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A Cross-Sectional Study of Frequency and Severity of Dry Eye in Occupational Workers at a Tertiary Health Care Centre

Swapnali S Bandgar* and Anuja D Satija

*Department of Ophthalmology, Government Medical College, Miraj, Maharashtra, India.

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ABSTRACT

Aim: The aim of this study is to find out the frequency and severity of dry eye in various occupations at a tertiary health care center.

Material and methods: In this cross-sectional study, 782 patients with dry eye symptoms were screened. 103 patients met the criteria. Their demographics, smoking history, occupation and residence were recorded. They completed the McMonnies Dry Eye Questionnaire, and those with suspected dry eye underwent Schirmer's test and tear film breakup time (TBUT).

Results: The prevalence of occupational dry eye was 13.17%. The largest age group was 41-60 years (48.54%). Males (76.70%) had a higher prevalence than females (23.30%). Rural patients (57.28%) outnumbered urban ones (42.72%). Farmers (28.16%) were the most affected, followed by field workers (23.30%). Computer use was reported by 24.27%. TBUT results showed 93.20% had mild to moderate grades, while 6.80% had severe cases. Schirmer's test classified 72.82% as mild, 16.50% as moderate, and 10.68% as severe dry eye cases.

Conclusion: The study highlights a high prevalence of occupational dry eye, especially among farmers and field workers due to outdoor exposure, and office workers due to prolonged screen time. Symptoms like itching, redness, and dryness are common, with severity varying. While most patients maintain good visual acuity, some experience severe dry eye. Targeted interventions, such as protective eyewear for outdoor workers and ergonomic measures for office workers, are essential to managing and preventing occupational dry eye.

Keywords: Dry eye, Symptoms, Itching, Redness, Disease

INTRODUCTION

Dry eye syndrome (DES) is a disorder of the tear film that results in damage to the ocular surface and is associated with symptoms of ocular discomfort. The International Dry Eye Workshop (2007) defined dry eye as, "a multifactorial disease of the tears 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 osmolarity of the tear film and inflammation of the ocular surface" [1-3].

The diagnostic criteria are: 1) assessment of symptoms, 2) qualitative or quantitative disturbance of the tear film (quantity: Schirmer I test less than 5 mm/5 min; quality: BUT less than 5 sec), 3) kerato-conjunctival epithelial damage (staining score greater than 3 points). The presence of all criteria renders a diagnosis of definite dry eye and the presence of two out of the three criteria renders a diagnosis of probable dry eye [4]. Although many clinical tests can be done to assess the tear film profile, the diagnosis of DES is made mainly on subjective symptoms perceived by the patient [5]. Patients present with ocular discomfort in the form of pain, itching, grittiness, foreign body sensation, dryness, redness, and, in severe cases, they may present with visual impairment [6].

Dry eye syndrome (DES) or simply dry eye is one of the most common conditions seen in ophthalmic clinics worldwide. The prevalence of dry eye ranges from 5% to 35% worldwide, while in India it is 29.25% based on Ocular Surface Disease Index (OSDI) data [7]. Reduction in quality

Corresponding author: Swapnali S Bandgar, Department of Ophthalmology, Government Medical College, Miraj, Maharashtra, India, Tel: 7709844349; E-mail: swapni333@gmail.com

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of life is inevitable when symptoms of dry eye occur [8]. If left untreated, dry eye may result in decreased vision complicated by ulceration and scarring [7].

The risk factors for DES include aging, female gender, wearing contact lenses, eyelid infection, smoking, alcohol use, refractive surgery, and living in a dry environment [9]. Low humidity is a known risk factor for DES. However, previous studies have been performed in experimental environments or using visual display terminals, which limit the strength of their findings [10]. Besides there is occupation-based etiology, like prolonged use of computers in IT professionals with exposure to air pollution, low humidity, high temperature, sunlight exposure in outdoor workers. Female gender appeared to be the most effective risk factor and this is supported by many studies. The high prevalence of DES among females may be related to the hormonal effects in which sex hormones especially androgens affect the lacrimal glands, Meibomian glands, conjunctival goblet cell density and ocular surface sensitivity [11].

In present study, we therefore aimed frequency and severity of dry eye in occupational workers at a tertiary health care center. So, the approach to dry eye is to identify symptom and severity based on diagnosis with group of diagnostic tests in hospital-based population in a tertiary care hospital.

