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Original Research Article

Evaluation of dry eye disease: prevalence, associated factors, and treatment outcomes in a tertiary care hospital in north Karnataka

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Abstract

Background: Dry eye disease (DED) is a prevalent condition affecting individuals' quality of life. This study aimed to assess the prevalence and associated factors of DED among patients attending Basaveshwar Teaching and General Hospital in Kalaburagi.

Materials and Methods: A total of 101 outpatients, aged 18 years and older were included in this observational study. Demographic data, systemic disorders, environmental factors, and lifestyle habits were collected. Diagnosis of DED was confirmed through clinical examinations, including tear film assessments and staining tests.

Results: The overall prevalence of DED was 58.4%, with significant associations found with age, gender, and systemic health conditions, particularly diabetes and hypertension. Notably, prevalence rates were similar between males (58.4%) and females (58.3%). Environmental factors, such as air conditioning and screen time, showed no significant correlation with DED. Treatment with lubricating drops significantly improved clinical parameters, including tear film stability and symptom relief.

Conclusion: This study underscores the importance of recognizing DED in clinical settings and emphasizes the need for timely diagnosis and intervention. The findings advocate for further research to explore the long-term effects of treatment strategies on DED management.

Keywords: Dry eyes, Systemic disorders, Environmental factors, Tear film.

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1. Introduction

Dry eye is a common complaint among patients visiting ophthalmology outpatient departments, often presenting as a burning sensation and ocular discomfort.[1] This condition, known as dry eye disease (DED), results from issues with the tear film and is characterized by reduced tear production or excessive tear evaporation, leading to symptoms of ocular dryness.[2] The Tear Film and Ocular Surface Society (TFOS) Dry Eye Workshop II (DEWS II) defined dry eye syndrome as, "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 hyper-osmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiologic roles.[3]

DED has a multifactorial etiology which include age, gender[4] (with women being more affected), environmental conditions (like low humidity and wind, intense temperature and poor indoor air quality),[5,6] systemic conditions such as autoimmune diseases[1] (Sjögren's syndrome, rheumatoid arthritis), hormone disorders (thyroid disorders, menopause and diabetes),[2] and allergic conditions such as hay fever. Additionally, certain medications (e.g., antihistamines, prolonged use of aromatase inhibitors and antidepressants) and radiotherapy can decrease tear production, exacerbating symptoms. Lifestyle factors such as prolonged screen time, frequent contact lens use and inadequate blinking also play a role in the disease's progression.[7] Understanding these elements is crucial for effective diagnosis and management of dry eye disease.

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The stability and renewal of the pre-ocular tear film are essential for maintaining a healthy and comfortable ocular surface. Dysfunction in any component of the tear film, such as its volume, content, distribution, or clearance, can lead to ocular surface disorders, often manifesting as dry eye disease.[8] Two primary mechanisms contributing to dry eye are tear hyper-osmolarity and tear film instability, which mutually reinforce one another. These mechanisms are activated by various subtypes of dry eye, explaining the diverse characteristics and symptoms associated with the condition.[8,9]

This study was conducted with an aim to evaluate the cause of dry eye syndrome in patients presenting to the tertiary care center and assess the outcomes after treatment.

2. Materials and Methods

A prospective study was conducted on patients presenting to the Department of Ophthalmology at Basaveshwar Teaching and General Hospital, affiliated with Mahadevappa Rampure Medical College, Kalaburagi. The study took place from August 1st, 2022, to January 31st, 2024, over a period of 18 months. A sample size of 101 patients was calculated based on the prevalence of dry eye in the general population (10.8%) as reported in a reference study on postmenopausal women.

2.1. Sample size

100.

N= sample size for study group

In the reference study: Prevelance of dry eye in post-menopausal women.

Authors: Pujari M R, Kavita Salagar, Sheetal N Bangare.

Prevelance of dry eye in general population =10.8%

Ethical clearance was obtained from an ethical clearance committee prior to commencement of the study.

Patients were selected after applying the inclusion and exclusion criteria. Inclusion criteria included patients aged 18 years and above presenting with symptoms suggestive of dry eye, such as ocular discomfort, burning, redness, itching, and dryness. Exclusion criteria ruled out patients with active ocular infections, lid anomalies, or corneal ulceration. Each patient's information was collected using a structured proforma, and a detailed medical history was obtained, including any previous treatments.

