EVALUATION OF DRY EYES IN DIABETES MELLITUS

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ABSTRACT

BACKGROUND

According to the National Eye Institute, dry eye is a condition in which the eye does not produce tears properly. It can also involve tears not having the right consistency or evaporating too quickly. Tears are necessary to help maintain moisture on the surface of the eye and for clear vision. Diabetes is often associated with several significant ocular conditions such as retinopathy, refractive changes, cataracts, glaucoma and macular oedema. However, one of the most common ocular complications associated with diabetes is dry eye.

The aim of the study is to study the prevalence of dry eyes in diabetes mellitus and to evaluate ocular and other risk factors relevant to diabetic dry eyes.

MATERIALS AND METHODS

A hospital-based cross-sectional clinical study of 100 diabetic patients who presented to the Department of Ophthalmology, Santosh Medical College and Hospital, Ghaziabad, between January 2016 to June 2017 was conducted. Detailed diabetic history was recorded. Assessment of anterior segment via slit-lamp biomicroscopy was done. The examinations for dry eyes included Schirmer's test, tear breakup time, fluorescein and rose Bengal staining.

RESULTS

Sixty two (62%) diabetic patients had dry eye. The prevalence in type I was 3% and prevalence in type II was 59%. Dry eye prevalence was maximum in those above 40 years of age. Symptoms like reduced corneal sensation (44%) and meibomitis (20%) were major attributable risk factors. Ocular surface damage was predominantly superficial punctate keratitis. Retinopathy was not statistically associated with the prevalence of dry eyes.

CONCLUSION

Diabetes and dry eye appears to be a common association. Reduction in the modifiable risk factors of dry eye is essential to reduce its prevalence. No significant statistical correlation was found between retinopathy and dry eyes. However, examination for dry eyes should be an integral part of the assessment of diabetic eye disease.

KEYWORDS

Dry Eye, Diabetes Mellitus, Tear Film, KCS.

BACKGROUND

Our knowledge of dry eye dates back to the clinical description of French dermatologist Gougerot who described the occurrence of atrophy of the salivary and conjunctival glands in a group of middle-aged women.[1] The defining work of Swedish ophthalmologist, Henrick S. C. Sjogren in 1933, established the term Keratoconjunctivitis Sicca (KCS) and attributed the dryness and symptoms of dry eye to a reduction of the aqueous component of the tears. He also documented the association of keratoconjunctivitis sicca with xerostomia and rheumatoid arthritis in his original thesis Zur Kenntnis keratoconjunctivitis sicca.[2]

Diabetes mellitus is a group of metabolic diseases in which the pancreas no longer produces enough insulin or cells stop responding to the insulin that is produced, so that glucose in the blood cannot be absorbed into the cells of the body. Symptoms include frequent urination, lethargy, excessive thirst and hunger. According to WHO, India has the highest number of diabetics and thus it has become "The Diabetic Capital of World." The rudimentary view that dry eye is simply a deficiency of tear fluid has evolved into an appreciation of dry eye as a disturbance in a complex interaction of the tear film, ocular surface and lacrimal glands that is conditioned by hormonal support.[3]

The modern definition of dry eye disease is based on the concept of the three layers of the tear film devised by Holly and Lemp[4] adopted by the National workshop on dry eyes.

Dry eye is 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.

Diabetes mellitus is associated with a number of ocular complications, which can lead even to blindness. Diabetic retinopathy, neovascular glaucoma, cataract, refractory deviations, ptosis and palsy of the oculomotor nerve are typical ocular complications in diabetic patients.

Various earlier studies have reported qualitative and quantitative tear film abnormalities in diabetics, but the precise role of these abnormalities in the pathogenesis of dry eyes is not well defined. More often ocular surface examination is ignored and much importance is given to retinopathy.

The amount or composition of the tear film can change because of aqueous deficiency, mucin deficiency or excess (with or without associated aqueous deficiency) and/or lipid abnormality (meibomian gland dysfunction). The preocular tear film is dispersed unevenly with an irregular corneal or limbal surface (inflammation, scarring, dystrophic changes) or poor contact lens fit. Eyelid-globe incongruity results from congenital, traumatic or neurogenic eyelid dysfunction or absent or dysfunctional blink mechanism.[5]

The average tear flow in humans is about 1.2 µL/min and ranges between 0.5 and 2.2 µmL/min. The volume of the tear fluid averages about 7 µL. About 1.1 µL of this total volume lies in the preocular film within the palpebral fissure, about 2.9 µL within the marginal strips and about 4.5 µL within the fornices.[5]

The present study was undertaken to study the prevalence of dry eyes in diabetes mellitus and to evaluate ocular and other risk factors relevant to diabetic dry eyes.

Aims and Objectives
Following were the aims and objectives of the study.
1. To study the prevalence of dry eyes and dry eye related ocular surface disorders in diabetic patients.
2. To evaluate ocular and systemic risk factors attributable to diabetic dry eyes.

MATERIALS AND METHODS
This was a hospital-based clinical study of 100 diabetic patients who presented to the Department of Ophthalmology, Santosh Medical College and Hospital, Ghaziabad, between January 2016 to June 2017.