MATERIALS AND METHODS

This cross-sectional study was conducted at a tertiary care hospital over 18 months. The sample size was calculated using a standard formula, with a minimum requirement of 91 patients. A total of 103 patients meeting the inclusion and exclusion criteria were included in the study.

Inclusion criteria consisted of patients aged over 18 years of all genders who presented with dry eye symptoms and had abnormal test results. Only those who provided written informed consent were included. Exclusion criteria included critically ill patients, those already on dry eye treatment, non-occupational dry eye cases, individuals with a history of ocular trauma or surgery within six months, patients with other ocular diseases or long-term systemic treatments.

The study was conducted in the ophthalmology department, where 782 patients with dry eye symptoms were screened. Among them, 103 patients met the inclusion and exclusion criteria and were enrolled. Informed consent was obtained from all participants after explaining the study's purpose and procedures. Demographic details, smoking history, occupation, and place of residence were recorded. Patients completed the 14-point McMonnies Dry Eye Questionnaire (Appendix 1), which assessed symptoms such as itching, redness, burning, watering, foreign body sensation, and photophobia. Those suspected of having dry eye underwent Schirmer's test and tear film break-up time (TBUT) measurement at 10-minute intervals to minimize reflex tearing.

Dry eye diagnosis was based on multiple criteria, including a McMonnies score greater than 10, a Schirmer's test result of less than 10 mm in five minutes, a TBUT of less than 10 seconds, and the presence of at least two clinical signs such as conjunctival injection, corneal erosions, or meibomian gland disease.

The McMonnies Dry Eye Questionnaire consisted of 14 questions, with a score above 10 indicating dry eye. Additionally, the Ocular Surface Disease Index (OSDI) was used to categorize dry eye severity: a score of 13-22 indicated mild dry eye, 23-32 indicated moderate dry eye, and 33-100 indicated severe dry eye.

Tear film stability was assessed using the TBUT test, where a result greater than 10 seconds was considered normal, 5-10 seconds indicated mild to moderate dryness, and less than 5 seconds indicated severe dryness. Schirmer's test, conducted without anesthesia, measured tear production. A result above 10 mm was considered normal, 8-10 mm indicated mild dry eye, 5-7 mm indicated moderate dry eye, and less than 5 mm indicated severe dry eye. For data analysis, quantitative variables were presented as mean ± standard deviation, while categorical data were expressed as percentages.

RESULTS

In this study, a total of 782 patients with dry eye symptoms were screened at a tertiary care center. Among these, 103 patients met the inclusion and exclusion criteria for the study. The prevalence of occupational dry eye in this study was found to be 13.17%.

In present study, the patient population is categorized into three age groups. The largest group comprises individuals aged 41-60, with 50 patients, representing 48.54% of the total. The 21-40 age group follows, including 33 patients or 32.04% of the total. The smallest group consists of patients aged 61-80, totalling 20 individuals and accounting for 19.42% of the population. Overall, there are 103 patients, with the mean age being 48.57 years, with a standard deviation of 12.51 years (**Table 1**).

Table 1. Distribution of Patients as Per Age.

Age Group	No. of Patients	Percentage
21-40	33	32.04
41-60	50	48.54
61-80	20	19.42
Grand Total	103	100.00
Mean age 48.57±12.51 years		

The gender distribution of patients in the study reveals a notable disparity between male and female participants.

With 76.70% of the patients being male and only 23.30% female, this suggests a significantly higher prevalence of dry eye among males (**Table 2**).

Table 2. Distribution of Patients as Per Gender.

Gender	No. of patients	Percentage
Female	24	23.30
Male	79	76.70
Grand Total	103	100.00

In present study the data shows that 59 (57.28%) of dry eye patients are from rural areas, while 44(42.72%) are from urban areas (**Table 3**).

Table 3. Distribution of Patients as Per Locality.

Locality	No. of patients	Percentage
Rural	59	57.28
Urban	44	42.72
Grand Total	103	100.00

Among the 103 patients surveyed, the distribution across occupations varied. The majority of patients were farmers, with 29 individuals representing 28.16% of the total. Field workers followed closely, comprising 23.30% with 24 patients. Office workers accounted for 16.50% of the sample, totaling 17 patients. Factory workers made up 10.68%, with 11 patients. Cooks and shopkeepers each represented 4.85% and 3.88% respectively, with 5 and 4 patients respectively. Teachers also made up 3.88% of the sample, with 4 patients. Drivers and watchmen each accounted for 0.97% and 1.94%, with 1 and 2 patients respectively. Mechanics were the least represented, with only 2 patients making up 1.94% (**Table 4**).

