Original Article

Assessment of Dry Eye Disease in Young Adults

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ABSTRACT

Background: The study aimed to assess the prevalence of dry eye disease (DED) in the young adult population that is invariably exposed to significant risk factors predisposing to the disease. **Materials and Methods:** Four hundred and eight young adults answered ocular surface disease index (OSDI) and standardized patient evaluation of eye dryness (SPEED) questionnaires. Those with OSDI and SPEED grading of moderate and severe DED were further evaluated. Appropriate treatment was started and patients were followed up after 8 weeks. **Results:** Prevalence of DED was 21.56% (n = 88) by OSDI score and 20.58% (n = 84) by SPEED score. Higher prevalence was seen in the age group of 23 years. Myopia, refraction, history of excessive video display terminal use, and contact lens use (P < 0.05) were noted to be significant risk factors for DED. Schirmer's test (ST) scores were <5 mm for 22 (25%) and 26 (29.54%) patients, 6–10mm for 22 (25%) and 12 (13.63%) patients in the right eye (RE) and left eye (LE) respectively by OSDI. By SPEED, 22 (26.2%) and 26 (31%) patients had <5 mm scores and 22 (26.2%) and 10 (11.9%) had scores of 6–10 mm in RE and LE, respectively. Tear film breakup time (TBUT) values of <10 s were observed in all patients (100%) in RE and all but two patients in LE from both questionnaires. Post-treatment means ST and TBUT values were significantly higher following lubricating eye drop treatment and lifestyle changes (P < 0.01). **Conclusion:** DED has a significant prevalence in the young adult population. Appropriate lifestyle changes along with medications are important for its management.

Key words: Dry eye disease, ocular surface disease index questionnaire, standardized patient evaluation of eye dryness questionnaire, young adults

INTRODUCTION

By definition, dry eye disease (DED) is a multifactorial disease of the tear film and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolality of the tear film and inflammation of the ocular surface. [DEWS Definition (2007)].[1] Common complaints include foreign body sensation, redness, blurred vision and increased sensitivity to light, frequent blinking, or heavy and tired eyes.[2]

In addition, DED can vitiate the results of refractive surgeries opted for frequently by young adults.[3] Frequent use of contact lenses is also an important risk factor causing DED.[4]

Most of the studies at present have assessed the prevalence of dry eyes in elderly individuals. Very few studies are done in young adults exploring its potential as a significant health concern. Frequent use of modern gadgets such as smartphones and computers, sleep deprivation, and myopic progression add to the risk factors of developing dry eyes, especially in young adults[5] Unhealthy devotion of the young adult population to technological gadgets has increased the risk of developing DED.

Access this article online	
Website: themmj.in	Quick Response Code
DOI: 10.15713/ins.mmj.90	

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Keeping this in mind, this study was conducted in a sample population of students at a rural medical college hospital in the age range of 18–23 years for a period of 18 months. With the help of detailed questionnaires and appropriate tests, an attempt was made to know the prevalence and risk factors of DED in this population.

MATERIALS AND METHODS

This descriptive observational study was conducted in the Department of Ophthalmology at a rural medical college hospital from November 2019 to April 2021. The study was approved by the institutional ethics committee. After obtaining written informed consent, 408 medical, physiotherapy students and arts and science graduate college students in the age group of 18–23 years of both sexes were included in the study.

The participants were asked to fill out a detailed ocular surface disease index (OSDI) and standardized patient evaluation of eye dryness (SPEED) questionnaires.

The OSDI questionnaire is a 12-item questionnaire, developed for a quick assessment of the frequency of DED symptoms, ease of performance of various visual tasks, and comfort related to changing environmental situations such as humidity and air conditioning in the past week. Three subscales encompassing ocular symptoms, vision related function, and environmental factors are recorded as the patient's response on a scale of 0–4 in order of severity. The final score ranges from 0 to 100 with a grading of 1–12 as normal,13–22 as mild DED 23–32 as moderate, and a score more than 33 as severe DED.[6]

The SPEED questionnaire assesses the progression of DED over a period of 3 months. It evaluates the frequency and severity of the symptoms with a score of 0 to 28 with a grading of 0–4 as mild, 5–7 as moderate, and more than 8 as severe DED.[7]

Those with OSDI grading of DED and SPEED grading of moderate and severe DED were further evaluated. History was obtained covering the use of smartphones/laptops, contact lens wear, and spectacle use. The time duration between refraction and present spectacle prescription was also noted.