Inclusion Criteria
All patients of either sex in all age groups diagnosed to have diabetes mellitus (by endocrinologists/as per ADA criteria) of any duration.

Exclusion Criteria
1. Patients with systemic diseases like diabetes and hypertension and local ocular surface diseases are assessed by history and clinical examination.
2. Patients who use to wear chronic contact lenses are examined.
3. Patients who had undergone ocular surgeries like keratoplasty, LASIK, etc.
4. Patients who are on medications either local or systemic, which are known to cause dry eyes.

Detailed history and examination of patients were recorded regarding presenting symptoms, duration, progression and associated conditions.

Ocular examination starting with visual acuity with the help of Snellen's chart was noted (in patients having vision less than 6/60, vision was recorded with the help of counting fingers or hand movements) also perception of light and projection of rays were recorded in those type of patients.

Examination of lids, meibomian glands, conjunctival surface (dryness, wrinkling, sheen) and corneal surface was done with help of slit lamp.

Cornea was examined under slit lamp for any abnormalities like superficial punctate keratitis SPK/mucous plaques/filamentary keratitis).

Corneal sensation was recorded test with a fine moist cotton.

Tear meniscus height was graded as normal or low under slit lamp and precorneal tear film was examined for presence of debris.

The basal secretion test was performed following the instillation of topical anaesthetic (4% Xylocaine drops) and the placement of a thin strip of filter paper in the inferior cul-de-sac. Measurement of less than 5 mm was taken as abnormal, 5-10 mm as equivocal.

This was carried out in the end, a moistened strip of rose Bengal (ContaCare Pvt. Ltd., Baroda) was applied to the inferior cul-de-sac under no anaesthesia. Van Bijsterveld scoring system was used to grade the staining of cornea and conjunctiva based on a scale of 0-3 in 3 areas, nasal conjunctiva, temporal conjunctiva and cornea. With this system, the maximum possible score is 9, a score of 3.5 or greater was considered positive for KCS.

Dry eye was defined as having one more symptoms (often or all the time present) along with one or more positive clinical findings (based on slit-lamp examination) and one or more positive clinical tests (tear breakup time of ≤10 seconds, Schirmer test score ≤10 mm with anaesthesia ≤5 mm, fluorescein score of ≥1 and rose Bengal stain score of ≥3.5. Patients who had no symptoms or mild symptoms, but with positive signs or positive tests were also assessed.

Dry eye was graded as follows; types- mild, moderate and severe.

Mild- Schirmer's test <10 mm in 5 minutes, TBUT <10 seconds and staining of cornea in less than 1 quadrant.

Mode rate- Schirmer test of 5-10 mm in 5 minutes, TBUT of 5-10 seconds with staining of >1 quadrant of cornea.

Severe- Schirmer <5 mm in 5 minutes TBUT <5 seconds and complete staining (with fluorescein and rose Bengal) of the corneal epithelium.

RESULTS
100 diabetic patients participated in this study of which 4 were type I diabetes and 96 were type II diabetes.

Age in Years	Type 1 DM	Type II DM
≤10	-	-
11-20	2	-
21-30	-	-
31-40	2	12
41-50	-	41
51-60	-	28
61-70	-	14
>70	-	5
Percentage	4	96
Table 1. Age Distribution		

Table 1 shows the age distribution of the participants. Type I diabetes patients were in the age range of 11-40 years 4%, whereas majority of type II patients were in the range of 31-70 years and above (96%).

	Type 1	Type 2	Percentage
Male	3	51	54
Female	1	45	46
Table 2. Sex Distribution			

Table 2 shows the sex distribution in both groups. 54% males and 46% females had diabetes.

Dry Eye/No Dry Eye	Type 1	Type 2	Percentage
No dry eyes	1	37	38
Mild dry eyes	3	28	31
Moderate dry eyes	-	22	22
Severe dry eyes	-	9	9
Table 3. Prevalence of Dry Eyes			

The prevalence in type I was 3% and prevalence in type II was 59%.

Other Causes for Dry Eyes	Type I	Type II	Total
Blepharitis (lids)	-	11	11
Meibomitis	1	19	20
Reduced corneal sensation	1	43	44
Hypertension	2	23	25
Table 4. Risk Factors			

Table 4 shows contributing factors prevalent in this diabetic population. Hypertension was more prevalent in type I population, meibomitis and reduced corneal sensation more in type II patients.

Symptoms	Type I	Type II	Total
Eye feel dry	1	17	**18**
Gritty feeling	-	8	**8**
Burning sensation	-	23	**23**
Watering	3	35	**38**
Redness	-	13	**13**
Table 5. Symptoms in Type I and Type II Patients			

Table 5 shows symptoms present in type I and type II patients.

Tests	Normal	Abnormal	Percentage Abnormality
Tear breakup time	64	36	36%
Schirmer's	57	43	43%
Fluorescence stain	61	39	39%
Rose Bengal stain	65	35	35%
Table 6. Shows Clinical Test Results			

DISCUSSION
Every clinician is familiar with the considerable discrepancy between the subjective complaints of patients and the clinical tests available to assess dry eye. Frequently, the results of Schirmer's test, tear film breakup time, rose Bengal staining and fluorescein staining do not correlate in clinical trials. Aqueous tear disease is correlated with ocular surface disease.

