



Prevalence of Dry Eyes in Type 2 Diabetics attending Ophthalmology Out patient department at a tertiary eye care hospital, Maharashtra

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Abstract:

Being a metabolic disorder diabetes mellitus nearly affects every type of tissue of every organ in the human body and thus it is very likely that it could be causing qualitative and quantitative alterations to the normal tear profile.

Aim: To study the prevalence of dry eyes and dry eye related ocular surface disorder in Type 2 diabetic patients.

Methods: This cross sectional study was conducted at a tertiary eye care hospital over a period of one year including 200 patients aged > 40 years. Individuals already diagnosed as Type 2 diabetics (of any duration) were enrolled in the group D and non diabetic individuals were enrolled into the group ND. A detailed history, questionnaire, complete ocular examination was done after informed consent and findings recorded. The data was coded and compiled on Microsoft Excel spreadsheet.

Results: Slight male preponderance was noted in both type 2 diabetics and non diabetic individuals (male to female ratio was 1.22:1). Majority of individuals in the study groups belonged to the age group 51 to 60 years. The mean age of the patients with type 2 diabetes (53.86 ± 7.94 years) was found to be slightly high as compared to non diabetic individuals (52.58 ± 9.27 years). The risk of developing dry eye syndrome in type 2 diabetics was found to be nearly two fold as compared to non diabetic individuals. "Feeling of dryness" in eyes was the commonest symptom reported by more than one fourth (26%) of type 2 diabetic patients. Significantly, higher number of patients with type 2 diabetes had low tear meniscus height and low tear film break up time values as compared to non diabetic individuals in both eyes. The mean Schirmer's test scores were found to be significantly low in patients with diabetes compared to non diabetics for both the eyes. The Rose Bengal Staining test showed significantly higher positive results among diabetics compared to non diabetics in both eyes.

Conclusion: A detailed ocular examination should be an integral part of all patients suffering with diabetes yearly for early detection and management.

Keywords: Dry eye, Diabetics, tear film

Introduction:

Diabetes mellitus is the commonest metabolic disorder in human population and is one of the most common leading cause of blindness in 20–74 years old people.¹ It is quickly emerging as one of the biggest health-related catastrophes the world has ever witnessed.² Experts project that the incidence of diabetes is set to soar by 64% by 2025, affecting 53.1 million people and resulting in medical and societal costs of half trillion dollars per year.³

Like the ever increasing incidence of diabetic population in the world, there is also a rising incidence of dry eye syndrome in populations especially in the urban setup. Though, commonsense attributes this increasing incidence to environmental hazards like air pollution, vehicular emission, industrialization and construction activities, there are internal factors in the body like state of meibomian glands, systemic and local inflammatory diseases and metabolic disorders which are also being considered as contributing factors. Being a metabolic disorder diabetes mellitus nearly affects every type of tissue of every organ in the human body and thus it is very likely that it could be causing qualitative and quantitative alterations to the normal tear profile.

While diabetic retinopathy is the more commonly known ocular complication of diabetes, diabetic patients have also been found to have symptoms indicative of dry eye such as gritty sensation, burning sensation, itching, photophobia, stinging, dryness, watering, ocular fatigue and redness.

Therefore, this study was conducted to understand the prevalence and correlation between diabetes mellitus and tear film abnormalities which further lead to dry eyes.

Aim:

- To study the prevalence of dry eyes and dry eye related ocular surface disorder in Type 2 diabetic patients.

Objectives:

1. To know the prevalence of dry eyes in patients with Type 2 diabetes.
2. To know the prevalence of dry eyes in non diabetics of similar age group (> 40 years) - Control group.

Materials and Methods:

This cross sectional study was conducted at a tertiary eye care hospital in Maharashtra over a period of one year after ethical approval. The study population consisted of individuals who came to the out-patient department. Adults aged > 40 years were taken into the study. Individuals already diagnosed as Type 2 diabetics (of any duration) were enrolled in the group D and non diabetic individuals were enrolled into the group ND. Patients having any ocular disorder or systemic disorder (other than diabetes mellitus), which are known to cause dry eye syndrome were excluded from the study. A total of 200 patients, 100 in each group were selected for the study. Group D consisted of Type 2 Diabetes Mellitus Patients (Age > 40 Years) and Group ND consisted of Non Diabetic individuals (Control group, Age >40 Yrs).