The diagnosis of dry eye was confirmed through a comprehensive slit-lamp examination. Diagnostic tests included Schirmer's test, fluorescein tear break-up time using slit-lamp bio-microscopy, Rose Bengal dye test, and Lissamine green staining test. Informed consent was obtained from all participants in their vernacular language, ensuring confidentiality and anonymity throughout the study.

All patients were treated with lubricating eye drops, such as Carboxymethylcellulose (0.5% or 1%) and sodium hyaluronate (0.18%), and their progress was monitored through follow-up appointments one month later.

Statistical analysis was performed using IBM SPSS version 25. Descriptive statistics were presented in terms of frequency, proportions, means, and standard deviations. Inferential statistics included chi-squared tests to establish associations between demographic factors and dry eye. Multiple logistic regression was used to assess independent associations of environmental factors, while pre- and post-treatment comparisons were conducted using paired t-tests for continuous variables and Kruskal-Wallis tests for ordinal variables.

3. Results

The study examined the demographic distribution and clinical characteristics of 101 patients with dry eye disease (DED) at the Basaveshwar Teaching and General Hospital in Kalaburagi. Out of the 101 participants, 59 (58.4%) had been tested positive for dry eyes and the rest 42 (41.6%) participants tested negative for dry eyes.

3.1. Correlation between demographic characteristics, comorbidities, refractive errors with dry eyes

Table 1 presents the demographic characteristics of the study participants, indicating that the majority (43.6%) belonged to the 51-60 age group, followed by 28.7% in the 41-50 age group. Notably, there was a significant association between gender and the presence of dry eyes (p-value = 0.000), with a higher percentage of males (58.5%) testing positive compared to females (58.3%). The analysis also revealed that individuals with systemic disorders such as diabetes mellitus showed a significant correlation with dry eye (p-value = 0.017), while refractive errors like myopia also had a notable association (p-value = 0.015).

Table 2 explores the impact of various environmental factors on the occurrence of dry eyes. The results indicate that wind presence, low humidity, air conditioner usage, and smoking did not exhibit significant associations with dry eyes, as evidenced by p-values greater than 0.05. The odds ratios suggest that while individuals using air conditioning were 1.379 times more likely to report dry eyes, this finding was not statistically significant (p-value = 0.428). Additionally, screen time usage indicated a trend towards increased dry eye presence with longer durations, but the p-value of 0.114 also suggested no significant association.

Table 1: Demographic distribution and comorbid conditions

Characteristic		Frequency	Dry eye		
			Present	Absent	p-value
Age group	18-30 years	15 (14.9%)	10 (9.9)	5 (4.9%)	0.458
	31-40 years	10 (9.9%)	7 (6.9%)	3(2.9%)	
	41-50 years	29 (28.7%)	19 (18.8%)	10 (9.9%)	
	51-60 years	44 (43.6%)	22 (21.7%)	22 (21.7%)	
	61-70 years	3 (2.9%)	1 (0.9%)	2 (1.9%)	
Gender	Males	53 (52.5%)	31 (30.69%)	22 (21.7%)	0.0000
	Females	48 (47.5%)	28 (27.7%)	20 (19.8%)	
Occupation	Laborers	37 (36.6%)	18 (17.8%)	19 (18.8%)	
	Homemakers	17 (16.8%)	7 (6.9%)	10 (9.9%)	
	Students	14 (13.9%)	10 (9.9%)	4 (3.9%)	
	Drivers	13 (12.9%)	9 (8.9%)	4 (3.9%)	
	Office worker	13 (12.9%)	8 (7.9%)	5 (4.9%)	
	Shop-owners	7 (6.9%)	7 (6.9%)	0	
Place of residence	Kalaburgi	83 (82.2%)	51 (50.5%)	32 (31.6%)	0.388
	Bellary	5 (4.9%)	2 (1.9%)	3(2.9%)	
	Bidar	5 (4.9%)	3(2.9%)	2 (1.9%)	
	Bijapur	2 (1.9%)	0	2 (1.9%)	
	Yadgir	5 (4.9%)	2 (1.9%)	3(2.9%)	
	Belgavi	1 (0.9%)	1 (0.9%)	0	
Systemic disorders	Diabetes mellitus	16 (15.9%)	8 (7.9%)	8 (7.9%)	0.017
	Hypertension	11 (10.9%)	2 (1.9%)	9 (8.9%)	
	Thyroid disorder	3 (2.9%)	3 (2.9%)	0	
Refractive disorders	Myopia	45 (44.9%)	32 (31.9%)	13 (12.9%)	0.015
	Emmetropia	42 (41.9%)	23 (22.9%)	19 (18.9%)	
	Hyperopia	14 (13.9%)	4 (3.9%)	10 (9.9%)	

