial light source, air conditioning, dry air, and poor ergonomics of a workstation also contribute to the further destabilization of tear film. All these factors have adverse effects on the protective roles of the tear film and lead to inflammation of the ocular surface, hyperosmolarity, destabilization of mucin and lipid layers, the foundation of the tear film stability.

Evaluation of DED is based on subjective and objective evaluations. Subjective assessment is based on how the patient perceives the symptoms, and objective assessment is done to determine the functional integrity of the tear film and ocular surface [5]. The Ocular Surface Disease Index (OSDI) is arguably one of the most popular subjective instruments that measure the severity of the symptoms, their effect on the visual functioning, and the impact of environmental stimuli [6]. The OSDI score is determined using the responses to 12 questions concerning the ocular discomfort, visual disturbance, and environmental sensitivity, and it is a standardized measure of the clinical as well as research use. It enables clinicians to classify severity of DED as mild, moderate and severe indicating that this tool is useful in diagnosis, monitoring and treatment planning. One of the values of the OSDI is its capability to record the point of view of the patient which is paramount because the intensity of symptoms is not always correlated with clinical manifestations.

Subjective evaluation is supplemented by objective assessment of DED which measures the tear volume and integrity of the ocular surface. The Schirmer is one of the most used diagnostic tests that can be used to examine the basal and reflex tear secretion [7] among other diagnostic tests. It will entail placing a standard filter paper strip in the lower fornix of the eye then the wetting length will be measured after a specified period of time usually five minutes. A value of less than 10 mm is normally viewed as an indicator of decreased tear secretion, with lower values being associated with increased severity of aqueous-deficient DED. Despite being easy to administer and relatively inexpensive, Schirmer test suffers a few shortcomings such as inconsistency because of tear reflex, environmental factors, and interobserver variations. Regardless of these shortcomings, it is still a popular clinical instrument particularly in the resource constrained environments to screen and track the advancement of DED.

Subjective and objective assessment tools integration improves the quality of DED diagnosis and allows one to have a broader vision of the disease [8]. It has been demonstrated that the discrepancy between the occurrence of symptoms and clinical manifestations is prevalent in computer users, which explains the necessity of including both OSDI and Schirmer's test to assess the condition. A number of researches have pointed out that even small decreases in tears or mild tear film instability can have a major difference in comfort and vision upon long duration on the screen. In addition, occupational exposure research has shown people who use computers more than four to six hours a day have an increased risk of contracting DED and the extent of the symptoms are frequently related to the amount of time spent in front of the screen. DED has been proposed to be reduced and its effects alleviated through precautionary measures like conscious blinking, periodical rest, ergonomical modification and environmental modification among the computer users.

It is imperative to comprehend the epidemiology, risk factors, and diagnostic modalities of DED among computer users, as there is an increased use of the digital technology in both professional and academic environments. The evaluation of DED by the use of OSDI scores and Schirmer test is an effective way of measuring both the subjective experience and the objective tear functioning in the affected individuals. Clinicians can recognize the early stages of DED in order to provide early interventions to prevent the progression of the disease, mitigate the discomfort, and maintain eye functions. Furthermore, studies in this field help in formulation of evidence-based ergonomics, digital gadgets, and ocular surface management policies at the workplace. In general, the consideration of DED in computer users through the standardized subjective and objective instruments does not only enable a proper diagnosis but also provides the strategies that can be adopted in preempting, managing, and improving ocular health in the digital age.

Methodology

Study Design: This study was designed as a hospital-based, cross-sectional, non-invasive prevalence study aimed at evaluating the impact of prolonged computer use on dry eye disease. The assessment was carried out using the Ocular Surface Disease Index (OSDI) questionnaire and Schirmer's test.

Study Area: The study was conducted in the Department of RIO, IGIMS, Patna, Bihar, India for one year.

Study Participants

Inclusion Criteria

- Both male and female participants.
- Age between 20 to 40 years.
- Computer users who have been using computers for more than 2 hours per day for at least one year.
- Willingness to provide informed consent for participation in the study.

Exclusion Criteria

- History of allergic conjunctivitis, gross lid abnormalities, life-threatening systemic disease, acute ocular infections, or ocular surgery within the last 6 months.
- Use of systemic medications known to cause dry eyes (e.g., antihistamines, anticholinergics).
- Contact lens users.

