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**Original article**

# Study of prevalence and associated risk factors for symptomatic dry eye disease amongst medical students attending online lectures during Covid-19 Pandemic

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**Abstract:**

**Context:** The modality of teaching has shifted towards online platforms during COVID-19 pandemic.

**Objective:** To determine the prevalence of symptomatic dry eye disease (DED) and its association with various risk factors amongst medical students attending online lectures.

**Settings and design:** This was a cross sectional, observational study conducted on 540 MBBS students studying in a North Indian medical college.

**Materials and methods:** MBBS students who were regularly attending online lectures for more than 15 preceding days were administered Ocular Surface Disease Index questionnaire. Risk factors associated with computer use were also elicited.

**Statistical analysis:** Data was compiled and categorized into student related factors and environmental factors affecting DED. Analysis was done using chi square test. P value less than 0.05 was considered significant.

**Results:** The mean age of the studied population was 20.99 ± 1.31 years. The prevalence of DED was 59.6%, mild DED in 19%, moderate DED in 16% and severe DED in 25%. Dry eye was present in 66% students who were exposed to > 5 hours of online classes daily (p value = 0.033) and was present in 68% students who had >4 hours screen exposure for leisurely activities (p=0.007). Taking break in between lectures and using protective screens on devices were found to have protective association with dry eye (p=0.0001 and p=0.01 respectively).

**Conclusion:** There is high prevalence of symptomatic DED amongst students attending online lectures during the pandemic. Restricting screen time, using protective screens and taking regular breaks were found to be protective.

**Key-words:** symptomatic dry eye, online lectures, covid-19 pandemic

## Introduction:

DEWS, 2017, has defined Dry eye disease as "a multifactorial disease of the tears and ocular surface that is associated with hyperosmolarity of tear film which in turn leads to inflammation and damage of the ocular surface that accompanied with ocular symptoms of discomfort, fatigue and disturbance in vision".[1] It may be due to reduced tear production and/or

excessive tear evaporation leading to symptoms of ocular discomfort.[2][3] Patients with dry eye usually experience symptoms like heaviness, pain, discomfort, foreign body sensation, grittiness and sometimes even blurring of vision. Presence of symptomatic dry eye impairs the quality of life of a person and can have significant socio economic impact. During the covid-19 pandemic, medical colleges had to suspend the classes of MBBS students initially as per the directives issued by the Government of India. But this led to a significant loss to the students in terms of academics. To compensate for the same, there was a shift to online teaching using the e-learning platforms. These platforms have immensely helped in continuing the process of teaching and learning during the pandemic. But at the same time, it has exposed the students to significant hours of screen time. These hours when added to the screen time on self learning or leisurely activities make up an enormous time that a student spends on screen.

Various studies have been done in the past to screen symptomatic dry eyes using dry eye questionnaire.[4] The diagnosis and grading of DED on the basis of symptom-based questionnaires such as the ocular surface disease index (OSDI) questionnaire (Allergen Inc, Irvine, California, USA) has been found to be more reliable than based on clinical tests.[4][5][6][7][8] The OSDI is, therefore, a unique instrument able to assess both the frequency of dry eye symptoms and their impact on vision-related functioning. Moreover, OSDI has been found to be reliable, valid, sensitive and specific.[8]

Given the COVID-19 pandemic, wherein e-learning has become an integral part of education, screening of symptomatic dry eye disease with reliable and valid DED questionnaire, OSDI questionnaire, assumes a big dimension.

Prevalence of symptomatic DED amongst various populations and its association with various risk factors has been studied in the past.[2][4][6] However, there has been no study to evaluate the ocular impact of sudden total shift over to online lectures from the traditional mode of teaching amongst the medical students during the pandemic and its associated risk factors.

In our study, we describe the prevalence of symptomatic DED and its associated risk factors amongst the medical students attending online classes in a medical college of North India.