All the participants fulfilling selection criteria were explained about the nature of the study. A written informed consent was obtained from all the participants before enrollment. Each patient enrolled in the study was asked about the presenting symptoms through a validated questionnaire of symptoms relating to dry eye which included feeling of dryness, feeling of gritty sensation, burning sensation, redness, watering, crusting of eyelashes, and sticking of eyes. Presence of one or more symptom was taken as positive (Figure 1). Further detailed anterior and posterior segment examination of each patient was done. Following this, five tests in the sequence starting from least invasive to most invasive viz. tear meniscus height, tear film break up time, fluorescein staining (graded according to oxford grading system), Schirmer's test and rose bengal staining (graded according to oxford grading system) were performed. Presence of one or more symptoms with one or more positive test of dry eye evaluation was diagnosed as dry eye.

The data was coded and compiled on Microsoft Excel spreadsheet. The association between dry eye syndrome and categorical data was done using either chi-square test or fisher exact test. The continuous data was compared using Independent sample T test. A probability value ('p' value) of < 0.05 at confidence interval of 95% was considered as statistically significant.

QUESTIONNAIRE

- Do your eyes ever feel dry ?
- Do you ever feel a gritty or sandy sensation in your eye?
- Do your eyes ever have a burning sensation ?
- Are your eyes ever red ?
- Do your eyes ever feel watery or tearing ?
- Do you notice much crusting or discharge on your lashes ?
- Do your eyes ever get stuck in the morning ?

Presence of symptoms from the dry eye questionnaire were graded as;

- Rarely – At least once in three to four months
- Sometimes – Once in two to four weeks
- Often – At least once a week
- All the time

Presence of one or more symptoms was taken as positive.

Figure 1: Questionnaire for participants

Results:

A total of 200 patients divided into two groups of 100 each as group D (patients with type 2 diabetes mellitus aged > 40 years) and group ND (Non diabetic individuals aged > 40 years) over a period of one year were enrolled and studied.

55% of the patients each in group D and group ND were males and the male to female ratio was 1.22:1 (p=1.000)(Figure 2). 44% of the patients in group D were aged between 51 to 60 years while in group ND 50% of the patients were aged between 41 to 50 years. However, this difference was statistically not significant (p=0.229). Mean age of the patients in group D and individuals in group ND were comparable (53.86 ± 7.94 years vs 52.58 ± 9.27 years; p=0.296).

Majority of the participants in group D (74%) and ND (80%) did not have dryness, while 13% of the individuals each in group D and ND reported dryness sometimes. However, the response with regard to dryness in among the individuals with group D and ND was comparable (p=0.525).

Gritty sensation was reported sometimes by 9% of the patients in group D and 5% of the individuals in group ND, while it was absent in 83% and 90% respectively. However, the response regarding gritty sensation in group D and ND was comparable (p=0.119).9%, of the patients in group D and 3% of the patients in group ND experienced burning sensation rarely. 5% of the patients in group D and 4% of the patients in the group ND experienced it sometimes. However, the difference observed was statistically not significant (p=0.152).6% of the

patients in group D and 3% of the patients in the group ND experienced watering sometimes. 1% of the patients in both the groups experienced it often. 1% of the patients in group D and 7% of the patients in the group ND experienced it rarely. However, this difference was statistically not significant ($p=0.097$)

Redness was noted among 6% of the patients with group D rarely compared to 3% in group ND. Similarly, 5% of the patients in group D experienced redness sometimes compared to 2% in group ND but the difference was statistically not significant ($p=0.486$). Crusting of the eyelashes was present rarely in 6% of the patients in group D compared to 1% in group ND. This difference was statistically not significant ($p=0.204$). Sticking of the eye was rarely noted among 7% of the patients in group D and same was present among 4% of the patients in group ND. However, this difference was statistically not significant ($p=0.352$).

Visual acuity with regard to right eye was comparable in patients with group D and individuals of group ND ($p=0.122$) visual acuity of left eye also was comparable among the individuals between group D and group ND ($p=0.924$).