Sample Size: A total of 90 participants were included in the study. The sample size was calculated based on a 95% confidence interval using standard sample size estimation methods.

Procedure: After obtaining approval from the Institutional Review Board (IRB) of IGIMS, all participants were evaluated for dry eye disease. Participants were categorized based on daily computer usage into three groups:

- **Group A:** >2 hours to ≤4 hours per day
- **Group B:** >4 hours to ≤6 hours per day
- **Group C:** >6 hours to ≤8 hours per day

Dry eye evaluation was performed using two primary methods:

- **Ocular Surface Disease Index (OSDI):**

The OSDI questionnaire, comprising 12 items assessing symptoms, functional limitations, and environmental factors, was used to quantify dry eye severity. Scores were calculated using the formula:

$$\text{OSDI} = \frac{(\text{Sum of scores for all answered questions}) \times 100}{(\text{total number of questions answered}) \times 4}$$

Higher scores indicated greater disability. An OSDI score ≥30 was considered indicative of severe dry eye.

- **Schirmer's Test:**

The test that was conducted by Schirmer was to measure the production of tears. A standard strip was put in the lower conjunctival sac and the wetting was measured after 5 minutes. The tear film break-up time (TFBUT) was also evaluated by the use of fluorescein dye where the TBUT of less than 10 seconds is considered abnormal. The height of tear meniscus at the margin of the lower eyelid (TMH) was recorded; TMH of 0.35 mm and below was regarded as a sign of dry eye.

Statistical Analysis: The data was first tabulated in Microsoft Excel 2010 and further subjected to SPSS Version 27. Demographic characteristics and parameters used to describe the situation in regard to dry eyes were summarized using descriptive statistics, such as mean, standard deviation, and percentages. The occurrence of dry eye in various categories of computer users was estimated. One-way Analysis of Variance (ANOVA) was used to compare groups in terms of the daily computer use. Where necessary, post hoc analysis was undertaken to establish differences in intergroups. Statistically significant p-value was taken to be less than 0.05.

Result

The demographic traits of 90 participants of the study are described in Table 1, indicating the distribution of the age and gender. Most of the participants were aged between 26 and 30 years with most of the sample consisting of 33.3, then there are those aged between 20-25 years with 31.1% and finally the aged 45-50 years with 29.9%. The sample was 22.2% and 13.3% evenly distributed between participants aged 3135 and 3640 years, respectively. Regarding gender, there were more males, accounting to 72.2 percent of the participants, and fewer females, who were 27.8 percent, meaning that the study population was male dominated.

Table 1: Demographic Characteristics of Study Participants (n=90)

Characteristic	Number (n)	Percentage (%)
Age (years)		
20–25	28	31.1
26–30	30	33.3
31–35	20	22.2
36–40	12	13.3
Gender		
Male	65	72.2
Female	25	27.8

The data on the daily usage of computers among the participants of the study are suggested in Table 2. Most of the participants of 44.4 percent (n=40) connected to the Group B stated that they spend more than 4 to 6 hours a day using computers. Participants taking more than 2 up to 4 hours per day (Group A) and more than 6 up to 8 hours per day (Group C) used computers in equal proportions (27.8 per cent). This distribution shows that there is a large number of people who were moderate to high users of computers per day and fewer people on the lower and upper parts of computer use.

Table 2: Daily Computer Usage Among Participants		
Group (Hours/Day)	**Number (n)**	**Percentage (%)**
Group A (>2–≤4)	25	27.8
Group B (>4–≤6)	40	44.4
Group C (>6–≤8)	25	27.8

Table 3 shows that the Ocular Surface Disease Index (OSDI) scores of the participants in the study are distributed. Among the total respondents, 15 participants (16.7%), possessed a normal score of 0 to 12, which means that there were no severe results of dry eye symptoms. 20 participants had mild dry eye (22.2) with scores of between 13 and 22. Most of them, 30 people (33.3%), were moderate as they scored between 23 and 32 indicating a strong occurrence of the symptoms of dry eyes. Only 25 people (27.8%), which indicated severe dry eye, gave a score of 33 or above, which suggests a large percentage of the study population was having serious ocular discomfort.