Table 4. Distribution of Patients as Per Occupation.

Occupation	No. of patients	Percentage
Farmer	29	28.16
Field workers	24	23.30
Office work	17	16.50
Factory work	11	10.68
Cook	5	4.85
Doctor	4	3.88
Shopkeeper	4	3.88
Teacher	4	3.88
Mechanic	2	1.94
Watchman	2	1.94
Driver	1	0.97
Grand Total	103	100.00

In present study among total population 25(24.27%) were using computer for daily work. While 73(75.73%) were not using computer. Mean working hours were 3.24±1.45 h (**Table 5**).

Table 5. Distribution of Patients as Per Use of Computer.

Use of computer	Working Hours	No. of patients	Percentage
Yes	< 3 h	14	24.27%
	> 3 h	11	
No	-	73	75.73%
Total		103	100%
Mean computer use 3.24±1.45 h			

In the study, the tear break-up time (TBUT) grades were distributed as follows: 96 patients, or 93.20%, had mild to moderate TBUT grades. In contrast, 7 patients, representing 6.80%, were classified with severe TBUT grades (**Table 6**).

Table 6. Distribution of Patients as Per Severity of Dry Eye on TBUT Grade.

TBUT grade	No. of patients	Percentage
Mild to Moderate	96	93.20
Severe	7	6.80
Grand Total	103	100.00

In the study, Schirmer test grades were distributed as follows: 75 patients (72.82%), were classified with mild dry eye, indicating relatively adequate tear production. A total of 17 patients, representing 16.50%, were categorized with moderate dry eye, reflecting a noticeable reduction in tear production. The remaining 11 patients, (10.68%) had severe dry eye, characterized by significantly impaired tear production **(Table 7)**.

Table 7. Distribution of Patients as Per Severity of Dry Eye Based on Schirmer Grade.

Schirmer grade	No. of patients	Percentage
Mild	75	72.82
Moderate	17	16.50
Severe	11	10.68
Grand Total	103	100.00

The analysis of dry eye severity across various occupations reveals distinct patterns. Farmers and field workers exhibit

the highest prevalence of dry eye, with farmers showing 28.16% and field workers 23.30% of cases, predominantly in the mild category. Office workers also experience significant dry eye issues, with 16.50% of cases, including mild and moderate severity. Factory workers report fewer cases overall, with 10.68% of the total, but a notable presence of moderate severity. Cooks, doctors, shopkeepers, and teachers each represent a smaller proportion of the total cases, with only mild to moderate dry eye, reflecting the lower frequency and severity in these professions. Mechanics and watchmen have the least number of cases, and drivers show the lowest prevalence with just 0.97% of the total cases (**Table 8**). This distribution underscores the varying impact of occupational environments on dry eye severity, with certain professions experiencing higher rates and severities than others.

Table 8. Distribution of Patients as Per Severity of Dry Eye in Various Occupational Categories.

Occupation	Schirmer grade			Grand Total	
	Mild	Moderate	Severe	No. of patients	Percentage
Farmer	17	8	4	29	28.16
Field workers	20	2	2	24	23.30
Office work	12	3	2	17	16.50
Factory work	8	3	0	11	10.68
Cook	5	0	0	5	4.85
Doctor	3	0	1	4	3.88
Shopkeeper	4	0	0	4	3.88
Teacher	3	1	0	4	3.88
Mechanic	0	0	2	2	1.94
Watchman	2	0	0	2	1.94
Driver	1	0	0	1	0.97
Grand Total	75	17	11	103	100.00

The distribution of Ocular Surface Disease Index (OSDI) scores among the 103 patients was as follows: none of the patients fell into the "Normal" category with scores ranging from 0 to 12. A total of 23 patients, representing 22.33%, were classified with "Mild Dry Eye," with scores between 13 and 22. The majority, 38 patients or 36.89%, had "Moderate Dry Eye," with scores ranging from 23 to 32. Additionally, 42 patients, or 40.78%, were categorized with "Severe Dry Eye," having scores above 32 (**Table 9**).

Table 9. Distribution of Patients as Per Severity of Dry Eye Based on OSDI Score Grade.

