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Original Research Article

A clinical study on dry eye

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ABSTRACT

Aim & Objective: The purpose of this study is to evaluate prevalence risk factors, symptoms, signs, objective tests of dry eye diagnosis in patients attending to Out Patient Department of Mamata General Hospital, Khammam.

Materials and Methods: All patients presenting with dry eye symptoms to ophthalmology outpatient department, Mamata Medical College over a period of one and half year. A prospective study was conducted for a period of 18 months from June 2018 to Jan 2021 among patients attending ophthalmology Out Patient Department unit with symptoms of dry eye.

Results: Among the 100 patients studied, prevalence of dry eye was found to be as high as 23%. The prevalence of dry eye increased with increase in age and was significantly higher among people more than 40 years of age. Prevalence was higher among females when compared to males. Conjunctival congestion was found to be reliable sign of dry eye with a strong positive association. Foreign body sensation was found to be the most common symptom associated with dry eye. People with refractive errors, with or without history of spectacle use, had a higher incidence of dry eye compared to emmetropes. OSDI was found to be reliable measure of dry eye symptoms. Higher, scores of OSDI, indicating severe dry eye, correlated well with diagnostic tests for dry eye. TBUT test showed a high sensitivity and specificity, followed by Schirmers test and impression cytology. Impression cytology was a reliable measure for detecting ocular surface changes. Many patients showed grade 2 or 3 changes. These changes were more among those with schirmer less than 5mm.

Conclusion: Dry eye evaluation with an appropriate and standard questionnaire along with standard tests for dry eye helps in diagnosis and treatment. This will go a long way in the effective and successful management of patients with dry eye, specially so as the disease is chronic and needs long term treatment. Early and appropriate management will provide ocular comfort and satisfaction with a better quality of life.

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1. Introduction

Dry eye disease (DED) is defined 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.¹ It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface. The prevalence of dry eye varies between 5–30%

Disease prevalence increases with age. It is more common in elderly females compared to men. Post-menopausal female are prone for DED than pre-menopause.² It is an under-diagnosed ocular disorder. Reduction in the modifiable risk factors of dry eye like smoking, caffeine use, air pollution is essential to reduce its prevalence.

Symptom assessment is the predominant diagnostic method. It has been documented that symptoms of dry eye does not reflect the severity of disease. Further diagnosis and assessment is complicated by considerable variation in disease symptoms, signs and definitive diagnostics tests.

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Hence the purpose of this study is to evaluate prevalence risk factors, symptoms, signs, objective tests of dry eye diagnosis in patients attending to Out Patient Department of Mamata General Hospital, khammam.

2. Aim & Objective

To study the prevalence, risk factors, clinical features and diagnostic tests of dry eye among the patients attending ophthalmology Out Patient Department Of Ophthalmology, Mamata Medical College, Khammam.

3. Materials and Methods

The study titled “ A clinical study on dry eye” was conducted in the out-patient department of ophthalmology, at Mamata Medical College, Khammam.

3.1. Source of data

All patients presenting with dry eye symptoms to ophthalmology outpatient department, Mamata Medical College over a period of one and half year.

3.2. Study period

A prospective study was conducted for a period of 18 months from June 2018 to Jan 2021 among patients attending ophthalmology Out Patient Department unit with symptoms of dry eye.

3.3. Inclusion criteria

1. Patients equal to and above 20 yrs with symptoms-
2. Burning sensation
3. Sandy gritty feeling
4. Foreign body sensation
5. Photophobia
6. Heavy lids

3.4. Exclusion criteria

1. Increased mucoid discharge and watery secretion suggestive of vernal kerato-conjunctivitis, vitamin A deficiency
2. Alkali burns, contactlens users
3. Ocular cicatrical pemphigoid
4. Acute ocular infections
5. Steven johnson syndrome
6. Trachoma
7. Ocular surgery within past 6 mnths ,impaired eyelid function like bells palsy, nocturnal lagophthalmus
8. Ectropion

3.5. Parameters used

1. Schirmer test

2. Tear film break up time (TBUT)
3. Rose Bengal staining
4. Fluorescein staining
5. Conjunctival impression cytology
6. Eyelid margin and meibomian gland examination by slit lamp

4. Results

The total number of patients examined in our study was 100 who are fulfilling the inclusion criteria. The age group was between 21-70yrs. The mean age of the patients being 47.92years. Of the total number of patients 64 were females and 36 were males. Among the entire group 23 patients were diagnosed to have dry eye based on the tests.