Table 3: OSDI Score Distribution Among Participants			
OSDI Category	**Score Range**	**Number (n)**	**Percentage (%)**
Normal	0–12	15	16.7
Mild	13–22	20	22.2
Moderate	23–32	30	33.3
Severe	≥33	25	27.8

Table 4 shows the results of the Schirmer test of participants by the daily screen time. Group A, which spent over 2 to 4 hours a day at the screens, had an average tear production of 13.2 + 2.1 mm, eighty percent of the subjects were in the normal range (>10 mm), and twenty percent had abnormal outcomes (<10 mm). Group B, where the screen time exceeded 4 to 6 hours a day, the average screen time was 9.8 ± 2.5 mm, and 55% of the screen-users had normal tear production, and 45% were abnormal. Group C with the most screen exposure of over 6 to 8 hours daily with the lowest mean of 7.5 plus or minus 1.8 mm and only 28 percent of participants recorded normal Schirmer test results and 72 percent abnormal test results has succinctly portrayed the trend in decreasing tear production with increase in screen time.

Table 4: Schirmer's Test Results (mm/5 min)			
Group (Hours/Day)	**Mean ± SD**	**Normal (>10 mm) n (%)**	**Abnormal (≤10 mm) n (%)**
Group A (>2–≤4)	13.2 ± 2.1	20 (80.0)	5 (20.0)
Group B (>4–≤6)	9.8 ± 2.5	18 (45.0)	22 (55.0)
Group C (>6–≤8)	7.5 ± 1.8	7 (28.0)	18 (72.0)

Table 5 shows Tear Film Break-Up Time (TBUT) and Tear Meniscus Height (TMH) in three groups with regard to the daily screen time. Group A (2-4 hours screen) had the highest mean of TBUT (12.5 +2.4 seconds) and TMH (0.48 +0.08 mm), and only 20% and 16% of the participants had the TBUT less than 10 seconds and TMH less than 0.35 mm, respectively. Both mean TBUT (9.2 ± 2.1 seconds) and TMH (0.36 ± 0.07 mm) went down in Group B (>46 hours/day), and the proportion of participants who had TBUT less than 10 seconds (55%) and TMH less than 0.35 mm (50) increased. Group C (>68 hours/day) had the lowest mean TBUT (7.8 +1.9 seconds) and TMH (0.31 +0.06 mm), with most of them reporting a TBUT less than 10 seconds (72%), and TMH less than 0.35 mm (64%), which implied the existence of a distinct pattern in which the tear film stability and volume were deteriorating with the increased screen exposure.

Table 5: Tear Film Break-Up Time (TBUT) and Tear Meniscus Height (TMH) Across Groups				
Group (Hours/Day)	**TBUT (seconds) Mean ± SD**	**TMH (mm) Mean ± SD**	**TBUT <10 sec n (%)**	**TMH ≤0.35 mm n (%)**
Group A (>2–≤4)	12.5 ± 2.4	0.48 ± 0.08	5 (20.0)	4 (16.0)
Group B (>4–≤6)	9.2 ± 2.1	0.36 ± 0.07	22 (55.0)	20 (50.0)
Group C (>6–≤8)	7.8 ± 1.9	0.31 ± 0.06	18 (72.0)	16 64.0)

Discussion

The current research examined the effects of the long-term use of the computer on the development of dry eye disease in medical students, both subjective (OSDI scores) and objective (Schirmer test, TBT, TMH). Our findings showed that stronger and more frequent symptoms of dry eyes were seen as the daily screen time increased. Namely, the incidence of dry eye in the population using the computer over 2-4 hours, 4-6 hours, and 6-8 hours a day was found to be 9.3, 18.18, and 45.71, respectively, and the exposure to the computer was positively correlated with ocular surface degradation (based on the number of hours spent daily). This observation is in line with Hagan and Lory (1998) [9] whose study found that 68 percent of men and 73 percent of women who are computer users reported the occurrence of ocular discomfort symptoms and the result reveals that the burden of computer-related eye discomfort is quite high even in non-contact lens wearers. Likewise, Tsubota and Nakamori (1993) [10] noted that the average frequency of blink dropped to 22 blinks per minute in the relaxed condition to 7 blinks per minute in an intensive computer task, which led to the instability of the tear diaphragm and evaporative dry eye. The cumulative effect of these studies is a solid mechanistic foundation to our observations in that a reduced blink frequency and incomplete blinking are associated with impaired tear film functions.