Visual acuity was recorded using Snellen's chart without and with spectacles. A slit lamp examination was done to evaluate for ocular surface disorders including mebomian gland dysfunction. Fundoscopy was documented.

Schirmer's 1 test (ST) and Tear film break-up time (TBUT) tests were done on the participants. ST was performed by using a standardized sterile Schirmer test strip (of 5×35 mm Whatman filter paper). This strip was placed in the lower conjunctival fornix of the participant, at the junction of the medial two-third and lateral one-third. The participant was asked to look up while maintaining a normal blink rate for a period of 5 min. The strip was removed after 5 min and the wet portion of the strip was measured in millimeters. Both eyes were tested simultaneously. <10 mm of wetting after 5 min was considered abnormal.[8]

TBUT was measured with a fluorescein strip coated with one drop of pro-paracaine (0.5%). After staining the inferior conjunctival fornix with the strip, the participant was asked to blink for a few seconds to ensure a uniform staining of the corneal surface. Then on the slit lamp, the participant was asked to keep his or her eye open till the first defect in the tear film occurred. The time interval between the last complete blink and the first appearance of a dry spot on the tear film surface was defined as TBUT. A TBUT of <10 s was considered as a positive finding for DED.[8]

The test results were recorded and the participants were counseled in terms of lifestyle and environmental changes. Lubricating eye drops with a content of carboxymethylcellulose (0.5%) were prescribed to participants with an ST value of more than 10 mm. Hydroxypropyl methylcellulose (0.3%) with glycerine (0.2%) and dextran 70 (0.1%) were prescribed to those with ST values <10 mm. The medication was prescribed 4 times a day. At the time of follow-up after 8 weeks, ST and TBUT tests were repeated and findings were recorded.

Statistical analyses were done using MedCalc for Windows, version 15.0 (MedCalc Software, Ostend, Belgium). Fischer's exact tests and Chi-square tests were used to establish the association between categorical data. A probability value (P) of <0.05 was considered statistically significant.

RESULTS

The mean age of the population was 21.18 years (standard deviation - 1.36 years) with a higher prevalence of DED in the age group of 23 years (>30%). There were 166 (40.68%) males and 242 (59.32%) females in the study. 21.56% (n = 88) had DED according to the OSDI score and 20.58% (n = 84) as per the SPEED score.

Of these participants with DED, 34% (n = 30) were males and 66% (n = 58) were females by OSDI classification while 34% (n = 30) were males and 64.3% (n = 54) were females according to SPEED criteria.

Of these 88 participants with DED according to the OSDI grading 66% (n = 58) were categorized as mild DED, 20.4% (n = 18) as moderate DED, and 13.6% (n = 12) as severe DED while according to the SPEED grading, 9.5% (n = 8) had mild DED, 23.8% (n = 20) had moderate DED and 66.7% (n = 56) had severe DED [Figure 1].

Myopia, refraction, a history of excessive video display terminal use, and contact lens use (P < 0.05) were noted to be significant risk factors for DED. There was no significance to the history of eye irritation to DED (P > 0.05). We could not comment on the statistical significance of refractive surgery and DED in this study as the data were inadequate. (Only one participant has refractive surgery) [Table 1].

Out of the patients with DED, 18 had allergic conjunctivitis, of which only 4 were contact lens users (OR = 1.51 with 95% CI at 0.2580–8.8395, P = 0.64 according to the OSDI score and OR = 1.42 with 95% CI at 0.2437–8.3757, P = 0.69) and this was statistically not significant. None of the DED patients had pathological myopia [Table 1]. Other than allergic conjunctivitis, no significant conjunctival or corneal disorders were noted in the patient population.

