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PREVALENCE OF DRY EYES IN PATIENTS WITH DIABETES MELLITUS

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Corresponding Author:
Dr. M. R. Flarence,
Email: benflarence@gmail.com

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M.R. Flarence[1], Darakhshan Quraishi[2], N Sujatha[3]

[1]Assistant Professor, Department of Ophthalmology, Regional Eye Hospital, Kakatiya Medical College, Warangal, Telangana, India.
[2]Assistant Professor, Department of Ophthalmology, Government Medical College, Maheshwaram, Telangana, India.
[3]Assistant Professor, Department of Ophthalmology, Government Medical College, Jagtial, Telangana, India

Abstract

Dry eyes may be caused by impairment in tear production or excessive tear evaporation and are associated with photophobia, red eyes, vision impairment, local pain, and pruritus. Researchers have described a higher prevalence of dry eyes in patients with diabetes mellitus (DM) compared to the normal population. This is a case-control study of 100 people with diabetes mellitus (DM) and 100 healthy people who were paired with them. The goal is to find out how common dry eyes are (using the Schirmer test) and how bad they are (using the Ocular Surface Disease Index) and how they are linked to clinical variables of the diseases. We found that 43% of DM patients had dry eyes, a prevalence that was higher than controls (p = 0.81). At univariate analysis, they were found to be more common in older individuals (p = 0.001) with type 2 diabetes (p = 0.001) and in those using metformin (p = 0.001). A multivariate linear regression showed that metformin use was the only independent variable associated with dry eyes. We found no differences in the intensity of the symptom when comparing patients with dry eyes with and without DM.

INTRODUCTION

Diabetes mellitus (DM) affects the eyes, and diabetic retinopathy is one of the disease's most feared complications.[1] Diabetic retinopathy (DR) may lead to vision-threatening damage to the retina, eventually leading to blindness. It is the most common cause of severe vision loss in adults of working age groups in the western world.[2] Dry eyes may also occur in these patients, and they contribute to loss of quality of life,[3] they cause blurred vision, photophobia, and pruritus, favored by the appearance of corneal ulcers.[4] Human tears are sophisticated structures that support corneal nutrition and protection. They are formed by mucin elaborated by the goblet cells and by an aqueous component, produced by the lacrimal glands.[5] The mucin layer helps reduce friction and protects the cornea during blinking; the aqueous component contains enzymes, vitamins, electrolytes, antibodies, etc. and is important for lubrication and local defense.[5] The eyelid sebaceous glands produce a hydrophobic lipid layer external to them, which prevents tear evaporation.[6] An eye may become dry either from inadequate tear production or from excessive tear evaporation.[6] Lacrimal gland dysfunction usually causes the former, while meibomian gland malfunction or blepharitis more commonly cause the second.[7] Reducing the tear production results in tear film hyperosmolarity and local inflammation.[8]

A normal person can have dry eyes, which are also called keratoconjunctivitissicca. It affects between 5% and 34% of people around the world.[8] Dry eyes can be caused by things like low humidity, wearing contact lenses, using computers too much, and more.[9] Some authors state that they are more common in DM than controls, although the reasons for this finding are not completely clear.[10,11] The prevalence of dry eye syndrome in DM varies from 15 to 53%.[10,11] There may be differences because of outside factors. This syndrome is more common in older people, people who take certain medications (like isotretinoin, tricyclic antidepressants, and selective serotonin reuptake inhibitors), people who have had eye surgery in the past (which can damage the tearing somatosensory reflex),[12] and some authors say that diabetes control,[10,11] can also make it worse. Kaiserman et al,[11] observed that poor glycemic control correlates with increased artificial tear use in diabetic patients. Animal studies showed that diabetic mice have a significant decrease in aqueous tear production when compared to the non-diabetic ones.[13] Also, the methods for searching this entity have considerable variability, and this may help to explain the variability found. Herein, we studied a sample of regional eye hospital (Warangal)

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patients with DM for dry eye syndrome, comparing its prevalence and severity with the normal population. We also aimed to see if diabetes variables do influence its appearance.