**Subjects and Methods:**

A cross sectional study was conducted on MBBS students studying in a medical college of North India. Research and ethical clearance was obtained from institutional research and ethics committee. Students who had been attending online lectures for the past at least 15 days and who consented to participate in the study were included. Students who had been wearing contact lens, or had undergone any eye surgery or trauma were excluded from the study. Also excluded were those students who had history of preexisting dry eye or had already been on any topical medications.

After informed consent, OSDI questionnaire was provided to the participants and comprehensive history pertaining to DED was elicited. The OSDI questionnaire has a total of 12 questions (box A, B and C) based on symptoms experienced in the preceding week. The questions are graded from 0 to 4, where 0 means none of the times and 4 means all of the time. Box B and C have the option of being non applicable as well. Responder assigns a score to each question based on the duration of their symptoms. The final OSDI score = [(sum of scores of all questions answered) ×25] ÷ (number of questions answered). Scores range from 0 to 100 with 0–12 representing normal, 13–22 representing mild DED, 23–32 representing moderate DED, and ≥33 representing severe DED.[9]

The data collected included demographic details (age, gender), student related factors - average daily screen time for online classes, average daily time spent on screen apart from online lectures and whether or not the student takes breaks in between lectures. Environment related factors affecting symptomatic DED were – presence of adequate illumination in the room, use of protective screen on the device, use of air conditioner in the room, average distance from the screen and

preferred mode of working on computer. Room is considered adequately illuminated if one can read a book even in the darkest corner of the room.

**Statistical analysis**

The responses obtained were compiled in Microsoft spreadsheet. The OSDI score was calculated. The data was categorized into student related factors and environment related factors in symptomatic DED and their association with DED was analyzed using chi square test. P value of less than 0.05 was considered as statistically significant.

**Results:**

A total of 540 students were administered the OSDI questionnaire, of which 534 students consented to participate in the study. Amongst these students, 24.91% (n=133) were excluded from the present study because of history of use of regular topical medication (n=64), regular contact lens (n=61) and history of trauma (n=8). Hence, 401 students who suited our selection criteria were selected and studied.

The mean age of the study population was 20.99 ± 1.31 years. It comprised of 57% males and 43% females. 40% students spent more than 5 hours on screen for online lectures. 47% students spent more than 4 hours on screen for activities other than online classes. There were 56% students who used to take breaks in between online lectures. The frequency of distribution of student related factors affecting DED have been detailed in Table 1.

Majority of students (90%) reported use of adequately illuminated rooms for use of screens. There were 48% students who used protective screen on their device. Only 23% students reported use of table and chair as their preferred mode of working on computer. Rest 77% students either preferred use of bed or mix of bed and table –chair for using the device. The frequency of distribution of various environment related factors have been detailed in Table 2.

The prevalence of dry eye was found to be 59.6% (n=239). Of these, 19% had mild DED, 16% had moderate DED and 25% had severe DED (Table 3). The mean OSDI score in mild DED was 18.4±3.1, in moderate DED was 28.1±2.6 and in severe DED was 48.2±15.4 (Table 3).

Amongst the student related factors affecting dry eye, average daily screen time for lectures and activities other than lectures were found to be positively associated with dry eye, p values = 0.033 and 0.007 respectively. 66% of students who attended online classes for more than 5 hours and 68% of students who spent more than 4 hours per day on screen for activities other than online classes had dry eye. Habit of taking break in between online classes was found to have a significant negative association with dry eye, p value=0.0001. However, there was no significant difference in dry eye based on gender (Table 4).

Use of protective screens for devices was found to have significant negative association with dry eye, p value=0.001. (Table 5)

There was no significant association between dry eye and gender, illumination of room, distance from screen, use of air conditioner in room or preferred mode of working on computer.

| Variable | Group | Number (Percentage) |
|---|---|---|
| **Gender** | Male | 230(57%) |
| | Female | 171(43%) |
| **Average screen time during lectures per day** | ≤ 5 hours | 242(60%) |
| | >5 hours | 159(40%) |
| **Average screen time hours apart from online lectures i.e phone, T.V etc** | < 2 | 49(12%) |
| | 2-4 | 162(40%) |
| | >4 | 190(47%) |
| **Taking break in between online lectures for 20 seconds** | Yes | 224(56%) |
| | No | 177(44%) |