OSDI Score Grade	No. of patients	Percentage
Normal (0-12)	0	0.00
Mild Dry Eye (13-22)	23	22.33
Moderate Dry Eye (23-32)	38	36.89
Severe Dry Eye (> 32)	42	40.78
Grand Total	103	100.00

DISCUSSION

In this study, patients were categorized into three age groups. The largest group (41-60 years) included 50 patients (48.54%), followed by the 21-40 age group with 33 patients (32.04%), and the 61-80 age group with 20 patients (19.42%). The mean age was 48.57 years with a standard deviation of 12.51 years.

In the study by Echieh [12], most patients were aged 31-50 years, with a mean age of 40.96±9.8 years. Similar findings were observed in the present study.

The present study found a higher prevalence of dry eye in males (76.70%) than females (23.30%), likely due to greater male representation in occupational categories. Similar gender disparities were reported by Mazumdar [13] (92.86% male), Ranjan [14] (63.36% male), and Bhatnagar [15] (71% male). While dry eye is generally more common in females due to hormonal factors, occupational exposure may explain the higher prevalence among males in this study.

The present study found a higher prevalence of dry eye in rural areas (57.28%) compared to urban areas (42.72%),

likely due to environmental factors, limited healthcare access, and occupational exposures. Similar findings were reported by Ranjan [14] (63.63% rural) and Bhatnagar [15] (77% rural), supporting the trend of increased dry eye cases in rural settings.

In the present study, dry eye was most common among farmers (28.16%), followed by field workers (23.30%), office workers (16.50%), and factory workers (10.68%). Other occupations, including cooks, shopkeepers, teachers, drivers, watchmen, and mechanics, had lower representation.

Tarig A and Sharief MA classified occupations into white-collar (31.1%), blue-collar (29.8%), and green-collar (24.9%) workers, based on job tasks. White-collar included teachers and office workers, while blue-collar was divided into skilled (mechanics, cooks) and unskilled (porters, housekeepers). Green-collar workers were mainly farmers and fishers [16]. The study's findings were comparable to the present study.

Kamalakshy [17]. in their study observed that history of outdoor work was given by 60% cases. Behera [18] observed history of outdoor work in 64% DED cases. Similar results were observed in present study.

The study found that 93.2% of patients had mild to moderate tear break-up time (TBUT) grades, indicating prevalent tear instability without severe dysfunction, while only 6.8% had severe TBUT. This suggests that although dry eye symptoms are common, severe cases are relatively rare, emphasizing the need for effective management strategies and regular eye examinations. Similarly, Schirmer test results showed that 72.82% of patients had mild dry eye, 16.50% had moderate dry eye, and 10.68% had severe dry eye, highlighting the importance of early intervention to manage tear deficiency and prevent worsening symptoms.

Ocular Surface Disease Index (OSDI) scores further confirmed the varying severity of dry eye, with no patients classified as normal. Mild cases accounted for 22.33%, requiring basic treatment, while 36.89% had moderate symptoms needing targeted interventions. The most concerning finding was that 40.78% had severe dry eye, significantly affecting daily life and necessitating advanced treatments. Comparative studies by Bhatnagar [15], Echieh [12], and Mazumdar [13] yielded similar findings, reinforcing the strong correlation between TBUT, Schirmer's test, and OSDI scores in assessing dry eye disease severity.

Occupational analysis revealed that farmers (28.16%) and field workers (23.30%) had the highest prevalence of dry eye, primarily mild cases, likely due to environmental exposure to dust, wind, and sunlight. Office workers (16.50%) also showed a significant prevalence, possibly due to prolonged screen time and digital eye strain. Factory workers (10.68%) exhibited more moderate cases, likely linked to exposure to industrial pollutants and fluctuating temperatures. Other professions, including cooks, shopkeepers, teachers, mechanics, watchmen, and drivers, had fewer cases, mostly mild to moderate in severity.

Studies by Khurana [19] and Shah & Jani [20] further highlighted the increased risk of dry eye among farmers and labourers due to prolonged exposure to harsh environmental conditions, including sunlight, dust, and chemicals. Economic constraints and a lack of awareness prevent many workers from taking protective measures, exacerbating the problem. These findings emphasize the need for preventive strategies, such as protective eyewear and improved awareness, particularly for high-risk occupational groups.

CONCLUSION

The study highlights a high prevalence of occupational dry eye, especially among farmers and field workers due to outdoor exposure, and office workers due to prolonged screen time. Symptoms like itching, redness, and dryness are common, with severity varying. While most patients maintain good visual acuity, some experience severe dry eye. Targeted interventions, such as protective eyewear for outdoor workers and ergonomic measures for office workers, are essential to managing and preventing occupational dry eye.

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