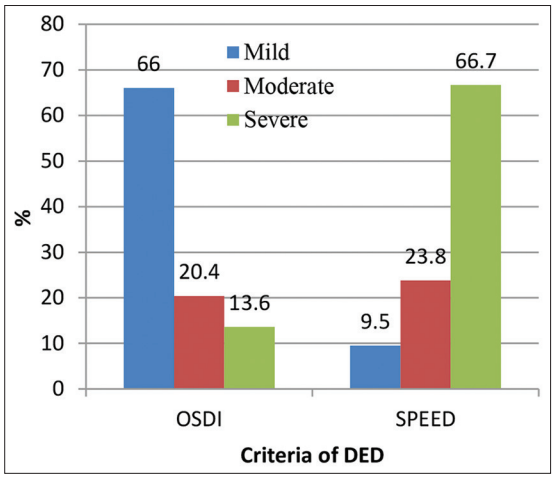

Figure 1: Severity of dry eye disease among the study sample

Schirmer's test (ST) was done in these 88 participants diagnosed by the OSDI questionnaire. Here Schirmer's 1 test findings of the right eye (RE) showed that 22 (25%) of those with DED had a tear strip wetting of <5 mm indicating very severe dry eye and 22 (25%) between 6 and 10 mm indicating severe dry eye. In the left eye (LE) 26 of the 88 (29.54%) DED patients had Schirmer's of <5 mm and 12 (13.63%) with values between 6 and 10 mm [Figure 2]. This was based on the OSDI questionnaire.

Based on the SPEED questionnaire, out of the 84 patients, in the RE, 22 patients (26.2%) had a tear strip wetting of <5 mm indicating very severe dry eye. 22 patients (26.2%) had tear strip wetting between 6 and 10mm indicating severe dry eye. In the LE, 26 patients (31%) had very severe dry eyes and 10 (11.9%) had severe dry eyes [Figure 3].

A TBUT of <10 s in the RE was observed in all 88 patients and in the LE 84 of the 86 patients (97.72%) based on the OSDI Questionnaire [Figure 4].

Of the 84 patients, in the RE, all had a breakup time of <10 s, and in the LE 82 patients (97.6%) had a TBUT of <10 s. Based on the ST grading of <10 mm, 40 patients have prescribed a combination of HPMC (0.3%) with Glycerin (0.2%) and Dextran (0.1%) and 32 patients with Schirmer's score >10 mm were prescribed carboxymethyl cellulose (0.5%).

On follow-up after 8 weeks, after lifestyle changes and lubricating eye drop use, the participants were re-tested with ST strips and TBUT [Figure 5].

The Schirmer's findings in the RE had only 2 (2.27%) participants with strip wetting <5 mm and 14 (15.91%) in the range of 6–10mm. Seventy-two

Table 1: Risk factors for DED

Risk factors	DED (%)	Non-DED	Odds ratio	95%CI	P-value
OSDI questionnaire					
VDT	0 (22.7)	18	4.9346	1.8624–13.0746	0.0013[c]
Myopia	36 (40.9)	58	3.12	1.517–6.4453	0.0020[c]
Refraction	14 (15.9)	6	9.9009	2.4436–40.116	0.0013[c]
Contact lens use	10 (11.4)	8	5	1.2822–19.4971	0.0204[c]
Irritation	6 (6.8)	6	3.8293	0.7452–19.6782	0.1079
SPEED questionnaire					
VDT	18 (21.4)	20	4.1455	1.562–11.0091	0.004[c]
Myopia	34 (40.5)	60	2.992	1.4380–6.2252	0.003[c]
Refraction	14 (16.7)	6	10.6	2.61–43.03	0.001[c]
Contact lens use	10 (11.9)	8	5.33	1.366–20.85	0.01[c]
Irritation	6 (7.1)	6	4.07	0.7923–20.97	0.09

[c]P<0.05, DED: Dry eye disease, CI: Confidence interval, VDT: Video display terminal, OSDI: Ocular surface disease index, SPEED: Standardized patient evaluation of eye dryness