Table 1: Distribution of student related factors associated with dry eye disease

| Variable | Group | Number (percentage) |
|---|---|---|
| **Adequate illumination in room** | Present | 381(90%) |
| | Absent | 20(5%) |
| **Protective screen** | Present | 193(48%) |
| | Absent | 208(52%) |
| **Taking online lectures in air conditioned room** | Yes | 202(50.4%) |
| | No | 199(49.6%) |
| **Distance from screen** | Less than one arm | 207(52%) |
| | More than one arm | 18(4%) |
| | Equals to one arm | 176(44%) |
| **Preferred mode of working on computer** | Bed predominantly | 96(24%) |
| | Both Bed & Chair | 212(53%) |
| | Table-chair predominantly | 93(23%) |

Table 2: Distribution of environmental factors associated with dry eye disease

| Grading | Frequency | Percentage | Mean OSDI SCORE |
|---|---|---|---|
| **Normal** | 162 | 40% | 6.1±3.9 |
| **Mild** | 76 | 19% | 18.4±3.1 |
| **Moderate** | 62 | 16% | 28.1±2.6 |
| **Severe** | 101 | 25% | 48.2±15.4 |

Table 3: Mean OSDI score and prevalence of varying severity of dry eye disease

| Variable | Group | Dry eye present | P value(chi square value) |
|---|---|---|---|
| **Gender** | Male | 105(61%) | .526(.402) |
| | Female | 134(58%) | |
| **Daily Screen time for online lectures (hours)** | ≤ 5 hours | 134(55%) | **0.033(4.534)** |
| | > 5 hours | 105(66%) | |
| **Average screen time hours apart from online lectures i.e phone, T.V** | < 2 | 22(45%) | **.007(9.886)** |
| | 2-4 | 107(56%) | |
| | >4 | 162(68%) | |
| **Taking break in between online lectures for 20 seconds** | Present | 106(47%) | **.0001(31.78)** |
| | Absent | 133(75%) | |

Table 4: Association of student related factors and dry eye disease

| Variable | Group | Dry eye disease present | P value(chi square value) |
|---|---|---|---|
| **Preferred mode of working on computer** | Bed predominantly | 64(67%) | .074(5.216) |
| | Both Bed & Chair | 128(60%) | |
| | Table-chair predominantly | 47(51%) | |
| **Adequate illumination** | Present | 228(55%) | .667(.185) |
| | Absent | 211(60%) | |
| **Distance from screen** | Less than one arm | 134(65%) | .065(5.455) |
| | More than one arm | 08(44%) | |
| | Equals to one arm | 97(55%) | |
| **Protective screen** | Present | 99(51%) | **.001(10.660)** |
| | Absent | 140(67%) | |
| **Working in Air conditioned room** | Yes | 115(57%) | .272(1.205) |
| | No | 124(62%) | |

Table 5: Association of environmental factors and dry eye disease

**Discussion:**

There were 401 subjects studied in the present study, 57% were males and 43% were females, with mean age of 20.99 ± 1.31 years. There were almost equal number of students who used protective screen on devices, air conditioner in the room and those who preferred otherwise. 48% students worked at more than or equal to one arm distance from the screen. This equal distribution of environmental factors affecting DED helped us to prevent unequal distribution bias in our study.

90% students had been attending classes in well illuminated room, although only 23% used table and chair during the lecture. 40% students had average daily exposure of more than 5 hours of classes. The online platforms provide a feature of taking attendance automatically. There was a diligent attempt by the students to attend the classes to avoid any shortage in attendance. 47% students had more than 4 hours of exposure to screens (mobiles, TV, Visual display terminals) apart from online lectures per day. This high duration is explained by the fact that rapidly spreading COVID-19 pandemic led to restriction of movement of public. With limitation of movement, and absence of outdoor activities, the focus of leisurely activities shifted to digital platforms and students spent more time on the same. Duration of online classes coupled with the time spent onscreen for leisurely activities accounted for longer hours of screen exposure.

