

Clinical Study on Risk Factors and Evaluation of Severity in Dry Eye

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Abstract

Background: “Dry eye” (DE) or keratoconjunctivitis sicca is a benign condition of the eye characterized by dryness of the eyes, gritty, scratchy, and irritating feeling in the eyes. The causes can be ocular and non-ocular. A clinical study is conducted to analyze the risk factors causing it in a hospital-based study.

Aim of the Study: This study aims to study and analyze the risk factors causing DE in a tertiary teaching hospital.

Materials and Methods: A prospective, cross-sectional study was conducted, and 168 patients with symptoms of DE were included in the study. Demographic data were collected. Risk factors such as climate, working place, profession, contact lenses, menopause and use of decongestant, previous ocular surgery, estrogen therapy, and diabetes were elicited. Ophthalmological examination was done to evaluate vision and other pathological conditions. DE was confirmed by tear film breakup time (TBUT) and Schirmer I test.

Observations and Results: Schirmer and TBUT values were lower in elderly female patients, those working in hot and dry climate and dusty and fumes atmosphere. Farmers and hard laborers were more prone for DE. Diabetes Type II and post-operative Lasik surgery are common risk factors observed. There was statistical significance between severities of DE by Schirmer test and TBUT with diabetes mellitus (DM) Type II, Lasik surgery with $P = 0.042$ and 0.004 , respectively.

Conclusion: The major risk factors of DE were hot and dry climate and dusty and fumes atmosphere, DM Type II, and Lasik surgery. If untreated, these may lead to severe complications.

Key words: Contact lens, Decongestants, Diabetes Type II, Dry eye, Estrogen, Hemoglobin 1AcMenopause

INTRODUCTION

The dry eye (DE) was defined as “ 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” by the DE Workshop Committee.^[1] It is also sometime accompanied by the increase osmolality of the tears and inflammation of the ocular surface.^[2] The damage to the ocular surface may include corneal epithelial disruption resulting in visual disturbances.^[3] The tear production may be decreased, evaporation of tears increased, and pathological changes

in the meibomian glands resulting in change in the composition of the tears.^[4] Review of literature shows wide variation in the prevalence of symptoms (65–50%) and signs of DE (10–16%) in different countries including the USA, Australia, Taiwan, and China. It may be attributed to the different questionnaires used in these studies and different test parameters laid down to define and diagnose the DE.^[5-8]

DE leads to reduction in quality of life when symptoms are unbearable. These symptoms range from mild transient irritation to persistent dryness, burning, itchiness, redness, pain, ocular fatigue, and visual disturbance.^[9] Most studies of the studies on DE are conducted in developed countries and in elderly populations, hence, there is lack of ethnic diversity.^[10,11] There are many non-ocular diseases which may also lead to DE like diabetes mellitus (DM), especially Type II. In these patients, ocular surface has reduced corneal sensitivity and by alteration in tear quantity and

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quality.^[12] DM patients also might exhibit DE symptoms probably due to neuropathy, metabolic dysfunction, or abnormal lacrimal secretions.^[13] Similarly, damage to the microvasculature of the lacrimal gland accompanied by autonomic neuropathy might impair lacrimation in persons who suffer from diabetes for a long time. Patients with diabetic retinopathy do not complain of symptoms of DE, but they have pathological and clinical signs of keratoconjunctivitis sicca.^[14] In this context, the present study was conducted to study and analyze the risk factors causing DE in a tertiary teaching hospital.

MATERIALS AND METHODS

A total of 178 patients of all age groups with symptoms of DE attending the Outpatient Department of Regional Eye Hospital, Kurnool, were included in the study. An Ethical Committee Clearance was obtained and a questionnaire approved by the Ethical Committee was used in the study.

Inclusion Criteria

(1) Patients aged above 10 years were included in the study. (2) Patients with symptoms of DE such as dryness, irritation, foreign body sensation in the eyes, gritty feeling, difficulty to blink, and diminished vision were included. (3) Patients using medications such as antihistamines or antidepressants, oral contraceptives, and diuretics were included. (4) Patients who had undergone Lasik surgery were included. (5) Patients wearing contact lenses were included. (6) Patients having Sjogren's syndrome, rheumatoid arthritis, systemic lupus erythematosus, and Parkinson's disease were included. (7) Patients with smoking habit were included. (8) Patients with Vitamin A deficiency were included. (9) Pregnant women were included.