Tear meniscus height in the right eye was low in significantly higher number of patients (28%) in group D compared to group ND (9%) ($p=0.001$). Similar observations were made in left eye also (28% vs 11%; $p=0.002$).

Tear film break up time test in the right eye was positive in significantly higher number of patients in group D (35%) compared to individuals in group ND (15%) ($p=0.001$). Also, in the left eye the test was positive in 34% of the patients in the group D as compared to 13% in the group ND ($p<0.001$).

study tear film break up time was significantly low in group D compared to group ND with regard to right (10.66 ± 2.80 seconds vs 12.13 ± 2.70 seconds; $p<0.001$) as well as left eye (11.10 ± 2.71 seconds vs 12.33 ± 2.47 seconds; $p=0.001$)

Fluorescein staining test in right eye among patients with group D revealed grade I in 12% of the patients while in group ND 9% of the patients had grade III. With regard to left eye, maximum patients in group D (14%) and group ND (10%) had grade I. However, the fluorescein staining test findings in group D and

ND were comparable in right ($p=0.213$) and left eyes ($p=0.429$).

Schirmer's test in right eye was positive among 17% of the patients in group D compared to 12% of the patients in group ND. The Schirmer's test for left eye revealed positive findings in 16% of the patients in group D as against 11% of the patients in group ND. However, these differences were statistically not significant in right ($p=0.315$) as well as left eye ($p=0.301$). Mean Schirmer's test score for right eye (13.39 ± 4.75 mm vs 15.65 ± 5.16 mm; $p=0.001$) as well as left eye (14.40 ± 5.60 mm vs 16.37 ± 5.17 mm; $p=0.007$) was significantly low in group D compared to group ND.

Rose Bengal Staining test for right eye showed 12% of the patients with grade I and 10% with grade II in group D compared to 9% and 2% in group ND. Similarly, the same grades for left eye in group D were present in 13% and 6% as against 9% and 2% in group ND respectively. The differences observed in the findings of right eyes ($p=0.008$) and left eyes ($p=0.022$) were statistically significant.

Prevalence of dry eye syndrome was significantly high in group D (44%) compared to group D (23%) ($p=0.002$). The relative risk of developing dry eye syndrome in diabetics was 1.913 (CI 1.255 to 2.915) compared to general population (Figure 3). In patients with Type 2 diabetes, mild dry eye syndrome was present in 24%, moderate in 11% and severe in 9% compared to 11%, 8% and 4% in non diabetics respectively. This difference was statistically significant ($p=0.014$).

Prevalence of dry eye syndrome among patients with diabetes was high in females (51.11%) compared to males (38.18%). However, statistically this difference was not significant ($p=0.228$).

44 patients with diabetes were aged between 51 to 60 years. Among them, 52.27% had dry eye syndrome. However, no association was found between dry eye syndrome and age ($p=0.428$). Maximum patients with diabetes reported duration of one to five years (61%). Among them dry eye syndrome was present in 39.34% and absent in 60.66%. No association was found between dry eye syndrome and duration of diabetes ($p=0.519$).