MATERIALS AND METHODS

The ethical committee at the regional eye hospital, Kakatiya Medical College, Warangal, approved this study. This is a case-control study, with a patient-to-control ratio of 1:1, involving two hundred individuals: 100 with diabetes mellitus (DM) and 100 as controls. We recruited DM patients from the regional eye hospital in Warangal. We excluded patients with chronic inflammatory diseases, ophthalmologic inflammatory complications, contact lens users, prior eye surgery, and those taking medications associated with dryness. Controls followed the same exclusion criteria as patients and had no personal or familial history of DM. This is a convenience sample that included all patients that agreed to participate in the study for the period of three months (October to December 2024).

Patients and controls had the Schirmer I test, without anesthetics done according to standard recommendations.[14,15] Dry eye was diagnosed when the Schirmer values in at least one eye were equal to or less than 10 mm.[14,15] For statistical purposes, the Schirmer value considered was the worst result from both eyes. Those with dry eyes were submitted to OSDI (Ocular Surface Disease Index) that evaluates the symptoms of ocular irritation consistent with dry eye and their impact on vision-related functioning.[15,16] OSDI is a 12-item questionnaire that scores the dryness symptoms on a scale from 0 to 100, with higher scores representing greater disability. Accordingly, toll values of 0–12 are considered normal, from 13 to 22 with light, from 23 to 32 with moderate, and >32 with severe symptoms.[15,16]

Treatment data, diabetes type, disease duration, fasting glycemia, and HbA1c were collected simultaneously with the Schirmer test realization. Fasting glycemia was measured by dry chemistry and HbA1c by liquid chromatography, and these laboratory tests have been done, at most, fifteen days prior to data collection.

Statistical analysis: The Shapiro-Wilk test judged the distribution of collected data. We used chi-squared and Fisher tests to compare gender, the number of smokers and post-menopausal women, DM subsets, treatment data, and the OSDI classification between patients, controls, and DM patients with and without dry eye conditions. We used the Mann Whitney test to compare age, disease duration, and Schirmer values. Correlation studies of Schirmer values with glycemic control were done with the Spearman test. Data that were associated with dry eye with $p < 0.1$ were studied with multiple linear regressions using the measurement of the Schirmer test as a dependent variable to test their independency. The statistical studies were done with the help of the software Epi-Info 7.2.5.0 statistical software, and the adopted significance was 5%.

RESULTS

[Table 1] shows the epidemiologic characteristics of studied sample and pairing data of patients and controls. It also shows the comparison of Schirmer test and OSDI between these two populations. Diabetes had 100 samples, there was slight female preponderance in the occurrence of Diabetes with males 52 (52%) and males 48 (48%). The Ratio of male to female babies in the study is 1.08:1. Insulin users 51/100 (51%) using, oral hypoglycaemic drugs (69/120 or 69% metformin users); 25/100 (25%) with type 1 DM and 75/100 (75%) with type 2 DM. The median disease duration was of 10 years (IQR = 5.0–18.0), the median fasting glucose of 138.8 md/dL (IQR =11–210 mg/dL) and the median HbA1c of 8.0% (IQR = 6.8–9.6%).

Table 1: Comparison of epidemiological data and dry eye features in DM (Diabetes Mellitus) patients and controls.

	Diabetes (N = 100)	Controls (N = 100)	P
Median age-years (IQR)	57 (46.2-63.68)	61 (45.82-67.27)	0.92
Gender			
Male	48 (48%)	43 (43%)	0.570
Female	52 (52%)	57 (57%)	
Post-menopausal women	41(78.85%)	39 (69.64%)	0.98
Individuals with dry eye (n)	43 (43%)	31 (31%)	0.81
OSDI			
Normal	25 (58.13%)	16 (51.61%)	
Light	10 (18.86%)	4 (12.90%)	
Moderate	4 (9.30%)	5 (16.12%)	
Severe	4 (9.30%)	6 (19.35%)	
Median Schirmer (mm) (IQR)	10.45 (7.0-15.0)	11 (9.5-15)	0.86

(*) Mann Whitney test; (**) chi squared test; N = number; IQR = interquartile range; OSDI = Ocular Surface Disease Index.