Each form of dry eye (tear deficient form or evaporative form) has certain global features in common, including- a set of characteristic symptoms, ocular surface damage, reduced tear film stability and tear hyperosmolarity. Increasingly, an inflammatory component has become apparent, which contributes not only to symptoms, but also to the disease process itself. Tear film instability appears to be a component of all forms of dry eye disease and tear hyperosmolarity is a key mechanism for ocular surface damage.

In this study, we have made the diagnosis of dry eye based on symptoms and signs, surface staining with fluorescein and rose Bengal stain and diagnostic tests, which included tear breakup time and Schirmer's test (total and basal secretion). We observed in our study that a large number of patients had no symptoms or signs of ocular surface damage yet had abnormal tear breakup time or Schirmer values. We have included these patients in dry eye diagnosis, since symptoms often do not correlate with signs of ocular surface damage can be a late presentation in the course of dry eyes, hence we may miss the milder forms of this disease.

In present study, prevalence of dry eyes was found to be 62%. In type I diabetes, it was 3%, and type II, it was 59%. In the table given below, prevalence of dry eyes in diabetes reported by various other studies is compared with present study.

The prevalence of dry eyes varies from 18.1% to 70%, thereby showing wide disparity. Much of this disparity stems from the fact that there is no standardisation of the types of patients selected for the study, objective tests and dry eye diagnostic criteria.

Moss et al[6] reported a higher incidence of dry eyes in diabetic women (16.7% compared with 11.4% in men).

In the present study, 54% of dry eye patients were males and 46% were females.

However, the prevalence of dry eyes was not statistically associated with sex when both type I and type II were combined. Deficient tear secretion from oestrogen

deficiency in menopausal women has been hypothesised to explain sex differences, although studies have found that women on hormone replacement therapy may have an increased risk of dry eye.[7]

The reflex secretion of tears as measured by Schirmer's I method (without anaesthesia) decreases significantly with increasing age as already was observed by Schirmer[8] in 1903 and by many others thereafter. The tear evaporation rate has not been found to be correlated with age. The evaporation is primarily controlled by the lipid layer of the tear film and lipid layer thickness appears to be constant for different age groups.[9]

Blepharitis and meibomitis are well known to contribute to evaporative dry eyes. Diabetic patients are prone to develop these more often. There is a possibility that, in some patients, meibomitis may create sufficient conjunctival inflammation to decrease tear secretion by damaging accessory lacrimal gland tissue in the conjunctiva.[10]

In the present study, 11 patients had blepharitis, meibomitis was present in 20 patients. Hypertension was more common in type I patients and reduced corneal sensation in type II patients.

Corneal sensation recording in the present study was a subjective method. Total 44 patients had reduced corneal sensation. Reduction in corneal sensitivity is a known diabetic complication. Corneal sensitivity is decreased in proportion to both the duration of the disease and the severity of the retinopathy. The diminished sensitivity maybe a kind of diabetic neuropathy. This can lead to the reduction of stimulatory signals from the ocular surface to the lacrimal gland and the influence on regulatory systems.

Hypertension was present in 25 patients. Diabetic hypertensives were 1.63 times more likely to develop dry eyes. Though it is not a known risk factor for dry eyes, association could be of mere coincidence or could be due to medications taken for hypertension mainly beta blockers.

Participants complained of most often watering (38%) followed by burning sensation (23% of subjects), followed by symptoms of dryness (18% of subjects) and grittiness (8% of subjects). These symptoms were reported more frequently compared with the other dry eye symptoms and were significantly related with clinical dry eyes.

Most of the present study patients had mild-to-moderate dry eye, ocular surface damage as assessed by TBUT, Schirmer's, fluorescein and rose Bengal stain was only 36%, 43%, 39% and 35%, respectively.

Tear film instability appears to be a component of all forms of dry eye disease and tear hyperosmolarity is a key mechanism for ocular surface damage. Although, these elements are present in most cases of dry eye, clinicians will sometimes encounter patients who have symptoms, but minimal ocular surface damage or signs of surface damage in the absence of symptoms.[11]

When all the clinical tests results were statistically analysed, Schirmer's was found to have more diagnostic value in terms of accuracy followed by fluorescein compared to any other clinical test.

CONCLUSION

After collecting the demographic data, symptoms of dry eye were assessed. Assessment of anterior segment via slit-lamp biomicroscopy was done. The examinations for dry eyes included Schirmer's test, tear breakup time, fluorescein and rose Bengal staining. Diagnosis of dry eye was made if one or more clinical tests were positive with or without symptoms.

Predominantly, milder grade of dry eye was seen in type I diabetics and mild-to-moderate in type II diabetes patients.

Higher prevalence was observed in those above 50 years of age in type II diabetics.

Diabetes and dry eyes appears to be a common association. Reduction in the modifiable risk factors of dry eye is essential to reduce its prevalence.

Examination for dry eyes should be an integral part of the assessment of diabetic eye disease.

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