ORIGINAL ARTICLE

Dry Eye Disease and Diabetes Mellitus

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ABSTRACT

Purpose: To find out the frequency of dry eye disease in patients of type II Diabetes Mellitus.

Study Design: A hospital based descriptive cross sectional study.

Place and Duration of Study: Federal Government Services Hospital Islamabad, from January 2015 to May 2016.

Material and Methods: Four hundred patients of type II Diabetes, diagnosed according to American Diabetic Association (ADA) criteria, were selected by convenient sampling technique. Patients with any ocular surgery, any systemic disease or medication affecting tear production, pregnancy, and contact lens users were excluded. Clinical data was obtained by direct patient interviews and their medical records. Basic demographics were recorded and a 6-item standardized Dry eye questionnaire (DEQ-6) was administered by a trained researcher to all patients. Detailed eye assessment was performed by a single surgeon under the same physical conditions. DED was assessed using Dry eye workshops DEWS (2007) recommendations.

Results: Participants had mean age of 55.6 ± 10.2 years. There were 61.5% males and 38.5% females. Mean duration of diabetes was 12.02 ± 7.5 years. Frequency of DED in this study was 58%. There were 19.7% patients who had an HbA1c ≥ 9.0%. Oral glucose lowering drugs (OGLDs) were used by 61% of the participants, while 22.5% were on insulin and 16.5% were on both. The most common symptom was burning and the most frequent sign was frothy discharge. TBUT was positive in 43.5% patients. Schirmer test was positive in 33.1% and corneal staining was present in 37% subjects.

Conclusion: Dry eye disease is a common finding in diabetes Mellitus which increases with the duration of Diabetes.

Key Words: Diabetes Mellitus, Flourescein stain, Dry eye, Schirmer test, Tear film breakup time.

How to Cite this Article: Baig MA, Munir R. Dry Eye Disease and Diabetes Mellitus. Pak J Ophthalmol. 2020; **36 (3):** 221-225.

Doi: 10.36351/pjo.v36i3.1003

INTRODUCTION

Dry eye disease (DED) is a multi-factorial disease of the tears resulting in tear-film instability with damage to the ocular surface[1]. About 4.7% of American men and 7.8% of women over 50 years have DED and 7–10 million Americans use artificial tears consuming US $100 million/year[2]. A study in Pakistan showed the DE prevalence was 16%[3]. Various risk factors influence DED like female sex, age, and hormones[4].

The word Diabetes was used by Arashes Cappodocia (81-133 AD) and the word mellitus was used by Thomas Willis in 1675. Egyptians, 3000 years ago, described DM and its clinical features[5].

Type 2 Diabetes, which accounts for nearly 90% of diabetes worldwide, is a chronic hyperglycaemia due to insulin deficiency, insulin resistance or both. It causes corneal neuropathy and corneal epithelium

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Received: February 9, 2020 *Revised: May 4, 2020*
Accepted: May 4, 2020

dysfunction. Human cornea contains both unmyelinated C and myelinated A-δ fibers[6]. The corneal complications like epithelial defects, trophic ulcers and superficial punctate keratopathy are caused by hyperglycemia all closely related with DE[6].

A review of the literature showed that DED was present in more than half of diabetic patients.

DED is present in 55% of people with type 2 diabetes compared to 27% people having type 1 and 29% of those having no diabetes.[7] Results also showed relations between diabetes duration and onset of diabetic retinopathy. It varied from 28.8% to 77.8% in persons having 5 years and 15 years duration respectively[8]. Studies have shown that DED is correlated with glycated hemoglobin level; higher the level of HbA1c, the higher is the DED symptoms[9].

The aim of this study is to know the effect of type 2 diabetes on tear film parameters.

MATERIAL AND METHODS

A descriptive cross sectional study was carried out among 400 type 2 diabetic patients attending diabetic eye clinic and referred from other departments of the Federal Government Services Hospital Islamabad from January 2015 to May 2016. Patients consent was taken and permission from Ethical committee was sought. All cases of diabetes diagnosed according to the American Diabetic Association (ADA) criteria, were consecutively selected. Those with any surgery, any systemic disease or medication affecting tear production, pregnancy, and contact lens users were excluded. Clinical data was obtained by direct patient interviews and their medical records. Demographic data was recorded and a 6-item standardized DE questionnaire (DEQ-6) was administered by a trained researcher to all the patients. Detailed eye assessment including visual acuity, like slit-lamp biomicroscopy, dilated fundus examination for retinal status and various dry eye tests were performed by a single surgeon under the same physical conditions. Early Treatment Diabetic Retinopathy (ETDRS) study criteria was used to grade diabetic retinopathy DR.

