Original Article

Dry Eye Syndrome in Patients with Diabetes Mellitus: Prevalence, Etiology and Clinical Manifestations

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ABSTRACT:
Background: Studies have indicated 54% prevalence of asymptomatic and symptomatic DES, in diabetes. However, the relationship between diabetes and DES still remains unclear. The reported prevalence of DES in diabetics is 15–33% in those over 65 years of age and increases with age and is 50% more common in women than in men. **Aim of the study:** To evaluate the prevalence, etiology and clinical manifestations of dry eye syndrome in patients with diabetes mellitus. **Materials and methods:** The present study was conducted in the Department of Ophthalmology. We selected 100 diabetic patients who reported to the outpatient department with type 2 diabetes mellitus. Clinical data of all patients which included sex, age, duration of diabetes as well as a history of other diseases, were obtained by reviewing the medical records and direct patient interview. Subjects with secondary diabetes and those who on medication or have other diseases were excluded. Dry eyes were suspected on the basis of a history of ocular discomfort, including soreness, gritty sensation, itchiness, redness, blurred vision that improves with blinking and excessive tearing. **Results:** A total of 100 patients were included in the study. The mean age of the patients was 59.21 years. The mean HbA1c level in the patients was at 7.81. Out of the total 100 patients, 39 patients were diagnosed with dry eye. The variables between both the groups were comparable and were statistically non-significant. **Conclusion**: From the results of present study, this can be concluded that with the available common diagnostic tests for evaluation of dry eye syndrome, the prevalence of dry eye syndrome in diabetic patients is underestimated.
Keywords: Diabetes mellitus, dry eye syndrome, HbA1c.

INTRODUCTION:

While diabetic retinopathy (DR) and diabetic cataracts are well-known complications, dry eye syndrome (DES), also referred to as keratoconjunctivitis sicca, is also common in the diabetic population.[1, 2] Studies have indicated 54% prevalence of asymptomatic and symptomatic DES, in diabetes. However, the relationship between diabetes and DES still remains unclear. The reported prevalence of DES in diabetics is 15–33% in those over 65 years of age and increases with age and is 50% more common in women than in men.[3, 4] The incidence of dry eye is correlated with the level of glycated hemoglobin: the higher the level of glycated hemoglobin, the higher the incidence of dry eye.

Tear hyperosmolarity and tear film instability caused by lacrimal functional unit (LFU) and ocular surface dysfunction are the key factors in DES.[5] Effects of hyperglycemia on any component of the LFU may be transferred to the entire system via neural connections, leading to insufficient tear production or excess tear loss, abnormalities in blinking, and changes in tear film composition; all these cause DES.[6] Hence, the present study was planned to evaluate the prevalence, etiology and clinical manifestations of dry eye syndrome in patients with diabetes mellitus.

MATERIALS AND METHODS:
The present study was conducted in the Department of Ophthalmology, Hind institute of Medical Sciences, Barabanki, Uttar Pradesh, India. We selected 100 diabetic patients who reported to the outpatient department with type 2 diabetes mellitus. A written informed consent was obtained from all the patients after explaining them the procedure of the study verbally. Clinical data of all patients which included sex, age, duration of diabetes as well as a history of other diseases, were obtained by reviewing the medical records and direct patient interview. Subjects with secondary diabetes and those who on medication or have other diseases were excluded. Dry eyes were suspected on the basis of a history of ocular discomfort, including soreness, gritty sensation, itchiness, redness, blurred vision that improves with blinking and excessive tearing. The condition was confirmed by ocular surface dye staining pattern with fluorescein, tear film break up time (TBUT) (value 15s) and Schirmer test (value 15 mm in 5 min), according to American Academy of Ophthalmology by a specialist. Diagnosis was established by positivity one or more of the tests (TBUT or Schirmer test). Structures of the eye were assessed with slit lamp biomicroscopy

examination. Retinal status was evaluated by indirect ophthalmoscopy after dilation by Tropicamid drop and retinal color photography. Diabetic retinopathy was graded according to early Treatment Diabetic Retinopathy (ETDRS) criteria.
The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