Table 1: Dry eye in relation to AGE distribution

Age (years)	Dry eye Present No. of Patients (%)	Dry eye absent No. of Patients (%)	Total No. of Patients (%)
21-30	0	5(100%)	5
31-40	4(36.3%)	15(78.94%)	19
41-50	5(38.4%)	17(77.27%)	22
51-60	8(53.3%)	21(72.45%)	29
61-70	6(42.85%)	19(76%)	25
Total	23	77	100

$\chi^2 - 0.358p = 0.986$

The entire study population was divided decade wise into subgroups and the relationship of age with dry eye prevalence was studied. The youngest patient was of 21 years and the oldest was 70 years.

In this study the prevalence of the dry eye was found to rapidly increase of 4th decade and it was most common between 51 to 60 years age group.

Table 2: Dry eye in relation to sex distribution

Sex	Dry eye present	Dry eye absent	Total
Females	15(65.21%)	49	64
Males	8(34.7%)	28	36
Total	23	77	100

$\chi^2 - 0.19 p \text{ value} = 0.99$

There were 64 females and 36 males in this study group with females being the most commonly affected with a prevalence of 65.21%

The patients were asked for history of dry mouth during recruitment into the study. This data was used to assess the number of people presenting with both dry mouth and dry eye. 6 patients (6%) were found to have evidence of both dry mouth and dry eye. 2 patients (2%) had a history of dry mouth but no evidence of dry eye.

Table 3: Presence of dry mouth in relation to dry eye

Dry mouth	Dry eye present	Dry eye absent	Total
Present	6	2	8
Absent	17	75	92
Total	23	77	100

Value = 0.002

Table 4: Relationship between refractive error & dry eye

Refractive error	No. of patients	Prevalence
Myopes	6	26.08%
Hypermetropes	15	65.21%
Emmetropes	2	8.69%

Hypermetropia was found to be most common refractive error associated with dry eye patients which is followed by myopia.

Table 5: Relationship between occupation and dry eye

Occupation	No. of patients	Prevalence
Agriculture labourer	11	47.8%
Housewife	8	34.78%
Factory worker	4	17.3%

Agriculture labourers (47.8%) were found to more prevalence of dry eye in this study followed by housewives (34.78%).

According to this study homemakers who are using fireplace for cooking are more affected with dry eye (5 patients) when compared to women using LPG cylinders (3 patients).

Table 6: OSDI scores

OSDI	No. of patients
0-12	63
13-22	14
23-32	17
33-100	6
Total	100

The ocular surface disease index (OSDI) was administered to the patients before subjecting them to examination or tests. Of the entire study group, 23% responded with symptoms of moderate to severe dry eye.

Table 7: OSDI scores and correlation with dry eye

OSDI scores	Dry eye present	Dry eye absent
0-12	0	63
13-22	2	12
23-32	15	2
33-100	6	0
Total	23	77

The eyes of the patients showing positive symptoms were then analysed and the symptoms were compared with the signs to look for correlation between symptoms and signs.

Table 8: Signs of Dry eye

Signs	No. of patients	Dry eye present	Dry eye absent
Conjunctival congestion	23	15	8
Corneal dryness	6	6	0

Table 9: Results of Schirmer test

Schirmer test	Dry eye present	Dry eye absent	No. of Patients
Positive	17	3	20
Negative	6	74	80
Total	23	77	100

A total of 20 patients gave a wetting of less than 10mm on performing the Schirmer test. Among these, 17 patients were proved to be positive for dry eye based on pre-determined diagnostic criteria. The Schirmer test showed a sensitivity of 73.91% and specificity of 96.1%. The positive predictive value of the test was found to be 85% and the negative predictive value was 92.5%.

Table 10: Distribution of patients according to Schirmer test results.

Schirmer (mm)	0-5	6-10	>10	Total
No. of patients	6	14	80	100
% of patients	6%	14%	80%	100%

Among the 20 patients who gave a positive result for dry eye based on the schirmer test, 6 patients had a wetting of less than or equal to 5mm. The rest i.e. 14 patients had wetting between 6 to 10mm, which is indicative of mild to moderate dry eye.