Subjects having 1 or more symptoms often or all the time, tear film break-up time (TBUT) of < or = 10 seconds in 1 or both eyes, schirmer's test (ST) < or = 5 mm in 5 min, corneal fluorescein staining (CFS) of > or = 1 for presence of conjunctival injection, punctate epithelial erosions (PEE) and slit lamp examination of lid for mucous threads/telengiectasias and meibomian gland dysfunction (MGD) were positive signs according to Japanese diagnostic criteria for dry eye. The diagnosis was made on the presence of three of five DE tests.

Suspected dry eyes based on symptoms like ocular discomfort, burning, redness, itchiness/gritty sensation, blurred vision which improved with blinking, excessive watering and confirmed by TBUT and ST test values were diagnosed as DE patients. Data was analyzed for frequencies/percentages using SPSS version 20.

RESULTS

A total of 400 type 2 Diabetic patients of varying duration, age ranging from 38-78 years, mean age 55.6 ± 10.2 years, were screened for DED. There were 246 (61.5%) male and 154 (38.5%) females and the mean duration of diabetes was 12.02 ± 7.5 years. Frequency of DED in this study was 58% (232/400), 56.0% male, 43.9% female and was found to increase with age 58–67 years' group and with duration of diabetes 15–19 years' group. The majority of our subjects were male (61.5%) who were in the age group of 48–57 years.

Table 1: *Baseline characteristics (n = 400) 38 – 78 years.*

Demographics	Respondents	(%)
Age group (years)		
38 – 47	98	24.5%
48 – 57	127	31.7%
58 – 6 7	104	26%
68 or above	71	17.8%
Total	400	100%
Sex		
Male	246	61.5%
Female	154	38.5%
Urban	281	70.2%
Rural	119	29.8%
Family history	136	34%
Smokers >5 years	111	28%
Glasses	82	20.5%
Computer users	141	35.2%

218 (54.5%) patients had Diabetic retinopathy, 89 (40.8%) had mild changes, 91 (41.7%) had moderate and 38 (17.4%) had severe form of retinopathy. 37% (148) subjects had peripheral neuropathy (PN), 24.5% (98) had diabetic nephropathy. 35.5% (142) subjects had HbA1c value below 7.0% and 19.7% (97) had an HbA1c ≥ 9.0%. Oral glucose lowering drugs (OGLDs) were used by 61% of the participants, while 22.5%

were on insulin and 16.5% were on both. 34% 136 patients had positive family history of diabetes.

The most common symptom was burning (51%) and the least common symptom was lids stuck together in the mornings (23%). The most frequently observed sign was frothy discharge in 67 (16.7%) patients. TBUT was positive in 101 (43.5%) patients, Schirmer test (ST) was positive in 77 (33.1%), corneal staining was present in 86 (37%) subjects and 117 (50.4%) had telengiectasias and plugging of Meibomian openings and/or mucous threads. Decreased tear film function was found in patients with DR than in those with non-DR.

Table 2: *Dry eye symptoms after smoking.*

Symptoms	Never	Rarely	Sometimes	Often	All the Time	% age
Burning/dryness	89	54	53	75	129	51%
F.B. sensations	92	90	56	69	93	40.5%
Redness	108	91	67	58	76	33.5%
Watering	122	104	61	68	45	28.2%
Discharge	120	132	56	53	39	23%

Table 3: *DED detection by DEQ5, Positive results of TFBUT, Schirmer test, Fluorescein staining, Lid pathology.*

DEQ6		TFBUT	Schirmer Test	Fluorescein Staining	Lid Pathology
Dry eye disease (n = 232)	7 (20.2%)	101 (43.5%)	77 (33.1%)	86 (37%)	117 (50.4%)
Normal (n=168)	21 (12.5%)	48 (28.5%)	33 (19.6%)	8 (5%)	20 (11.1%)

Table 4: *DED related to duration of diabetes.*

Duration	Total No.	Dry Eyes	% Frequency
1 – 5 years	89	34	38.2%
6 – 10 years	110	63	57.2%
11 – 15 years	130	81	62.3%
16 – 20 years	71	54	76%
Total	400	232	58%

DISCUSSION

In Pakistan, about 10 percent of the population suffer from diabetes and the incidence of blindness is similar to other studies (5.5% and 3.6% in Nigeria and Barbados respectively) as reported by World Health Organization (WHO)[10]. Another study in Pakistan, showed that the prevalence of type 2 diabetes mellitus was 11.7% over 25 years of age which was higher in males than females and was more common in urban than the rural areas[11] similar to our study.