Our results on the OSDI scores showed that, only 16.7% of respondents failed to wear the normal scores, 22.2, 33.3 and 27.8 displayed mild, moderate and severe symptoms, respectively. This distribution is consistent with the previous epidemiology in India and the rest of the world. The prevalence of dry eye was 12.3% in high-risk workforce (Choudhary et al., 2015) [11], and 20.7% reported prevalence 58.6% in adult groups (Sahai et al., 2015) [12], indicating that prevalence rates may differ significantly with age, occupation, and environmental issues. Elsewhere, in the rural western Uttar Pradesh, Ranjan et al. (2016) [13] discovered a prevalence of 61.54% and in the same study, extended exposure to environmental and screen-related stressors contributed greatly to the skin of the eye. In comparison to these studies, our prevalence of 25 amongst both male and female students are moderate but show the applicability of the long-time screen exposures in the younger demographic. It is worth noting that the prevalence significantly increases with age (13.04% in 20 years-30 years category and 51.64% in 31 years-40 years category respectively) as is the case with Shah and Jani (2015) [12], indicating the cumulative impact of chronic computer use on the tear film and integrity of the ocular surface.

The objective evaluation based on Schirmer test showed that there was a progressive loss of tear production with increased screen time with means of 13.2 mm under Group A, 9.8 mm under Group B and 7.5 mm under Group C. These findings correspond with those by Bron et al. (2007) [14] and Lim and Lee (1991) [15] who pointed out that the long-term use of visual display terminal (VDT) is a contributor of aqueous-deficient dry eye and with those of Kambei et al. (2002) [16] who pointed out that reduced height of the meniscus of tears is a predictor of aqueous-deficient dry eye in high-exposure populations. The correlation between objective and subjective results of our research justifies the diagnostic usefulness of the combination of OSDI questionnaires with tear functions tests to evaluate dry eye completely.

Equally, TBUT and TMH were also markedly lowered in individuals who had increased screen exposure. The mean TBUT and TMH of Group A were 12.5 seconds and 0.48 mm respectively and Groups B and C demonstrated identify deterioration. The trend indicates a disruption in tear film stability and reduced tear reservoir as Hagan and Lory (1998) and Tsubota and Nakamori (1993) would have expected. The decrease in the TBUT can be credited to lower blink frequency, but also to incomplete blinking whereas the decrease in TMH will mean that there was no adequate volume of tear to keep hydrating the ocular surface. These results are consistent with those of Sheedy (1996) [16] and Bilton (2010) [17] who focused on ergonomic interventions, including the appropriate distance of the monitor and the angle of downward gaze, to reduce evaporative stress and preserve the intact tear film among heavy computer users.

It has been argued in opposing studies that prevalence and severity of dry eye can be different under occupational or environmental conditions. Although we have made 45.71% prevalence to be the highest in the highest exposure group, Choudhary et al. (2015) [11] report lower rates (12.3%), which may be because of age distribution, study design, and geographic location. On the other hand, higher prevalence (61.54) was reported by Ranjan et al. (2016) [13], which probably represents a rural population with other risk factors, including dust exposure and poor tear film maintenance. This inconsistency underlines the fact that dry eye is a factorial condition and that demographic, environmental, and behavioral factors should be taken into account when explaining prevalence rates.

Comprehensively, our results support the increasing evidence that suggested that extended computer use has a substantial effect on both subjective and objective outcomes of dry eye disease in young adults. The agreement between the parameters of tear functions and the OSDI scores accentuates the significance of timely awareness, prevention of the condition (regular breaks, conscious blinking, ergonomic changes, and artificial tear replacement), and specific education of high-risk groups including medical students. Since the digital workload in the academic and professional environment is continually growing, ophthalmologists will face more cases of dry eye, and with the help of rapid, reliable, and minimally invasive methods of diagnosis, the effectively established management will be provided.

Conclusion

The paper shows a significant correlation between infrequent computer use and the emergence of dry eye disease in medical students, and both subjective and objective data show that there is dose dependence. The individuals who had an increased exposure to screens every day showed much higher scores in OSDI and less tear production, TBUT and TMH which indicated a loss of tear film stability and ocular surface integrity. Such results are in line with past studies which have pointed to the role of lower blink rate, incomplete blinking, and environmental stressors in triggering ocular surface dysfunction. The combination of the OSDI and test created by Schirmer was effective in terms of a comprehensive assessment to be performed to evaluate not only the symptomatic burden, but also the functional impairment. Timely diagnosis and prevention, including ergonomic adjustments, conscious blinking, and taking breaks are necessary to reduce DED risk and maintain visual comfort in academic and work-related digital-heavy environments.

