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Original Research Article

Study on association of dry eye disease (DED) with visual display terminal (VDT) use among medical college students

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ABSTRACT

Purpose: To study the prevalence of Dry Eye Disease (DED) among undergraduate medical students using Visual Display Terminal (VDT).

Materials and Methods: Cross-sectional study was conducted on 444 students at Medical college Hospital in the department of Ophthalmology. All the consented study participants, after ruling out the exclusion criterion, underwent dry eye workup which included routine slit lamp examination and Tear film break up time (TBUT). In this study, TBUT ≤ 10 seconds was considered abnormal. They were asked to fill out an OSDI (Ocular Surface Disease Index) questionnaire (Allergen Inc, Irvine, Calif, USA). The participants were asked to answer questions related to VDT use. Statistical analysis was done using the SPSS software (IBM).

Results: Based on the OSDI questionnaire, clinically significant DED was found in 28.8%. DED was classified as mild DED in 17.1%, moderate DED in 6.3% and severe DED in 5.4% of the participants. Among those with DED, VDT use was 2 to 4 hours in 29% of the participants, VDT > 4 hours was seen in 32.7% of participants. Thereby, indicating that increase in VDT use had an association with increase in prevalence of DED. DED based on signs (TBUT< or = 5 sec) was observed in 86.3% of participants.

Conclusion: There is a statistically significant association between VDT use and DED among young students.

1. Introduction

"Dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles."[1]

Prevalence of Dry Eye Disease worldwide is 5 to 50%.[1] Prevalence of Dry Eye Disease based on clinical signs alone up to 75% in some countries.[1] The prevalence of DED in India is 18.4% to 54.3%.[2,3] It is higher than the prevalence world-wide. A study was conducted at LV Prasad Eye Institute to estimate the incidence of DED. In that study DED was 16,482 per million population in adults.[4]

Dry eye disease is categorized into three main groups- Aqueous deficient DED, evaporative DED and the hybrid type.[5] Visual Display Terminal (VDT) use is identified as an important risk factor for evaporative DED. There is a reduction in blink rate when we are using VDT or other prolonged visual task such as prolonged computer use, reading, watching TV, working on microscope etc. This can aggravate the signs as well as the symptoms of dry eye. These includes blurred vision, ocular surface staining,

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decreased tear film break-up time [TBUT]. All these symptoms and signs limit the patients visual functioning capabilities.[6] The Osaka study which was conducted in Japan showed a high prevalence of DED among young to middle aged Japanese workers using VDT.[7] In other studies, multiple risk factors for DED have been studied along with VDT use in different age groups. VDT use has been on the rise in young individuals who are using them for prolonged hours. In this study, we have eliminated all other causes of DED and tried to study the effect of VDT use on a relatively young population (Undergarduate medical students).

2. Materials and Methods

A cross-sectional hospital-based, observational study was conducted on 444 undergraduate medical students at our Medical college Hospital. Ethics clearance was obtained from our Institutional Ethics committee. We have taken consent from all the study participants.

All the study participants underwent comprehensive eye examination using slitlamp.

They have also answered the given questionnaire (OSDI questionnaire) regarding DED.

2.1. Exclusion criteria

Participants who reported a history of contact lens use, refractive surgery, presence of systemic or ocular disease contributing to dry eye, uncorrected refractive error, ocular hypertension, use of any ocular medication within 1 month before the beginning of the study, any systemic treatment with drugs such as beta-blocking agents, diuretics, benzodiazepines, hormones, antihistamines, and other drugs that could interfere with tear production were excluded from the study.

All the students were advised not to use VDT 1 hour before examination. The slit lamp examination was done under normal room temperature (26 to 27^{o}C) and 61 to 65% humidity.