RESULTS:
Table 1 shows the demographic varibles of the study group. A total of 100 patients were included in the study. The mean age of the patients was 59.21 years. The mean HbA1c level in the patients was at 7.81. Out of the total 100 patients, 39 patients were diagnosed with dry eye syndrome. Table 2 shows the comparison of OSDI, Schirmer I test, rose Bengal staining, fluorescein staining, and TFBUT test results between diabetic patients with dry eye and without dry eye. The variables between both the groups were comparable and were statistically non-significant. [Fig 1]

Table 1: Demographic varibles of the study group

Variables	Mean values
Total number of diabetic patients	100
Age (years)	59.21
HbA1c (%)	7.81
Duration of diabetes (years)	8.12
Number of patients diagnosed with Dry eye syndrome	39

Table 2: Comparison of OSDI, Schirmer I test, rose Bengal staining, fluorescein staining, and TFBUT test results between diabetic patients with dry eye and without dry eye

	Diabetic patients with Dry eye	Diabetic patients without dry eye	p-value
Number of patients	39	61	
OSDI score	2.01	2.02	NS
Flourescein staining (score)	0	0	NS
Rose Bengal staining (score)	0	0	NS
Schirmer I test (mm)	6	5	NS
TFBUT (secs)	9	7	NS

Figure 1:OSDI, Schirmer I test, rose Bengal staining, fluorescein staining, and TFBUT test results
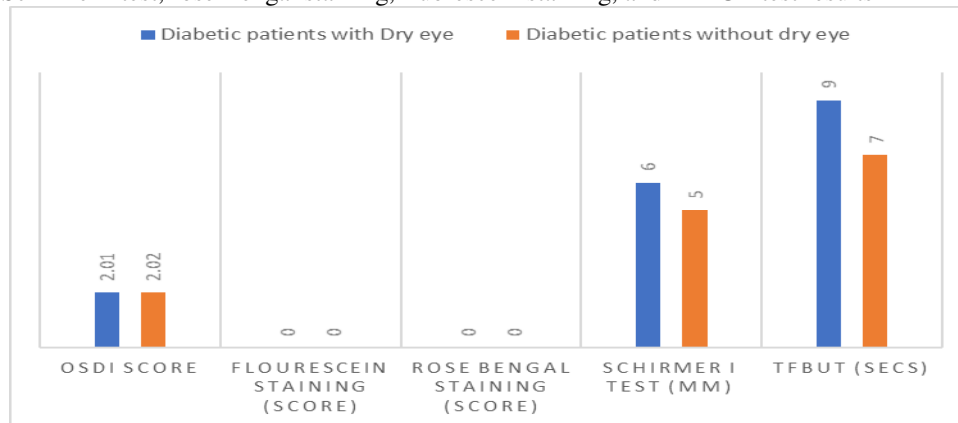
DISCUSSION:

Several previous studies, investigated the relationship between diabetes and DED. It has shown that composition of tear proteins in people with diabetes is different from healthy subjects.[7, 8] In diabetes mellitus corneal and conjunctival epithelial alterations, persistent epithelial defects, and potential visual impairment due to corneal scaring have been observed. Damage to the microvasculature of the lacrimal glands accompanied with autonomic neuropathy could impair lacrimation in long standing diabetes.[9, 10] A total of 100 diabetic patients were included in the study. 39 patients were diagnosed as having dry eye. The comparison of OSDI, Schirmer I test, rose Bengal staining, fluorescein staining, and TFBUT test results between diabetic patients with dry eye and without dry eye showed that the variables between both the groups were comparable and were statistically non-significant. The results were compared with previous studies. Manaviat MR et al assessed the prevalence of dry eye syndrome and diabetic retinopathy (DR) in type 2 diabetic patients and their contributing factors. 199 type 2 diabetic patients referred to Yazd Diabetes Research Center were consecutively selected. All Subjects were assessed by questionnaire about other diseases and drugs. Dry eye syndrome was assessed with Tear break up time tests and Schirmer. All the subjects underwent indirect ophthalmoscopy and retinal color photography. DR was graded according to early Treatment Diabetic Retinopathy (ETDRS) criteria. Of 199 subjects, 108 patients (54.3%) suffer from dry eye syndrome. Although dry eye syndrome was more common in older and female patients, this association was not significant. But there was significantly association between dry eye syndrome and duration of diabetes. Dry eye syndrome was more frequent in diabetic patients with DR. DR was found in 140 patients (70.35%), which included 34 patients (17.1%) with mild non-proliferative DR (NPDR), 34 patients (17.1%) with moderate NPDR, 22 patients (11.1%) with severe NPDR and 25 patients (25.1%) with proliferative DR (PDR). There were significant relations between age, sex and duration of diabetes and DR. They concluded that the prevalence of dry eye syndrome was 54.3%. Diabetes and dry eyes appear to have a common association. Han SB et al evaluated the prevalence of and risk factors for dry eye disease (DED) in an elderly Korean population. This population-based study in Yongin, Korea, included 657 individuals 65 years or older randomly selected from an official household registration database. Dry eye symptoms were assessed using a 6-item questionnaire, and DED was defined as having 1 or more dry eye symptoms often or all the time. Dry eye tests, including the Schirmer test, tear film break-up time measured using fluorescein, cornea fluorescein staining, and examination for meibomian gland dysfunction, were performed. The crude prevalence of DED was 30.3%, and the age-, sex-, and region (urban vs rural)-adjusted prevalence was 33.2%. Women and urban dwellers were more likely to have DED. Of those with DED, 85.1% had tear film break-up time of 10 seconds or less, 54.1% had meibomian gland dysfunction, 39.2% had a fluorescein score of 1 or greater, and 32.8% had a Schirmer test score of 5 mm or less. A low Schirmer score was correlated with increased prevalence of DED, although sensitivity was low. They concluded that the dry eye disease is common in elderly Koreans; female sex and living in an urban region were strongly correlated with its frequency.[11, 12]

Kim KW et al investigated the association between depression and dry eye disease (DED) in a community-dwelling elderly population. The subjects were 657 Korean elders ≥ 65 years of age randomly selected from an official household registration database in Yongin, Korea. DED symptoms were assessed using the six-item Dry Eye Questionnaire. DED signs were evaluated using the Schirmer test, fluorescein stain score, tear film break-up time (BUT). Depression was assessed using the Korean version of the Short Geriatric Depression Scale (SGDS-K). The association between DED and depression was evaluated using logistic linear analyses. The SGDS-K score correlated with the number of positive responses in the Dry Eye Questionnaire, but not with tear film break-up time or Schirmer test score. In the binary logistic regression model, female sex, residence in urban areas, depression, and Schirmer score of ≤ 5 mm were associated with the risk of DED. Depression was associated with the risk of DED in the patients with Schirmer score > 5 mm but not in those with Schirmer score ≤ 5 mm. It was concluded that the depression was associated with DED symptoms in subjects with normal or mildly reduced tear production. Lin PY et al analyzed the association between dry-eye symptoms and signs in an elderly Chinese population in Taipei, Taiwan. The participants were those of the Shihpai Eye Study, a population-based survey of eye diseases in the elderly (> or =65 years) in Shihpai, Taipei, Taiwan. Of 2045 randomly selected noninstitutionalized residents, 1361 (66.6%) participated in the study. Dry-eye symptoms were evaluated with an interviewer-administered questionnaire. Dry-eye signs, including tear-film breakup time, Schirmer test result, score for fluorescein staining of the cornea, and meibomian gland dysfunction, were assessed. Correlations between symptoms and signs were analyzed. Of the participants, 33.7% (459/1361) were symptomatic, defined as reporting one or more symptoms often or all the time. A Schirmer result of < or =5 mm was the only sign associated with frequent symptoms. Its sensitivity and specificity in detecting symptomatic subjects were 62.5% and 43.7%, respectively. The agreement between each sign was statistically significant, although weak, except that no correlation was found between the Schirmer result and meibomian gland anomalies. Of the symptomatic subjects, 85.4% (392/459) had either a low Schirmer result or a meibomian gland anomaly; 38.8% (178/459) of them were abnormal on both tests. They concluded that the Schirmer test was shown to be incapable of detecting meibomian

gland disease. However, a low Schirmer result was significantly associated with dry-eye symptoms in this elderly Chinese population. [13, 14]

CONCLUSION:
From the results of present study, this can be concluded that with the available common diagnostic tests for evaluation of dry eye syndrome,the prevalence of dry eye syndromein diabetic patients is underestimated.

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