The prevalence of symptomatic dry eye based on OSDI questionnaire in our study was 59.6%. Various studies on different populations have estimated the prevalence of symptomatic dry eye to be between 7% and 34%.[1][10][11][12][13] Sahai A et al reported questionnaire based DED prevalence of 18.4%.[14] The prevalence of DED in a study by Titiyal JS etal et al has been 32%.[4] The prevalence of DED was estimated to be 29.25% in a study by Gupta N etal.[15] Hyon JY conducted a study amongst medical students, wherein the prevalence was reported to be 27.1%.[16] Study by Baisoya P etal has reported DED prevalence of 46.71%.[17] The TFOS DEWS II epidemiology report reports the prevalence of dry eye to range between 5 % and 50%.[1]

The high variation in prevalence amongst various studies is attributed to the difference in studied population, diagnostic tests used and variations in the selection criteria. The exceptionally high prevalence of symptomatic dry eye in the present study is striking. This is because the population included and the ongoing pandemic situation is exceptional. Never before has teaching in medical colleges been exclusively online. Since there has been no study, so far, to assess the impact of complete digitalization of teaching-learning amongst medical students during the pandemic, comparison with other studies during non COVID times don't correlate well with our results.

In the present study, there was no significant association of gender and prevalence of symptomatic DED. Studies like the Beaver Dam eye study and the study conducted by Schaumberg DA et al have reported the prevalence of DED to be more in females as compared to males.[11][18] Various studies conducted on Indian population also reported a higher prevalence amongst females.[14][15][19] Although, a hospital based study conducted by Titiyal JS etal on North Indian population found a significantly higher prevalence in males.[4] These variations can be well explained by the demographic differences in the population studied.

In our study we found a strong correlation between symptomatic dry eye and the duration of screen time. Study by Titiyal JS et al also reported a strong association between VDT usage and severe DED.[4] Normal blinking is essential to ensure the normal distribution of the tear film.[20] Spontaneous eye blinking has been found to be significantly reduced during use of computers.[21] Long term computer use can cause poor distribution of tear film, facilitating the evaporation of tears thus predisposing to DED.[22]

We observed a significant negative association of symptomatic DED with use of protective screen on device. The protective screen provides protection against DED by filtering harmful high energy visible light emitted by the display. This leads to reduction in eye strain and dry eyes.

We observed negative association of symptomatic DED and behaviour of taking breaks in between lectures. Students who did not take breaks in between lectures had a higher prevalence of DED.

We did not observe any significant association between dry eye and illumination of room, distance from screen, use of air conditioner in room or preferred mode of working on computer.

There are certain limitations to our study. As it was conducted during COVID-19 times, with limited or no access to the participants, the screening of DED is purely questionnaire based. No objective tests could be conducted. Secondly, our study is conducted on MBBS students with mean age of 20.99 years. Generalizing the results of the same to all the students will need substantiation by more studies on the same subject.

The present study is novel in itself as it highlights the ocular impact of online classes during the exceptional circumstances of pandemic. To the best of our knowledge, there has been no such study, conducted in recent times to understand the ocular impact of adopting technology to this large extent in teaching –learning modality.

**Conclusion**

Technology is a double edged sword. Adopting a new lifestyle became essential during the COVID-19 pandemic but it came with its own health concerns. With a sudden drastic change in lifestyle, there has been a growing need felt for inculcation of telemedicine in the regular medical practice. However, the norms for 'tele-education' still remain in ambiguity. Precise regulations on digital exposure for educational institutes and sensitization of resource faculty in preventing ocular and other health hazards associated with the same need to be done on priority basis. Limiting the duration of lectures and introduction of small water breaks in between can prevent ocular morbidity to a large extent. Additionally, these small water breaks shall ensure maintenance of adequate hydration during summers amongst the students. This shall help the students to concentrate better and imbibe more from the class, thereby increasing their overall performance.

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