2.2. Outcome measures

2.2.1. Ocular surface disease index (OSDI) questionnaire

All the students participating in the study were asked to answer this OSDI questionnaire (Allergen Inc, Irvine, Calif, USA), which is the most widely used and validated questionnaire for detecting symptoms of DED.[8] A single examiner had administered the questionnaire. OSDI questionnaire has three domains. Domain A has five questions related to the ocular symptoms. Domain B has four questions related to visual function. Domain C has three questions related to environmental triggers. Each question is given a score of 0 (none of the time) to 4 (all of the time). The students were instructed to give a score for every question based on symptoms they have experienced the previous week. Each domain has a sub-total score (A, B and C). All the sub-total scores were then added to get D. The number of questions answered is given as E. The OSDI score is obtained by multiplying the total score (D) by 25 and then dividing the total score obtained by the number of questions answered (E). Scores range from 0 to 100. 0–12 is normal, 13–22 is mild DED, 23–32 is moderate DED, and ≥33 is severe DED.[9]

2.3. VDT use

The participants were asked to answer a question related to VDT use. VDT is visual display terminal like smart phone, tablet, laptop etc. There were asked to choose one option from 0 to 2 hours, 2 to 4 hours and more than 4 hours.

2.4. TBUT

All the study participants underwent a clinical evaluation for dry eye with the Tear film break up time (TBUT). It was done under similar environmental conditions like temperature and humidity. The TBUT is done as follows: Fluorescein impregnated strip wet with saline solution was used for staining. Participants were requested to blink several times to ensure adequate mixing of the fluorescein dye with tears. The time interval between the last complete blink and the appearance of the first corneal dark spot was measured by a stopwatch, with the mean of 3 measurements regarded as TBUT in this study. TBUT ≤ 10 seconds was considered abnormal.[10] TBUT less than 5 seconds was considered DED clinically.

Unstable Tear Film is the central feature of VDT related Dry Eye.[11] OSDI score more than 12 and TBUT less than or equal to 5 sec is defined as Dry Eye Disease.

Prevalence of DED based on symptoms alone was estimated with OSDI score>12. Prevalence of DED based on signs alone was also estimated from TBUT ≤ 5 sec in either eye.

Prevalence of DED was also estimated based on both symptoms and signs (OSDI>12 and TBUT ≤ 5 in either eye).[10]

2.5. Statistical analysis

SPSS software was used for statistical analysis. The association between Visual Display Terminal use and OSDI score was established using Chi-square test. Logistic regression analysis was done to know the association of OSDI score with VDT use and gender. A p value of <0.05 was considered significant in the study.

3. Results

500 medical students were approached, out of which 444 students were eligible (after consideration of exclusion criterion) to participate in the study. All the variables to be analyzed were entered into the data collection software.

Out of the total study population 168(37.8%) were males and 276(62.2%) were females aged between 18 to 24 years (Table 1).

Table 1: Characteristics of study population

Age	Male (%)	Female (%)
18 to 24 yrs	37.8	62.2

The duration of VDT use (>4 hours) was 25.2% among males and 44.6% among females. (Table 2) Based on the OSDI questionnaire, clinically significant DED was found in 28.8% of the students. DED was classified as mild DED in 17.1%, moderate DED in 6.3% and severe DED in 5.4% in the participants. The details of the OSDI score are summarized in Table 3.

Table 2: VDT use among the study population

VDT use	Male (%)	Female (%)
0 to 2 hrs	2.3	2.8
2 to 4 hrs	9.6	13.8
>4 hrs	25.2	44.6

VDT: Visual display terminal

Table 3: Mean OSDI and domain scores among subjects with DED

DED	OSDI score (mean)	Domain A score	Domain B score	Domain C score
Mild	17.0 ± 2.7	3.8 ± 1.5	2.2 ± 1.8	1.9 ± 1.9
Moderate	27.8 ± 2.3	6.0 ± 2.4	3.7 ± 2.2	3.1 ± 2.2
Severe	48.4 ± 10.4	10.0 ± 3.0	6.2 ± 3.0	5.5 ± 2.3

OSDI: Ocular surface disease index, DED: Dry eye disease

Among 28.4% students with DED, VDT use for 2-4 hours was seen in 29% of the study participants, VDT use for > 4 hours was seen in 32.7% of participants. The association between VDT use and OSDI score was obtained by chi-square test as 4.86 and p value is 0.08.

DED in males is 25% and in females it is 31.2%. The association between gender and OSDI score was obtained by chi-square test as 0.96 and p value is 0.33.

TBUT ≤ 5 sec (either eye) was observed in 86.3% of participants. Mean TBUT value among males was 4.5+2.4 sec and among females was 4.0+2.0 sec. TBUT value among the three classes of DED is summarized in Table 4.