[Table 2] shows the comparison of diabetes sample with and with-out dry eye. Correlation studies of Schirmer values with fasting glucose and HbA1c were non-significant ($p > 0.05$). Data that associated

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with dry eye with p < 0.1 (DM type, age, insulin and metformin use) were studied by multiple regression to test independence of the variables. Only metformin use remained significant with p = 0.002

Table 2: Comparison of clinical and epidemiological data of diabetic population with and without dry eye

	With dry eye (N = 43)	Without dry eye (N = 57)	P
Gender			
Males (n)	19 (44.19%)	29 (50.87%)	0.001
Female (n)	24 (55.81%)	28 (49.13%	
Median age-years- (IQR)	63 (56-72)	54.8 (38.5-67.8)	0.89
Women at menopausa (n)	20 (833.33%)	22 (78.57%	0.001
Current smockers (n)	4 (9.30%)	5 (8.78%)	0.004
Metformin users (n)	31 (72%)	38 (66.66%)	0.002
Insuline users (n)	22 (51.15%)	29 (58.09%	0.001
Type 1 DM	10 (23.25%)	15 (26.32%)	0.001
Type 2 DM (n)	33 (76.75%)	42 (73.68%)	0.001
Median disease duration-years- (IQR)	12.5 (4.8-20.00)	10 (6.0-15.5)	0.04

(*) Fisher test; (**) chi squared test; (***) Mann Whitney test; n = number; DM = diabetes mellitus; IQR = interquartile range.

DISCUSSION

Our findings showed that patients with DM have drier eyes than controls with a prevalence of 43 (43%). This result is in agreement with those from Ozdemir et al,[10] that studied 40 DM patients compared to controls. Hom and De Land,[17] found higher prevalence than us in 53% of their sample. However, these authors diagnosed this entity using a self-reported instrument. Conversely, a Chinese study,[18] reported a lower prevalence of dry eyes, with a mere 17.5%. In this latter study, the sample had only type 2 DM from a community-based population that may have had a milder disease. Some explanations for the presence of dry eyes in DM were offered. One of them says that insulin is needed for the growth of corneal epithelial cells and lacrimal acinar secretory cells.[19]

Diabetic corneal neuropathy causes corneal insensitivity, which impairs the tearing reflex.[20] It has also been verified that the content of glucose and advanced glycation end products (AGEs) may be increased in tears, favoured by hyperosmolarity and inflammation.[21] Some authors have found an association between glycaemic control and dry eye findings in this context.[21,22] Our findings could not support this idea, as neither fasting glucose nor HbA1c levels correlated with Schirmer values. Uchino et al,[23] Galor et al,[24] and Schaumberg et al,[25] could not prove the association of dry eye with hyperglycemia. Also, a study in 152 patients from the UK did not find a correlation of dry eye with glucose levels and HbA1c, but a positive association of glycemic control with dryness symptoms and loss of quality of life was found.[26] We also found that dry eyes were more common in older individuals with type 2 diabetes using metformin. Interestingly, the only documented independent factor was the metformin use, although we do not find a satisfactory explanation for this link. Chew et al,[27] found that metformin had some anticholinergic action, mainly when used in high doses or in frail patients, and this could be offered as a possible explanation. Prospective studies evaluating lacrimal production before and after using this drug could be enlightening.

Finally, some authors have found an association between diabetic retinopathy and dry eyes. We did not study retinopathy, and this is a limitation of this study. Other limitations are its cross-sectional design, the limited number of samples, and not having glycemic levels in controls. Also, the use of more sophisticated tools for the evaluation of dry eyes, such as measurement of tear osmolarity, would be interesting. Nevertheless, it does highlight the high prevalence of dry eyes in patients with DM and the possible role of metformin in its occurrence. In daily practice, diabetic patients undergo regular fundus examinations, but no attention is payed to tear dysfunction. Doctors need to be aware of this easily diagnosed and treated complication. Dry eyes may result in ocular discomfort, corneal ulcers, and even blindness, leading to an important loss of life quality.

CONCLUSION

In conclusion, our results show that DM patients have a greater risk of developing dry eyes than controls. Metformin use was an independent factor associated with its occurrence.

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