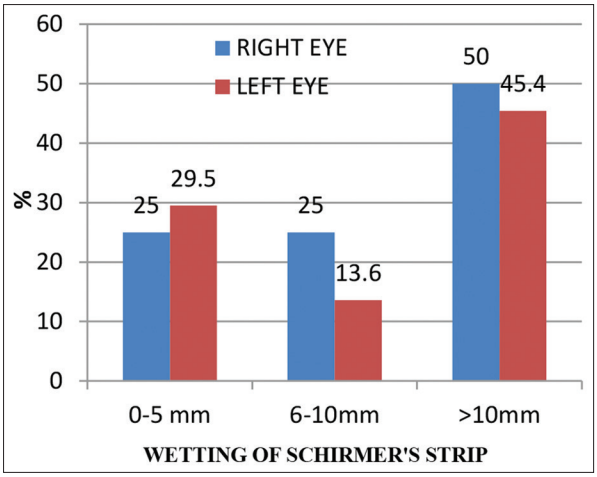

Figure 2: Schirmers score from ocular surface disease index questionnaire

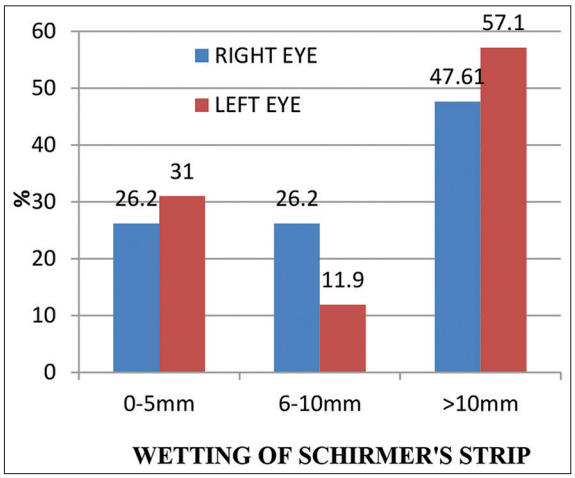

Figure 3: Schirmer's scores from standardized patient evaluation of eye dryness questionnaire

(81.82%) participants had normal ST values. For the LE, 4 (4.55%) participants had Schirmer's value of <5 mm and 20 (22.73%) in the range of 6–10mm, 64 participants (73.72%) had a normal ST score, thus, showing an improvement [Figure 6]. All the participants had a normal TBUT score.

Mean ST and TBUT value was significantly higher following lubricating eye drop treatment and lifestyle changes (P < 0.01), suggesting the effectiveness of treatment.

DISCUSSION

DED, though of frequent occurrence is often undiagnosed and untreated due to variable presentations. Although

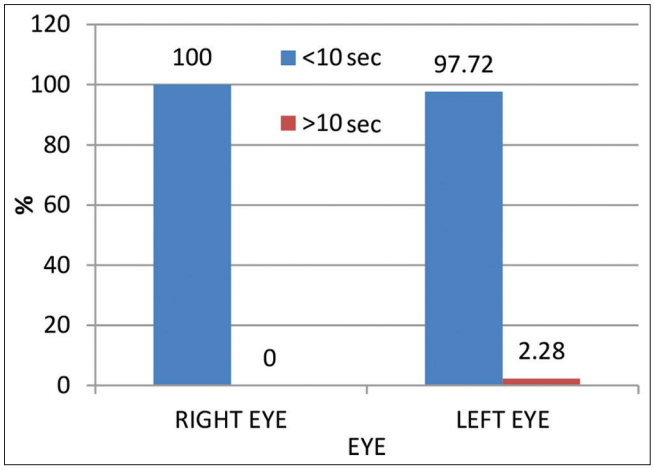

Figure 4: Tear film breakup time scores in participants diagnosed as DED according to ocular surface disease index questionnaire

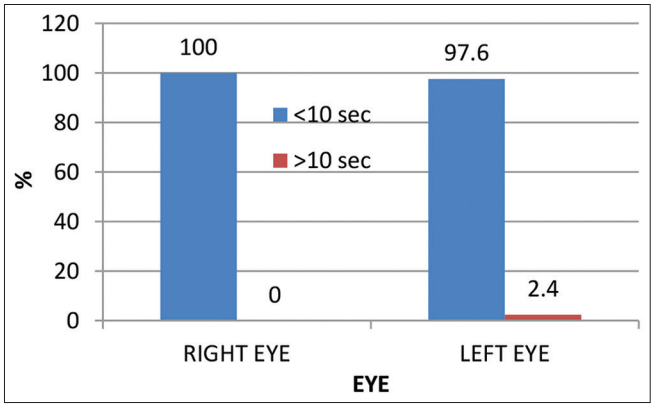

Figure 5: Tear film breakup time scores according to standardized patient evaluation of eye dryness questionnaire

studies to establish its prevalence have been done, its prevalence in the young adult age group is still not widely established. Very few studies are reported in young adults.[5,9,10]

We used the established OSDI questionnaire and the SPEED questionnaire together to establish a diagnosis of DED. The OSDI takes into account the frequency of dry eye symptoms, limitations in the performance of various visual tasks, and comfort related to environmental conditions for the past week. It has good reliability, sensitivity, and specificity.[11] Whereas, the SPEED questionnaire assesses the presence, frequency, and severity of dry eye symptoms over a period of 3 months. It is also a good parameter for the separation of asymptomatic and symptomatic participants in comparison to OSDI.[12] The advantage of the SPEED questionnaire is the lower