The frequency of DED among Diabetic patients in our study was 58%, is consistent with Manaviat et al[8], Najafi et al[9] and Seirfart and Strempel who had found a it to be 54.3%, 53% and 52.8% respectively among their diabetic population. Out of 58% (232/ 400) patients who had DED, males were 56.0% while females were 43.9%. This is contrary to other study[12] that showed females were more prone to DED. Some authors[13] showed that DE incidence rises in women due to the low levels of protective hormones like androgens. Other studies in diabetics negate gender relation in diabetic keratoconjunctivitis sicca[14].

Majority of our subjects were in the age group of 48 – 57 years. There was an increase in DED with age (59 – 68 year group), which is comparable to Chia et al[15] who found higher DED prevalence with age in diabetics. Liu et al[16] also found that diabetes and increased age were risk factors for dry eye. Contrary to that, Manaviat et al.[8] denied older age as a risk factor for DED in diabetics.

In our study, decreased TFBUT and ST values with advancing age were consistent with another study[11] which showed that with increasing age there was decrease in aqueous part of tear film causing symptoms of DED. Thirty-four percent patients had positive family history in this study. Patients with a family history of diabetes were also prone to DED is consistent with other study[17].

Zhang et al, showed that 33% of diabetic patients exhibited lower values of Schirmer test than normal[18]. In a series by Gupta and Dogru, 22.7% to 34% of eyes had lower Schirmer values[19].

In our study, 218 (54.5%) subjects had diabetic retinopathy, 89 (40.8%) had mild changes, 91 (41.7%) had moderate and 38 (17.4%) had severe form of retinopathy similar to other study showing 28.8% to 77.7% DR prevalence during five to over 15 years duration[20]. In our study 38 (17.4%) subjects with

proliferative diabetic retinopathy (PDR) showed decreased tear film function than those with non-PDR is consistent to other study showing that both TBUT and ST values were decreased in the PDR group compared to the non-DR group[21].

In our study there was an interesting relation between sex and grades of DR. Lower grades of DR was common in women and more severe form of DR was common in men, similar relation was found in Rema et al[22] study. Another interesting observation was that most of the DED patients had diabetes for longer duration 10-14 years and the decreased tear film function was present in patients with PDR than NPDR similar to studies of Chen et al[17] and Manaviat et al[8] while Imam et al mentioned fewer dry eye symptoms[23] in those with longer duration of diabetes.

The most commonly reported symptom in this study was burning (61% of Diabetics) and the least reported was eyelids stuck together in the morning. The study by Chia et al[15] found that itchiness was the most commonly reported symptom. In our study, 37% of subjects had peripheral neuropathy (PN) leading to DED. This is consistent to Nakata et al[24] showing that Diabetic neuropathy may be an important risk factor for lacrimal gland dysfunction.

Dry eye incidence is related with the level of glycated hemoglobin; higher the glycated hemoglobin level, the higher is the DED. In our study DED symptoms were related to HbA1c but Najafi et al[9] did not find the relationship while Zia et al[25], found more use of artificial tears among diabetics with a higher HbA1c.

Strength of our study is that we used 6-items questionnaire to detect DE symptoms. A single trained researcher helped reducing the scoring bias. Our results were closer to those studies utilizing the questionnaires similar to present study.

CONCLUSION

There is a link between Dry Eye disease and diabetes. DED is both public health and economic burden suggesting that dry eye tests must be part of the ocular examinations among diabetics.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board.

Conflict of Interest

Authors declared no conflict of interest

Author's Designation and Contribution

Munir Amjad Baig; Associate professor: *Study design, data collection, manuscript writing.*

Rabeeya Munir; Demonstrator: *Data collection, manuscript writing.*

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DEQ 6

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?
6. Do your eyes ever get stuck shut in the morning?

Possible answers to the questions were 'none', 'rarely or sometimes', and 'often or all the time'.

Subjectively dry eye was defined as having one or more symptoms 'often or all the time'.