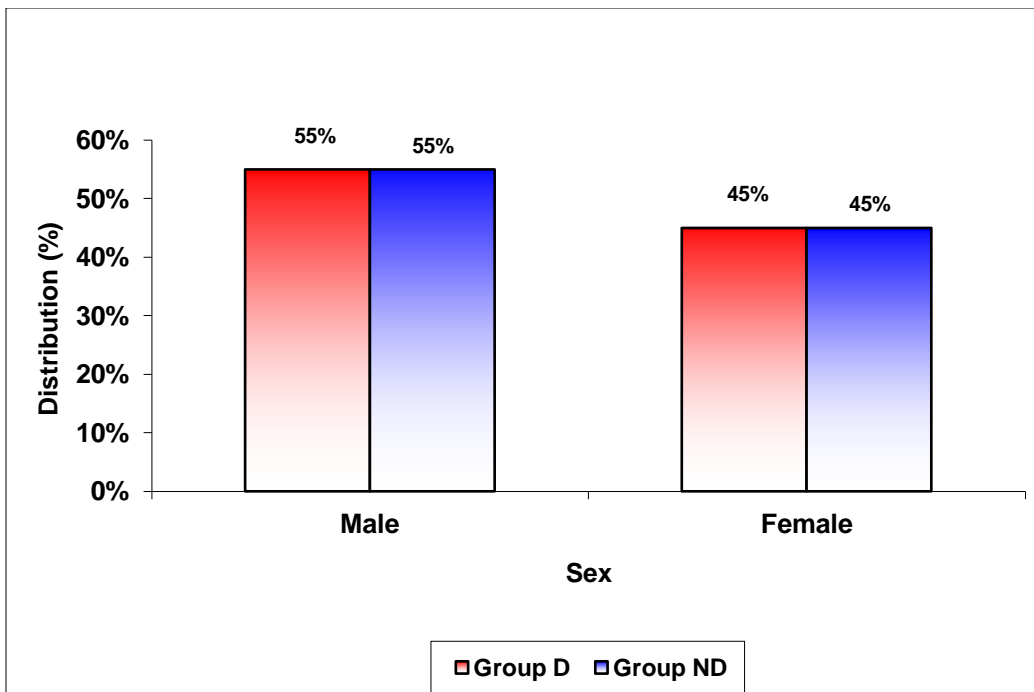


Figure 2: Distribution of study population according to gender

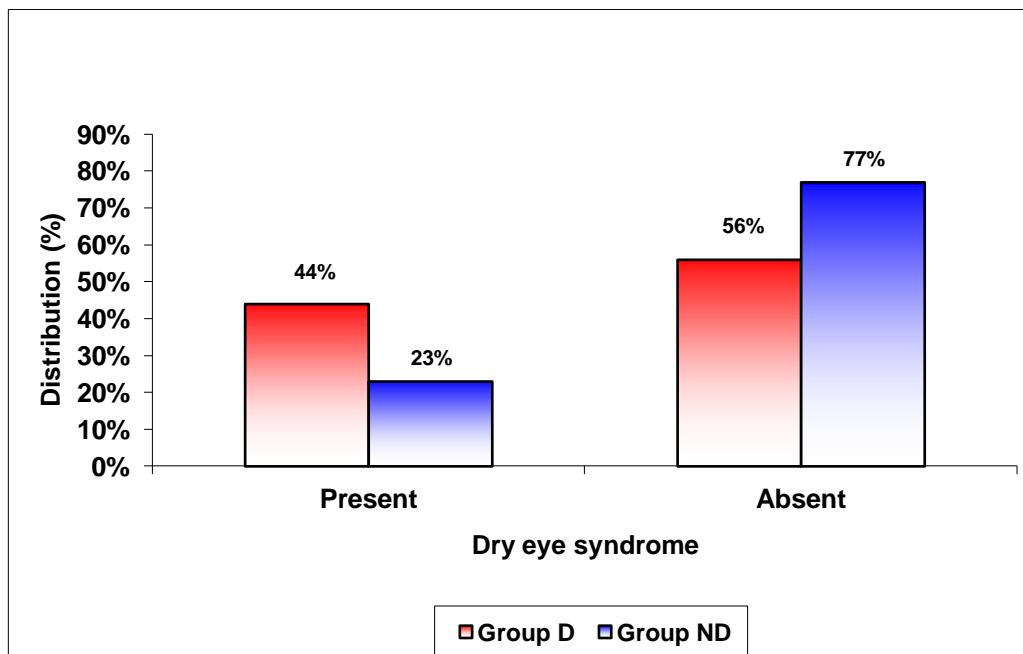


Figure 3: Prevalence of dry eye syndrome in study population

Discussion:

The incidence of ocular surface disorders secondary to dry eye syndrome has been steadily rising globally and has already reached an alarmingly high figure, especially in the urban population. Though atmospheric pollution, global warming and altered

life style of present era are considered to be the major contributory factors for this ailment there is a perception that the rising incidence of diabetes mellitus could be correlated to this phenomenon as this metabolic disorder is now believed to be a strong risk factor in causing quantitative and qualitative

alteration in normal tear secretion. The present study has been conducted in a tertiary level eye care institution to compare an age and sex matched population of established cases of type 2 diabetes mellitus with equal number of individuals, who were screened for diabetes mellitus, and were declared non diabetic.