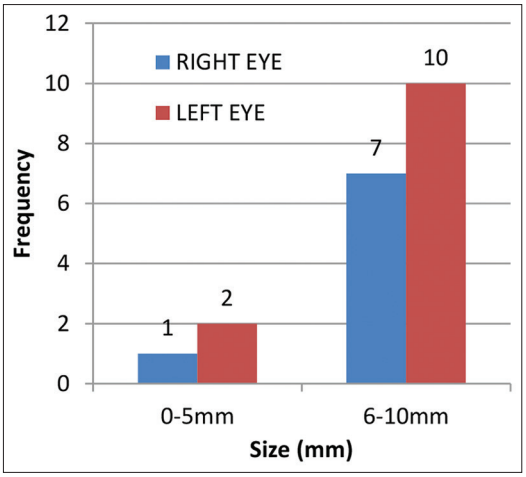

Figure 6: Schirmer's test after treatment

number of questions and easier interpretability. In the comparative study of the two questionnaires, the SPEED questionnaire scores seemed to correlate more with parameters of evaporative dry eye The OSDI values correlated more with parameters of aqueous tear-deficient dry eye. However, Finis *et al*. state that it is not possible to distinguish between evaporative and aqueous tear deficient dry eye only on the basis of the results of questionnaires.[13]

In our study, 88 participants had DED based on the OSDI criteria and 84 participants based on the SPEED questionnaire. The prevalence of DED was 21.56% based on the OSDI questionnaire in the study population. The global prevalence of DED ranges from 18.4% to 54.3% over all age groups.[5,10,14-16] The varying prevalence is because of the different age groups included and the different criteria used for the diagnosis of DED.

The majority of participants having DED were of age 23 years based on both questionnaires. These were the students undergoing internship training and preparing for their competitive entrance exams. Both these activities increased the screen time every day. This could be a contributing factor for the increased prevalence in this age group.

Video display terminal use, myopia, inadequate refractive correction, and contact lens use were found to be statistically significant risk factors contributing to DED in the present study based on both questionnaires ($P < 0.05$) [Table 1]. The association of VDT and DED is supported by numerous studies.[9,17,18] Continuous VDT usage is thought to decrease the blink rate which causes inadequacy in the uniform distribution of tear film of the eye.[9,17] Also, the longer duration of eye-opening and the higher gaze angle while viewing laptops contribute to tear film evaporation causing DED.[14] A low tear volume in teenagers with myopia has been explained.[16] Persons with refractive errors tend to rub their eye more frequently thus predisposing to tear film instability.[19]

Of the nine contact lens users, five patients had DED. There is an increased tendency to use contact lenses in young adults.[20] The contact lens tends to divide the tear film into pre- and post-lens tear films. The division of the tear film layer and the decreased wettability of the CL surface cause instability of the tear film layer. This, coupled with the increasing friction between the eyelid and the ocular surface contributes to the causation of DED.[21]

Only two participants had an ST score of <5 mm in the RE and four in the LE after the use of lubricating eye drops at the first follow-up.

Overall, the ST and TBUT scores were significantly higher following lubricating eye drop treatment and lifestyle changes ($P < 0.01$), suggesting the effectiveness of treatment.

Limitations of this study

The study was carried out on a sample population of medical, physiotherapy college, and arts and science graduate students and may not describe the general population. Although the sample size was adequate, we did not evaluate for DED secondary to other causes of aqueous deficiency or evaporative dry eye due to meibomian gland dysfunction by meibography. Subclassification into these categories would have added to the etiological diagnosis in our study group. Furthermore, longer follow-ups would be ideal to look into the long-term effectiveness of the treatment.

CONCLUSION

In our study, 21.56% ($n = 88$) had DED according to the OSDI score and 20.58% ($n = 84$) as per the SPEED score. Correction of refractive error, proper use of contact lenses, advice regarding restriction of screen time use of video display terminals, and lifestyle changes along with medications are also important in the management of DED in young adults.

ACKNOWLEDGMENTS

This work is supported by a research grant sanctioned by the Maharashtra University of Health Sciences, Nashik

for a short-term research scheme for the academic year 2018–2019 vide letter no MUHS/URD/192/2019 dated November 13, 2019.

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How to cite: Ger MR, Sambarey PP, Gupta RP. Assessment of Dry Eye Disease in Young Adults. MIMER Med J 2023;7(2):16-21.

Source of Support: Maharashtra University of Health Sciences, Nashik Short Term Research scheme.
Conflicts of Interest: None declared.