Table 2: Association of environmental factors with occurrence of dry eyes

Environmental factor		Total	Dry eyes			
			Present	Absent	p value	Odds ratio
Wind	Present	27	19	18	0.130	0.531
	Absent	64	41	23		
Low humidity	Present	95	55	40	0.672	0.688
	Absent	6	4	2		
Use of air conditioner	Present	48	30	18	0.428	1.379
	Absent	53	29	24		
Smoking	Present	27	14	13	0.419	0.694
	Absent	74	45	29		
Screen time usage	< 4 hours	53	26	27	0.114	-
	4- 8 hours	29	19	10		
	>8 hours	19	14	5		

Table 3: Association of environmental factors with occurrence of dry eyes

Parameter	Interval	Mean	Std. Deviation	Std. Error Mean	p-value
Tearfilmmeniscus (Righteye)	Pre-treatment	.350	.1591	.0158	0.000
	Post-treatment	.476	.0961	.0096	
Tearfilmmeniscus (Lefteye)	Pre-treatment	.392	.2003	.0199	0.000
	Post-treatment	.510	.1338	.0133	
Schirmerstest1(mm) (Righteye)	Pre-treatment	14.15	8.794	.875	0.000
	Post-treatment	15.84	7.494	.746	
Schirmerstest1(mm) (Lefteye)	Pre-treatment	14.49	8.997	.895	0.000
	Post-treatment	16.18	7.763	.772	
Fluorescein Tear Break-up Time (Righteye)	Pre-treatment	9.84	3.434	.342	0.000
	Post-treatment	12.17	2.684	.267	
Fluorescein Tear Break-up Time (Lefteye)	Pre-treatment	10.17	3.589	.357	0.000
	Post-treatment	12.27	3.043	.303	

Table 4: Pre and post-treatment comparisons of grades of fluorescein staining, Rose Bengal staining and Lissamine green staining using Kruskal Wallistest for Righteye

Dye	Grade	Right eye		
		Pre-treatment (n = 101)	Post-treatment (n = 101)	p value
Fluorescein grading	0	42	45	0.023
	1	10	23	
	2	24	30	
	3	20	3	
	4	5	0	
Rose Bengal staining grades	0	42	59	0.000
	1	8	12	
	2	7	17	
	3	16	5	
	4	10	7	
	5	13	1	
	6	5	0	
Lissamine green staining	0	46	49	0.034
	1	8	16	
	2	11	21	
	3	14	14	
	4	20	1	
	5	2	0	

3.2. Comparisons of pre and post-treatment outcomes of various parameters

Table 3 presents pre and post-treatment comparisons of various clinical parameters, revealing significant improvements following treatment. For both eyes, there was a marked increase in tear film meniscus height and Schirmer's test results, with p-values of 0.000 indicating strong statistical significance. The fluorescein tear break-up time (FBUT) also showed significant improvement, with p-values confirming that the treatment was effective in enhancing tear production and stability. These results demonstrate that the treatment regimen significantly benefitted the participants, contributing to improved ocular health and relief from dry eye symptoms.

3.3. Comparisons of pre and post-treatment outcomes of different staining grades

Table 4 and **Table 5** compares the grades of fluorescein, Rose Bengal, and Lissamine green staining before and after treatment for right and left eyes, respectively. The data indicates significant reductions in staining grades across all dyes, particularly for Rose Bengal, which showed a remarkable improvement with a p-value of 0.000 for both eyes. The fluorescein grading also exhibited a significant improvement (p-value = 0.023), indicating a decrease in corneal epithelial damage after treatment. Similarly, Lissamine green staining demonstrated a significant reduction, particularly in the left eye (p-value = 0.026).