The diagnosis of DED based on both symptoms (OSDI > 12) and signs (TBUT ≤ 5 sec) was made in 27% of participants.

Logistic regression analysis was done using OSDI score with VDT use, gender and years of exposure but did not yield any association.

Table 4: TBUT value among subjects with DED

DED	TBUT value (RE)	TBUT value (LE)
Mild	5.3±3.5	4.1±3.2
Moderate	3.5 ± 1.7	3.0 ± 1.5
Severe	2.9±1.6	2.9±1.6

TBUT: Tear film break up time, DED: Dry eye disease

4. Discussion

Dry Eye Disease is one of the most prevalent ocular disease which may have an adverse impact on the quality of life of an individual.

We have conducted this study to estimate the prevalence of Dry Eye Disease in undergraduate medical students. The prevalence of DED was more in female students (62.2%) when compared to male students (37.8%).

OSDI questionnaire was used to assess the symptoms of the students. Based on OSDI score the prevalence of DED was 28.8%.In previous studies the prevalence of DED ranged from 5 to 50%,[1] which is in agreement to our present study. Also in a recent study done on Prevalence of symptomatic dry eye disease with associated risk factors among medical students at Chiang Mai University the prevalence of mild, moderate, and severe dry eyes in medical students based on the OSDI score were 24.2%, 18.8% and 27.8%, respectively**.**

Their study included evaluation of psychological stress related to dry eye symptoms using Thai version of the 10-Item Perceived Stress Scale-10 (T-PSS-10).[12] In their study female sex, contact lens wear, prolonged hours of contact lens wear, higher frequency use of artificial tears per day, longer duration of VDT use per day and higher score of T-PSS-10 were also associated with increased severity of dry eyes.

Among those found to have DED, most of them belonged to the mild category. The prevalence of DED in males is 25% and in females is 31.2%. Females are more commonly affected in most of the dry eye studies.[1,11]

VDT use for >4 hours was found in 25.2% of males and 44.6% of females. This indicates a greater use of VDT by females. Among those with DED, VDT use was 2 to 4 hours in 29% of students and VDT use for > 4 hours was seen in 32.7% of participants. Thereby, indicating that increase in VDT use had an association with increase in prevalence of DED. There was a study done in North India, in that study there was a significant correlation between DED ($P < 0.001$) and number of hours of VDT usage. 89.98% of the study population with 4 hours or more of VDT use had severe dry eye (adjusted OR 60.2; 95% confidence interval [CI] 43.9–82.7).[7] In a study conducted in middle-aged office workers of Japan, prolonged VDT use >8 hours (vs short VDT use, i.e <8 hours, OR $\frac{1}{4}$ 1.94, 95% CI $\frac{1}{4}$ 1.22-3.09, P $\frac{1}{4}$ .005) was associated with definite or probable DED.[5] In

the above studies, multiple risk factors for DED have been studied along with VDT use in different age groups. VDT use has been on the rise in young individuals who are using them for prolonged hours.

In our study DED based on signs (TBUT< or = 5 sec) was observed in 86.3% of participants. TBUT as a sign did not co-relate well with the severity of DED according to the OSDI questionnaire. The dry eye tests show inter-observer variability and poor repeatability.[13–15] TBUT may be decreased early in the natural course of DED and after a certain period, symptoms begin to develop. TBUT can also be used as an early tool to screen DED due to VDT use as it is decreased due to an unstable tear film.[8] In a study done in North India TBUT of <10 s (indicative of tear film instability) was observed in 95.8% cases.[6] There was another study conducted in Japan on office workers who were middle aged .In that study 78.6% of subjects showed a TBUT of <5 seconds,[5] These results are similar to our study.

The prevalence of DED based on both symptoms and signs was 27.5% in contrast to the prevalence based on symptoms alone which was 28.8%. This implies that a small percentage of study group having Dry Eye Disease based on the OSDI questionnaire did not show any clinical signs. This proves that, we cannot rely on a single tool to assess the prevalence of Dry Eye Disease (DED). The students should be given health education regarding reduction in VDT usage and advised to use treatment according to the severity of symptoms and signs.