In our study, though slight male preponderance was noted in both groups of diabetics and non diabetics, the sex distribution ratio was comparable as the male to female ratio in the group of diabetics and non diabetics was 1.22:1, with 55% of male patients in each group. Similar sex distribution pattern was observed in an Indian study done by Sahai *et al.*⁴ with males 55.2% and females 44.8%, out of the total 500 patients studied for prevalence of dry eye. Whereas, a prospective case control study from Manipal, Karnataka by Pai SG *et al.*⁵ assessed the changes in tear film function among diabetics and non diabetics. The authors reported 30% of males and 40% of females in the diabetic group and 26% males and 48% of females in the non diabetic group.

Majority of individuals in the present study belonged to the age group 51 to 60 years; diabetics were 44% in this age group in comparison to non diabetics 50%. The difference again was not statistically significant ($p=0.229$). The study of assessment of dry eye status in type 2 diabetic patients in a tertiary care hospital in Navi Mumbai,⁶ also noted that the commonest age group of patients was 51 to 60 years.

Mean age of patients with diabetes was slightly high (53.86 ± 7.94 years) compared to non diabetics (52.58 ± 9.27 years), but the difference was statistically not significant in this study. Similarly, in a study done in Iran the mean age of type 2 diabetic patients with dry eye syndrome was 54.16 ± 11.02 years.⁷

Tear meniscus height was low in 28% cases in group D in both eyes, it was low in 9 % cases in right eye and 11% cases in left eye of ND group. Thus, it was observed that significantly higher number of patients with diabetes had low tear meniscus height compared to non diabetics with regard to both right (28% vs 9%; $p=0.001$) and left eyes (28% vs 11%; $p=0.002$). Similar findings were reported in the prospective case control study from Manipal, Karnataka by Pai SG *et al.*⁵

A total of 100 eyes of 50 patients with type 2 diabetes and 100 eyes of 50 non-diabetics coming to out patient department of a tertiary hospital were chosen. The tear film break up time was found to be significantly reduced in 15 (30%) patients in the diabetic group as compared to 7 patients (14%) in the non-diabetic group. The overall mean TBUT in the diabetic group was 9.8 ± 7.01 seconds and that in the non-diabetic group was found to be 12.8 ± 5.71 seconds. The tear film parameters were significantly reduced in the diabetic patients. The findings of the present study and the above study from Manipal indicate that dry eye in diabetic patients is a significant contributor for ocular surface disorder.

Schirmer's test results had positive findings among 17% of the patients with diabetes compared to 12% of the non diabetics in right eye and 16% of diabetics and 11% of non diabetics in the left eye. These differences were statistically not significant (right $p=0.315$; left $p=0.301$). In the Beijing Eye study⁸, the Schirmer's test was positive in $20.4 \pm 2\%$ in the symptomatically dry eye group and $21.0 \pm 1\%$ in the asymptomatic group. The mean Schirmer's scores were 11.4 ± 7.0 mm and 12.0 ± 7.2 mm in both the groups respectively. Similarly, the value of Schirmer's test was found to be reduced significantly ($p<0.001$), in the Proliferative diabetic retinopathy (PDR) group as compared to control group, in the study of tear film function in type 2 diabetics with retinopathy.⁹ In the study done in China by Li HY *et al.*¹⁰ tear film functions of 111 patients with type 2 diabetics and 100 controls were studied. The average Schirmer's scores were 10.61 ± 6.86 mm in diabetic group and 10.92 ± 7.0 mm in the non diabetic group.

Rose Bengal staining test for right eye was positive in 37% of diabetics compared to 16% of the non diabetics. In the left eye diabetics showed positivity among 34% of patients as compared to 16% of non diabetics. The difference in the diagnosis of dry eye syndrome based on Rose Bengal Staining test showed significantly higher positive results among diabetics compared to non diabetics in right ($p=0.008$) as well as left eyes ($p=0.022$). In the Melbourne Visual Impairment Project¹¹, dry eye was diagnosed in 10.8% individuals by Rose Bengal Staining. Whereas, in a study done in India¹², which determined the prevalence of dry eye among symptomatic patients attending a ophthalmology OPD showed positive Rose Bengal Staining in 51

eyes (37.5%). In contrast, the study done in Manipal by Pai SG et al.⁵ reported that, the Rose Bengal test was positive only in 4% of patients in both the diabetic and non diabetic groups.