Table 11: Results of tear film break up time (TBUT) test

TBUT	Dry eye Present	Dry eye Absent	Total
Positive	19	0	19
Negative	4	77	81
Total	23	77	100

TBUT was the second test to be performed. It was found to be positive (<10 seconds) in 19 patients. All the patients who gave a positive result showed objective evidence of dry eye. This test was found to have a sensitivity of 82.61% and specificity of 100%. Its positive predictive value was 100% and negative predictive value was 95.06%.

A total of 10 patients showed positive staining. Among these, 8 patients were positive for dry eye. The test was

Table 12: Results of Rose Bengal test

Rose Bengal test	Dry eye present	Dry eye absent	Total
Positive	8	2	10
Negative	15	75	90
Total	23	77	100

found to have a sensitivity of 34.78% and specificity of 97.4%. The positive predictive value of the test was 80%, and negative predictive value was 83.33%.

Table 13: Results of Flourescein staining

Flourescein staining	Dry eye present	Dry eye absent	Total
Positive	10	5	15
Negative	13	72	85
Total	23	77	100

A total of 15 patients showed positive staining. Among these, 10 patients were positive for dry eye. The test was found to have a sensitivity of 43.48% and specificity of 93.51%. The positive predictive value of the test was 66.67% and negative predictive value was 84.71%.

Table 14: Results of Conjunctival impression cytology

Conjunctival impression cytology	No. of patients	Dry eye present	Dry eye absent
Grade 0-1	83	6	77
Grade 2	11	11	0
Grade 3	6	6	0

5. Discussion

Among the total sample of 100 patients, we found 23 patients to have evidence of dry eye, based on the positive results of at least two out of four objective tests. The prevalence of dry eye in this study was found to be 23%.

The Salisbury eye study³ showed a prevalence of 14.6% based on subjects reporting symptoms

In the study conducted by Sahai et al⁴ dry eye was present in 18.4% of the subjects studied.

In a population based study in Indonesia, conducted by Lee AJ et al the prevalence of dry eye was 27.5%.⁵

In a study conducted by Jie Y et al⁶ the prevalence of dry eye was found to be 21% in the adult population in china , based on symptoms.

The prevalence of dry eye varies from 10.8% to 57.1%, there by showing wide disparity.⁴⁻⁷ The vast disparity in dry eye prevalence stems mainly from the different dry eye diagnostic criteria employed and different cut-off values for the objective dry eye tests.

The high prevalence in some studies is also because objective dry eye tests have been performed in patients with

positive symptom score (there by introducing a selection bias) or in patients in Sjogren's syndrome, which have proven dry eye components.⁸ Our dry eye prevalence of 23% falls within this range.

The total patient sample was divided into 5 subgroups based on their age (Table 1). The prevalence of dry eye was found to significantly increase with increase in age of the patients (p value = 0.986) and was found to be significantly higher in persons aged more than 40 years. This corresponds to the study by Moss et al.⁷

In our study, the percentage of patients >40years testing positive for dry eye was 82.6%.

The mean age of the patients in our study was 47.92 years. The mean age in Khurana et al⁹ study was 49.19 years.

We found a higher prevalence of dry eye in women compared to men, which corresponded to the findings of other studies.

Moss et al⁷ found a prevalence of 16.7% in women compared to 11.4% in men. These were the prevalence rates obtained after adjusting for age. Sahai et al⁴ found prevalence of 22.8% in women compared to 14.9% in men in his study on hospital based population.

An OSDI scoring of 33-100 which corresponds to severe dry eye, was found to correlate significantly with objective tests of dry eye (p value- 0.001).

Similar findings were noted by Ozcura et al¹⁰ who evaluated the OSDI questionnaire for diagnosis of dry eye and found a significant inverse correlation between OSDI and TBUT scores.

Simpson TL et al¹¹ have found that this scoring system is highly sensitive in differentiating symptomatic and asymptomatic subjects of dry eye. Srinivasan et al¹² used the OSDI scoring system to detect dry eye in postmenopausal women and concluded that OSDI could be effectively used to separate post-menopausal women who demonstrate clinical signs of ocular dryness.

In our study large number of patients with dry eye do show symptoms and the symptoms correlate well with signs of severe dry eye though not much in cases of moderate dry eye. There have been a few cases where the symptoms did not match our findings. Asymptomatic patients or patients with very few symptoms were found to have dry eyes.

Another reason for the low symptoms may be that, most of the patients in our study were from low socioeconomic status with lower literacy rates. These patients were more worried about systemic symptoms and tend to undermine their ocular symptoms.

In our study 6% of the study population was found to have evidence of both dry eye and symptoms of dry mouth (Table 3).