Many important parameters like symptoms from OSDI questionnaire, signs like TBUT, tear film osmolarity, tear film biomarkers must be studied together to really understand VDT related DED. This can be the topic for further research. Amount of VDT exposure before testing, brightness of the screen are important factors that can be considered for further research.

5. Conclusion

There is a significant correlation between VDT usage and DED in a large number of studies. But prevalence of this condition is widely underestimated. DED in VDT users has important consequences in medical college students because this may compromise the number of study hours and their productivity. There has to be an universal agreement and well structured protocol for the diagnosis criteria of DED. This would not only help the ophthalmologists to develop appropriate preventive strategies but also collectively contribute to understand the risk of DED in medical students and also in general population on a larger aspect.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Craig JP, Nelson JD, Azar D, Belmonte C, Bron AJ, Chauhan SK, et al. TFOS DEWS II Report Executive Summary. *Ocul Surf*. 2017;15(4):802–12.
2. Gupta N, Prasad I, Jain R, DSouza P. Estimating the prevalence of dry eye among Indian patients attending a tertiary ophthalmology clinic. *Ann Trop Med Parasitol*. 2010;104(3):247–55.
3. 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 J Ophthalmol*. 2015;8(3):151–6.
4. Donthineni PR, Kammari P, Shanbhag SS, Singh V, Das AV, Basu S. Incidence, demographics, types and risk factors of dry eye disease in India: Electronic medical records driven big data analytics report I. *Ocul Surf*. 2019;17(2):250–6.
5. Messmer EM. The pathophysiology, diagnosis, and treatment of dry eye disease. *Dtsch Arztebl Int*. 2015;112(5):71–82.
6. Torkildsen G. The effects of lubricant eye drops on visual function as measured by the Inter-blink interval Visual Acuity Decay test. *Clin Ophthalmol*. 2009;3:501–6.
7. Uchino M, Yokoi N, Uchino Y, Dogru M, Kawashima M, Komuro A, et al. Prevalence of dry eye disease and its risk factors in visual display terminal users: the Osaka study. *Am J Ophthalmol*. 2013;156(4):759–66.
8. Titiyal JS, Falera RC, Kaur M, Sharma V, Sharma N. Prevalence and risk factors of dry eye disease in North India: Ocular surface disease index-based cross-sectional hospital study. *Indian J Ophthalmol*. 2018;66(2):207–11.
9. Grubbs JR, Tolleson-Rinehart S, Huynh K, Davis RM. A review of quality of life measures in dry eye questionnaires. *Cornea*. 2014;33(2):215–8.
10. Schiffman RM, Christianson MD, Jacobsen G, Hirsch JD, Reis BL. Reliability and validity of the Ocular Surface Disease Index. *Arch Ophthalmol*. 2000;118(5):615–21.
11. Tsubota K, Yokoi N, Shimazaki J, Watanabe H, Dogru M, Yamada M, et al. New Perspectives on Dry Eye Definition and Diagnosis: A Consensus Report by the Asia Dry Eye Society. *Asia Dry Eye Society*. 2016;15(1):65–76.
12. Tangmonkongvoragul C, Chokesuwattanaskul S, Khankaeo C, Punyasevee R, Nakkara L, Moolsan S, et al. Prevalence of symptomatic dry eye disease with associated risk factors among medical students at Chiang Mai University due to increased screen time and stress during COVID-19 pandemic. *PLoS One*. 2022;17(3):e0265733.
13. Nichols KK, Mitchell GL, Zadnik K. The repeatability of clinical measurements of dry eye. *Cornea*. 2004;23(3):272–85.
14. Begley CG, Chalmers RL, Abetz L, Venkataraman K, Mertzanis P, Caffery BA, et al. The relationship between habitual patient-reported symptoms and clinical signs among patients with dry eye of varying severity. *Invest Ophthalmol Vis Sci*. 2003;44(11):4753–61.
15. Kallarackal GU, Ansari EA, Amos N, Martin JC, Lane C, Camilleri JP. A comparative study to assess the clinical use of Fluorescein Meniscus Time (FMT) with Tear Break up Time (TBUT) and Schirmer's tests (ST) in the diagnosis of dry eyes. *Eye (Lond)*. 2002;16(5):594–600.

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