Prevalence of dry eye syndrome was as high as 44% in patients with diabetes with severity of mild grade in 24%, moderate grade in 11% and severe grade in 9% while in non diabetic individuals the prevalence was 23% with severity of mild grade in 11%, moderate grade in 8% and severe grade in 4%. The higher prevalence observed among diabetics compared to non diabetics was statistically significant ($p=0.002$). Also, the differences observed with regard to severity of dry eye syndrome in diabetics compared to non diabetics were suggestive of significantly higher frequency in diabetic population ($p=0.014$). The relative risk of developing dry eye syndrome in diabetics was 1.913 at confidence interval 1.255 to 2.915 compared to general population. These findings suggest that the risk of developing dry eye syndrome in diabetics is nearly two fold compared to non diabetics.

The prevalence of dry eyes varies from 18.1% to 70%, thereby showing wide disparity. A recent study from Navi Mumbai⁶, India assessed the prevalence of dry eye syndrome in hundred type 2 diabetic patients, 42% were suffering from dry eye syndrome. Nepp et al showed 43% of diabetics having dry eyes in his study¹³. Hom and De Land showed that 52.9% of patients with either diabetes or borderline diabetes had self-reported clinically relevant dry eyes¹⁴. In a study done in Iran by Manaviat et al.⁷ the prevalence of dry eye syndrome was 54.3% in type 2 diabetics. According to Beaver Dam Eye Study¹⁵, 19.8% of Type 2 Diabetics had dry eyes. The prevalence of dry eye syndrome observed in the present study was comparable with the study done by Nepp et al¹³ and the recent study from Navi Mumbai⁶.

Prevalence of dry eye syndrome among diabetics was high among females (51.11%) compared to males (38.18%) but same was not true statistically ($p=0.228$) suggesting no association between sex and dry eye syndrome in patients with diabetes. Moss et al¹⁵ reported a higher incidence of dry eyes in diabetic women (16.7% compared with 11.4% in men). Sahai et al. reported a higher prevalence amongst females (22.8%) as compared to males

(14.9%)⁴. A study from Iran reported no sex predilection in dry eye syndrome.¹⁶

The prevalence of diabetic microvascular complications is higher in patients with longer duration of diabetes.¹³ These individuals may have an increased risk of developing dry eye syndrome. In our study, the duration of diabetes was reported to be one to five years in 61 patients. The dry eye syndrome was widely prevalent in patients with duration between 11 to 15 years (57.14%) followed by 6 to 10 years (53.85%), 1 to 5 years (39.34%) and least being > 15 years (33.33%) but statistically the same was not true ($p=0.519$). These findings postulate poor association between dry eye syndrome and duration of diabetes. In the study⁷ from Iran, the prevalence of dry eye syndrome was significantly higher in patients with longer duration of diabetes. In type II diabetic patients, most of the long term complications of diabetes are well known to correlate with duration, dry eyes could also be a part of this.

Our study showed higher prevalence of dry eye syndrome in patients with type 2 diabetes as compared to non diabetics aged more than 40 years. The most common complaints of patients with dry eye syndrome were dryness and gritty sensation. Patients with type 2 diabetes did not present with any specific symptom pertaining to dry eye syndrome as compared to normal population. Tear meniscus height, tear film break up time and Rose Bengal staining tests were more reliable and statistically significant and hence may be preferred for screening of patients with dry eye syndrome.

Overall considering increased prevalence of dry eyes, early ocular examination in diabetic patients should be done for early detection of the ocular surface disorders. Examination of dry eyes should be an integral part of the assessment of diabetic eye disease so as to improve the patient's comfort and to prevent or minimize further structural damage to the ocular surface.

Conclusion: The relative risk of developing dry eye syndrome in diabetics is nearly as high as twice compared to the general population. A detailed ocular examination should be an integral part of all patients suffering with diabetes yearly for early detection and management.

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