Schein et al¹³ did a population based assessment of dry eye and dry mouth and found that the dry mouth symptoms increased with age, female sex and white race.

Conjunctival congestion and corneal dryness were the most common signs observed (Table 8). 65.21% of the patients with conjunctival congestion showed evidence of dry eye. The association between dry eye and conjunctival congestion was found to be statistically highly significant ($p=0.148$).

Our findings correspond to those of Srinivas et al¹² who also found an increased incidence of bulbar hyperaemia in women with dry eye. It may be used as one of the diagnostic signs for screening for evidence of dry eye instead of directly performing the tests.

In our study the patients also were found to have other signs like superficial punctate keratitis, conjunctivalisation of cornea, superficial vascularisation.

In our study the most common symptom complained by the patients with dry eye is foreign body sensation (43.4%), followed by burning sensation (34.7%), itching (21.7%).

We found a significant correlation between the presence of refractive errors and dry eye (Table 4).

In Our study the prevalence of dry eye based on various refractive errors was hypermetropes (65.21%), myopes (26.08%), compared to emmetropes (8.69%).

Our findings are consistent with other studies (Sahai et al)⁴ which have shown that compared to emmetropes, prevalence of dry eye was higher in those with corrected and uncorrected refractive errors, especially hypermetropes (22.9%), myopes (16.8%), compared to emmetropes (14%) and in Choudary et al, hypermetropes (48.2%), myopes (37.7%), compared to emmetropes (14.1%).

Study by Jie et al⁶ has shown that there was significantly higher incidence of dry eye among people with under corrected refractive errors. It has been postulated that persons with refractive errors have an increased tendency to rub their eyes which apart from introduction of infective material, sebum and sweat could cause the lodgement of particulate foreign substances into the eye that predispose to tear film instability, predisposing to dry eye.¹⁴

In our study agriculture labourers (47.8%) were found to more prevalence of dry eye in this study followed by housewives (34.78%).

According to this study homemakers who are using fireplace for cooking are more affected with dry eye (5 patients) when compared to women using LPG cylinders (3 patients).

In our study the increased dry eye prevalence in rural and urban and in labourers.⁴ They also found increased prevalence of dry eye in rural residents than urban and in farmers and labourers (25.3%).⁵ This was a direct consequence of overwhelming exposure of the rural residence largely farmers and manual labourers to sunlight, high temperature and excessive wind.

In our study we found that air pollution is the most common attributable risk factor for dry eyes. Gupta et al.¹⁵ in their study found that air pollution (24%) over a long

period of time increases the prevalence of dry eye because it causes tear film abnormalities.

Smoking predisposes the eye to tear film instability by its direct irritant action on the eye and represents a modifiable risk factor in dry eye concentration and drugs too may disrupt one or more components of the tear film causing it to become unstable and result in the signs of dry eye.

In our study the various drugs which attributed to the development of dry eye are isotretinoin and anti hypertensives.

Systemic drugs may cause dry eye secondary to decreased tear production, alteration of nerve input including reflex secretion and decreased corneal sensation or a direct inflammatory effect on secretory glands. Some may cause increased evaporation by changes in tear film composition, ocular surface abnormalities, number and quality of blinking, changes in mucus producing cells, and inflammatory changes in various ocular tissues.

Currently, there is no gold-standard diagnostic test in DED. Combinations of diagnostic tests have been used to assess symptoms and clinical signs, but there is no agreement on which combination provides the best results. Obtaining a thorough history, including a review of symptoms, medications, social history and an exhaustive eye examination is extremely important. In addition, a search of systemic symptoms such as joint pains, dry mouth or skin rashes can help determine if there is any underlying systemic disease that may be contributing to the DED

TBUT was found to be positive (<10 seconds) in 19 patients. TBUT test was found to have a sensitivity of 82.61% and specificity of 100%.

It is the next best test in terms of sensitivity and specificity.

In our study all the patients were subjected to Schirmers Type 1 test. A total of 20 patients gave a wetting of less than 10mm on performing the Schirmer test.

Among these, 17 patients were proved to be positive for dry eye based on pre-determined diagnostic criteria.

The Schirmer test showed a sensitivity of 73.91% and specificity of 96.1%. The positive predictive value of the test was found to be 85% and the negative predictive value was 92.5%.³

In Our study Rose Bengal staining showed a sensitivity of 34.78% and specificity of 97.4%. The positive predictive value of the test was 80%, and negative predictive value was 83.33%.