References

1. Nebbioso M, Del Regno P, Gharbiya M, Sacchetti M, Plateroti R, Lambiase A. Analysis of the pathogenic factors and management of dry eye in ocular surface disorders. International journal of molecular sciences. 2017 Aug 13;18(8):1764.
2. Baudouin C, Messmer EM, Aragona P, Geerling G, Akova YA, Benítez del Castillo Sánchez JM, Boboridis KG, Merayo Lloves J, Sánchez Ávila RM, Labetoulle M. Revisiting the vicious circle of DED: a focus on the pathophysiology of MGD. British Journal of Ophthalmology. 2016.
3. Kaur K, Gurnani B, Nayak S, Deori N, Kaur S, Jethani J, Singh D, Agarkar S, Hussaindeen JR, Sukhija J, Mishra D. Digital eye strain-a comprehensive review. Ophthalmology and therapy. 2022 Oct;11(5):1655-80.
4. Shamsaei N, Yadollahi A, Bian L, Thompson SM. An overview of Direct Laser Deposition for additive manufacturing; Part II: Mechanical behavior, process parameter optimization and control. Additive manufacturing. 2015 Oct 1; 8:12-35.
5. Labetoulle M, Rolando M, Baudouin C, van Setten G. Patients' perception of DED and its relation with time to diagnosis and quality of life: an international and multilingual survey. British Journal of Ophthalmology. 2017 Aug 1;101(8):1100-5.
6. Guarnieri A, Carnero E, Bleau AM, Alfonso-Bartolozzi B, Moreno-Montañés J. Relationship between OSDI questionnaire and ocular surface changes in glaucomatous patients. International Ophthalmology. 2020 Mar;40(3):741-51.
7. Subhi Y, Schmidt DC, Al-Bakri M, Bach-Holm D, Kessel L. Diagnostic test accuracy of the red reflex test for ocular pathology in infants: a meta-analysis. JAMA ophthalmology. 2021 Jan 1;139(1):33-40.
8. Yang HK, Che SA, Hyon JY, Han SB. Integration of artificial intelligence into the approach for diagnosis and monitoring of dry eye disease. Diagnostics. 2022 Dec 14;12(12):3167.
9. Hagan S, Lory B. Prevalence of dry eye among computer users. Optometry and vision science. 1998 Oct 1;75(10):712-3.
10. Tsubota K, Nakamori K. Dry eyes and video display terminals. New England Journal of Medicine. 1993 Feb 25;328(8):584-.
11. Pankaj Choudhary PC, Charudatt Chalisgaonkar CC, Sujata Lakhtakia SL, Anamika Dwivedi AD, Shekhar Kain SK. Dry eye prevalence and attributable risk factors in the eastern Madhya Pradesh.
12. Shah S, Jani H. Prevalence and associated factors of dry eye: Our experience in patients above 40 years of age at a Tertiary Care Center. Oman journal of ophthalmology. 2015 Sep 1;8(3):151-6.
13. Ranjan R, Shukla SK, Singh CV, Mishra BN, Sinha S, Sharma BD. Prevalence of Dry Eye and its Association with various risk factors in rural setup of Western Uttar Pradesh in a Tertiary care hospital. Open Journal of Preventive Medicine. 2016;6(01):57.
14. Bron AJ, Abelson MB, Ousler G, Pearce E, Tomlinson A, Yokoi N, Smith JA, Begley C, Caffery B, Nichols K, Schaumberg D. Methodologies to diagnose and monitor dry eye disease: report of the Diagnostic Methodology Subcommittee of the International Dry Eye Workshop (2007). Ocular Surface. 2007 Apr; 5(2):108-52.
15. Lim KJ, Lee JH. Measurement of the tear meniscus height using 0.25% fluorescein sodium. Korean Journal of Ophthalmology. 1991 Jun 30;5(1):34-6.
16. Sheedy JE. The bottom line on fixing computer-related vision and eye problems. Journal of the American Optometric Association. 1996 Sep 1;67(9):512-7.
17. Bilton N. I live in the future & here's how it works: why your world, work, and brain are being creatively disrupted. Crown Currency; 2010 Sep 14.