Exclusion Criteria

(1) Patients ages below 10 years were excluded. (2) Patients with critical illnesses were excluded. (3) Patients with severe cardiac or renal disorders were excluded. A questionnaire approved by the Ethical Committee was used.^[15,16] It contained questions: (1) Do your eyes ever feel dry? (2) Do you ever feel a gritty or sandy sensation in your eye?, (3) Do your eyes ever have a burning sensation? (4) Are your eyes ever red? (5) Do you notice much crusting on your lashes?, and (6) Do your eyes ever get stuck shut? Distribution of each DE symptom by frequency of response was also elicited as Grade 0: Never, Grade 1: Rarely, Grade 2: Sometimes, Grade 3: Often, and Grade 4: All the time. Demographic data were elicited like information about age, gender, current occupation, and current cigarette smoking status, and household fuel use was also collected. The profession of the patients was elicited like agricultural (fisherman, farmers, hard laborer,

office goers, housewives and students, factory workers, and shopkeepers). Primary fuel used for cooking was divided into gas/kerosene and charcoal/firewood categories. Ophthalmological examination included examination for pterygium and autorefractometry. DE was confirmed by tear film breakup time (TBUT) and Schirmer's I test. Diagnosis was established by positivity of one or both the tests (TBUT or Schirmer's test). Structures of the eye were assessed with slit lamp biomicroscopy examination. Retinal status was evaluated by indirect ophthalmoscopy after pupillary dilation. All the data were analyzed using standard statistical methods.

OBSERVATIONS AND RESULTS

Among the 178 patients, there were 107 (60.11%) female patients and 71 (39.88%) male patients with male-to-female ratio of 1.5:1. The patients belonged to the age groups of 10–70 years with a mean age of 45.30 ± 5.70 . Patients living in hot and dry climate were 86 (48.31%), in dusty and fumes were 62 (34.83%), and cold and wet climate were 30 (16.58%). There was a history of smoking in 51 (28.65%). The household fuel used was gas in 113 (63.48%), firewood in 21 (11.79%), and kerosene in 44 (24.71%). 48 were farmers (26.96%), 39 were hard laborers, office goers were 36 (20.22%), and housewives were 35 (19.66%). Workplace was air conditioned in 32 (17.97%), hot and humid in 41.57%, and dusty fumes and dry in 72 (40.44%) patients. Among the women, 86 (48.41%) had attained menopause. 38 patients were using contact lenses (21.34%). Patients who had undergone Lasik surgery were 15 (8.42%). 17 (9.55%) patients were using decongestants. 19 (23.03%) patients were using estrogen. 54 (30.33%) patients were having DM Type II; among them, 48 (26.96%) patients had $>7.0\%$ of hemoglobin 1Ac (Hb1Ac) levels [Table 1].

Grading of the DE was done depending on the severity of the symptoms and Grade 3 was observed in 79 (44.38%) and Grade 4 was observed in 55 (30.89%) of the patients [Table 2].

Moderate grade TUBT test was observed in 89 (50.00%) and severe grade TUBT test was observed in 68 (38.20%) patients. Schirmer's test in moderate grade was found in 83 (46.62%) and severe grade in 54 (30.33%) patients [Table 3].

Among 54 of the 86 patients who were living in hot and dry climates were observed with moderate-to-severe grades of TUBT and Schirmer's test which was found to be statistically significant observation with $P = 0.013$ (P significant at <0.05). Patients who were farmers, hard laborers showed moderate-to-severe grade TUBT and

Schirmer' test results which were significant with *P* value at 0.024 and 0.031, respectively. However, office goers showed severe and moderate grade TUBT and Schirmer's test in 27.77% and not significant with *P* value at 0.160 [Table 4]. Similarly, work places with hot and humid atmosphere and dusty with fumes were significant with *P* values at 0.035 and 0.028, respectively. Patients with uncontrolled DM with >7.0 Hb1Ac levels were significantly affected in the study with moderate-to-severe test results showing *P* = 0.042. Patients who had undergone Lasik surgery were affected in 80% of the patients with DE and significant statistically with *P* value at 0.004 [Table 4].

Table 1: The various risk factors elicited in the study (n=178)

Observation	Number (%)
Mean age	45.30±5.70
Gender	
Male	071 (60.11)
Female	107 (39.88)
Climate	
Hot and dry	86 (48.31)
Dusty and fumes	62 (34.83)
Cold and wet	30 (16.58)
Smoking	
Yes	051 (28.65)
No	127 (71.34)
Household fuel	
Gas	113 (63.48)
Firewood	021 (11.79)
Kerosene	044 (24.71)
Profession	
Housewife	35 (19.66)
Student	19 (10.67)
Hard labor	39 (21.91)
Farmers	48 (26.96)
Office goers	36 (20.22)
Working place	
Air conditioned	32 (17.97)
Hot and humid	74 (41.57)
Dusty, fumes, and dry	72 (40.44)
Menopause	
Yes	86 (48.41)
No	21 (11.73)
Use of contact lenses	
Yes	038 (21.34)
No	120 (67.41)
Lasik surgery	
Yes	015 (08.42)
No	163 (91.57)
Use of decongestants	
Yes	017 (09.55)
No	161 (90.44)
Use of estrogen	
Yes	041 (23.03)
No	137 (76.96)
DM-62	
Type I	008 (04.49)
Type II	054 (30.33)
Hb1Ac<7.0	016 (08.98)
Hb1Ac>7.0	048 (26.96)