In our study a total of 15 patients showed positive staining. Among these, 10 patients were positive for dry eye. The test was found to have a sensitivity of 43.48% and specificity of 93.51%. The positive predictive value of the test was 66.67% and negative predictive value was 84.71%.

In our study impression cytology was done and the patients were categorised in to three grades and found 17 patients showing grade 2 or grade 3 changes that define dry

eye.

The test showed a Sensitivity of 73.91% and Specificity of 100%. The positive predictive value of the test is 100% and Negative Predictive Value is 92.77%. The sensitivity and specificity of this test was found to be moderate compared to the other tests used in our study. However, it is the best means to detect the morphological changes occurring on the ocular surface in dry eye states.

Management options depend upon the variability in symptom presentation. Although the main treatment goal is to restore tear film homeostasis.

Artificial tears are, to date, the mainstay of the therapy for dry eye syndrome. Secretagogues like Rebamipide helpful for dry eye management.¹⁶ The goal of using tear substitutes is to increase humidity at the ocular surface and to improve lubrication. The artificial tear substitutes should provide an environment in which the epithelium can recover its normal structure and function.

Step therapy approach was followed for management depending on the presenting symptoms.

First steps emphasizes patient education regarding the condition, management options and the prognosis. Patient education should cover information on environmental and dietary modifications, elimination of medications that worsen DED, and personal hygiene practices that can attenuate symptoms.

6. Limitations of the study

This study was hospital based therefore the findings cannot be extrapolated to the general population. Furthermore only some but not all the dry eye signs were measured, therefore we cannot comment on the epidemiology of this metrics in our population.

The follow-up was not done as most of the patients were from low socioeconomic background, there was no compliance for follow-up, which is the main backdrop of our study

Despite these limitations our study adds to the understanding of prevalence of risk factors of dry eye. This information is important for clinicians as it supports the idea that dry eye is a heterogeneous condition with different patient populations being at variable risk for different components of the disease.

Dry eye syndrome is not a common cause of vision loss, but it is still a serious issue for people who have it. The symptoms become progressively troublesome and exert an increasing burden on the patients as the disease progresses.

These types of patients have various of health related QoL impairment, can become frustrated with their treatment course, repeatedly visit doctors seeking treatment changes, and may seek alternative treatments leading to significant utilization of medical resources.

Studies have shown that these patients are reported to have significant loss of productivity each year, often losing

approximately 5 work days and working an average of 208 days with dry eye symptoms.¹⁷

It reduces the functional visual acuity of the patient and also leads to his life long dependence on his doctor. Sufferers of dry eye syndrome are more likely to report problems with daily activities, like reading, using a computer, driving and watching television, than people without dry eye syndrome.

The signs do not manifest till late stage of the disease. If not detected early dry eye can lead to complications.

Finally, it's important to evaluate the status of the meibomian glands and lid margins. Healthy meibomian glands are absolutely vital to a healthy tear film and are often responsible for a majority of dry-eye signs and symptoms. By secreting lipids that help stabilize the tear film, the meibomian glands minimize the evaporate loss of tear fluid, and any meibomian gland abnormalities may create significant ocular surface problems.

As dry-eye diagnostics continue to advance, the simplicity and tangibility of these standard tests make them a valuable option to both physicians and patients.

There are variety of diagnostic approaches to evaluate a patient's tear film instabilities and ocular surface desiccation. Nevertheless, innovation and refining of diagnostic methods and materials are crucial to tackling the disease.

7. Conclusion

Dry eye is an under-diagnosed ocular disorder. This is because diagnosis and assessment of dry eye are complicated by the considerable variation in disease symptoms and signs and lack of definitive diagnostic tests. It is not difficult diagnosing dry eye. One should be alert for its occurrence. Age of the patient is an important consideration as dry eye is more common in elderly. While considering a diagnosis of dry eye, attention should also be paid to other factors such as gender, presence of refractive error, occupation as dry eye has positive correlation with these factors. Dry eye evaluation with an appropriate and standard questionnaire along with standard tests for dry eye helps in diagnosis and treatment. This will go a long way in the effective and successful management of patients with dry eye, specially so as the disease is chronic and needs long term treatment.

Early and appropriate management will provide ocular comfort and satisfaction with a better quality of life.

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8. Conflict of Interest

The authors declare that there is no conflict of interests

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None.

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