Table 5: Pre and post-treatment comparisons of grades of fluorescein staining, Rose Bengal staining and Lissamine green staining using Kruskal Wallistest for Lefteye

Dye	Grade	Left eye		
		Pre-treatment (n = 101)	Post treatment (n = 101)	p-value
Fluorescein grading	0	42	45	0.023
	1	10	23	
	2	24	30	
	3	20	3	
	4	5	0	
Rose Bengal staining grades	0	39	58	0.000
	1	8	18	
	2	8	15	
	3	13	3	
	4	19	5	
	5	13	2	
	6	1	0	
Lissamine green staining grades	0	44	47	0.026
	1	8	11	
	2	12	31	
	3	16	12	
	4	19	0	
	5	2	0	

4. Discussion

The study examined the prevalence and characteristics of dry eye disease (DED) in 101 adult outpatients at Basaveshwar Teaching and General Hospital in Kalaburagi, revealing notable trends regarding age, gender, systemic disorders, and environmental factors.

4.1. Prevalence by age

The demographic analysis showed that 75.3% of the participants were aged 40 years and older, with the highest prevalence of dry eye symptoms found in the age groups of 18-30 (66.6%), 31-40 (70%), 41-50 (63.4%), 51-60 (50%), and 61-70 years (33.4%). This aligns with previous findings by Chang et al.[7] in Tianjin China, who reported similar demographic patterns, noting a general trend of increasing prevalence with advancing age.

4.2. Prevalence by gender

The gender distribution in this study revealed that the prevalence of DED was nearly identical between males (58.4%) and females (58.3%), which is contrary to the majority of existing literature that typically indicates a higher prevalence in females.[11,12] The hormonal changes associated with menopause are often cited as contributing factors to the increased prevalence in women.

4.3. Association with systemic disorders

The study found that participants with diabetes had a prevalence of 50%, while those with hypertension and thyroid disorders also demonstrated significant rates of dry eye symptoms (p-value 0.017). This is consistent with findings by Kamel et al.[1612] where diabetic patients were found to be more susceptible to dry eye. The strong correlation between systemic conditions and dry eye further emphasizes the need for holistic approaches in the management of DED, particularly in populations with prevalent comorbidities.

4.4. Association with environmental and lifestyle factors

The study assessed smoking habits, which were linked to DED, particularly among males (26.4% prevalence). While previous studies indicated a direct connection between smoking and dry eye symptoms, the current analysis did not establish a significant correlation.[11,14]

In present study, there was no significant association between use of air conditioner, low humidity with presence of dry eyes. Contrary to findings of present study, a study by Wolkoff et al.[17] observed that use of air conditioners exacerbates dry eye symptoms.

The study found varied prevalence rates with increased screen time, but the overall association with DED was not statistically significant (p-value 0.114). This finding parallels a study conducted by Jansen et al.,[8] where screen time did not show a significant relationship with dry eye symptoms.

4.5. Association with occupation

The study results indicated that laborers, drivers, and students reported higher instances of DED, possibly due to prolonged exposure to environmental stressors such as dust, wind, and air conditioning. This is consistent with study by Shah et al. that identified office workers as having a heightened risk of developing dry eye.[15]

4.6. Treatment efficacy

Patients treated with lubricating drops showed significant improvements in tear film meniscus height, Schirmer's test results, and fluorescein break-up time, with p-values indicating strong statistical significance (all $p < 0.001$). These findings align with those from the study by Tauber et al.[18] who noted that artificial tears can improve symptoms and increase tear film stability.

In present study, a significant decrease in grading of staining (fluorescein stain, Rose Bengal stain and Lissamine stain) was observed post-treatment with lubricating eye drops.

5. Limitations

The limitations of this study include its relatively small sample size (101 patients), which may limit the generalizability of the findings to broader populations. Additionally, the study was conducted in a single tertiary care hospital, potentially introducing selection bias and limiting external validity.

6. Conclusion

The findings highlight that the prevalence of DED is notably associated with age, gender, and systemic health conditions, particularly diabetes and hypertension. Environmental factors, such as air conditioning and screen time, did not show significant associations with DED, while occupational exposure to harsh conditions was relevant. Importantly, the study demonstrated the efficacy of lubricating eye drops in improving symptoms and clinical parameters of dry eye. These results emphasize the need for heightened awareness of DED in clinical practice and underline the importance of early diagnosis and intervention to enhance the quality of life for affected individuals. Future research should focus on longitudinal studies to explore the long-term effects of treatment strategies.

7. Sources of Funding

None.

8. Conflicts of Interest

None.

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