Hb1Ac: Hemoglobin 1Ac, DM: Diabetes mellitus

DISCUSSION

The present study was a prospective study conducted in a tertiary teaching hospital which was also regional eye hospital to study and analyze the risk factors causing DE. Comparison between the studies of various countries is difficult because these population-based studies evaluating DE differ in the choice of DE questionnaire and objective

Table 2: The grades of DE in the patients of the study (n=178)

Grading of DE	Number (%)
Grade 1	09 (5.05)
Grade 2	35 (19.66)
Grade 3	79 (44.38)
Grade 4	55 (30.89)

DM: Diabetes mellitus

Table 3: The TBUT and Schirmer's test results (n=178)

Tests and results	Number (%)
TUBT test	
>10 s (normal)	02 (01.11)
8–10 s (mild)	19 (10.67)
5–7 s (moderate)	89 (50.00)
<5 s (severe)	68 (38.20)
Schirmer's test	
>10 mm (normal)	06 (03.37)
8–10 mm (mild)	25 (14.04)
5–7 mm (moderate)	83 (46.62)
<5 mm (severe)	54 (30.33)

TBUT: Tear film breakup time

Table 4: The correlation between common risk factors, TBUT, Schirmer's test results, and grading of the DE in the study (n=178)

Risk factors	Symptoms Grading 3 and 4 (%)	TUBT- and Schirmer's test results- moderate and severe (%)	<i>P</i>
Climate			
Hot and dry	62/86 (72.09)	54/86 (62.79)	0.013
Dusty and fumes	51/62 (82.25)	47/62 (75.80)	0.021
Profession			
Hard labor	28/39 (71.79)	23/39 (58.97)	0.024
Farmers	39/48 (81.25)	30/48 (62.50)	0.031
Office goers	27/36 (75.00)	10/36 (27.77)	0.413
Working place			
Hot and humid	57/74 (77.02)	51/74 (68.91)	0.035
Dusty, fumes	53/72 (73.61)	45/72 (62.50)	0.028
DM			
Hb1Ac			
>7.0–48	31/48 (64.58)	33/48 (68.75)	0.042
Lasik surgery			
Yes	14/15 (93.33)	12/15 (80.00)	0.004

Hb1Ac: Hemoglobin 1Ac, DM: Diabetes mellitus, TBUT: Tear film breakup time

tests, definitions of DE and the selection of the study population.^[17] There was increased reporting of DE with increasing age earlier.^[17,18] Schein *et al.*^[19] found no age correlation to exist. In this study, an association with age was observed on Univariate analysis but was not significant after adjustment for all other variables. There were reports mentioning the prevalence of DE among the women in many studies.^[20-22] In this study, such prevalence was not observed. Estrogen deficiency during menopause was thought to explain the DE in women.^[22,23] In the present study, 41 (23.03%) of women were using estrogen, but only 10/41 showed moderate-to-severe grades of TUBT and Schirmer's test results so were not significant. Moss *et al.*^[10] observed smoking as a risk factor, but in this study, smoking was not found as a risk factor because 51 patients (28.65%) were smokers and the TUBT and Schirmer's results were only mild grade hence not significant. Correlation between the moderate and severe grades of symptoms and the moderate and severe grades of TUBT and Schirmer's test results was statistically significant with $P < 0.05$ in regard with the risk factors such as (1) Climate: Hot and dry and dust and fumes, (2) Professions such as farmers and hard laborers working under the sun, (3) Lasik surgery, and (4) DM Type II in the present study. Similar findings were observed in a study by Magdum *et al.*^[24] It should be noted that symptoms reported can be due to other conditions (for example, blepharitis) and that DE disease can be symptomless.^[25] While assessing the grading of the DE assessment of symptoms has been recommended besides tear stability/dynamic and ocular surface damage assessment.^[26,27] Brennan and Efron^[28] reported DE in 75% of the contact lens wearers. In the present study, only 38 (21.34%) were using contact lenses and the severity of DE was mild. It should also be noted that advances in contact lens technology between 1986 and 2005 may or may not be a factor in DE symptom prevalence. In this study, people who were diagnosed and have had previous treatment for DE were shown to be still having symptoms. Smoking was not associated with symptomatic DE disease in this study unlike the observations made by Tong *et al.*^[29] Smoking as a risk factor is controversial; reported as a risk factor in one study^[6] and not as a risk factor in another.^[19,30] There are few shortcomings in this study such as the systemic diseases such as Sjogren's syndrome and other collagen tissue disorders, Vitamin A deficiency,^[31] Hepatitis C infection,^[32] androgen deficiency,^[33] and radiotherapy are not evaluated as risk factors.

CONCLUSION

The major risk factors of DE were hot and dry climate and dusty and fumes atmosphere, DM Type II, and Lasik surgery. If untreated, these may lead to severe complications.

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