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Relation of Dry Eye Syndrome with Diabetic Retinopathy in Patients with Type 2 Diabetes Mellitus

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Abstract **Original Research Article**

Background*:** This study was performed to assess the prevalence of dry eye syndrome with diabetic retinopathy in patients with type2 diabetes mellitus and their contributing factors. ***Objective: To investigate whether Dry Eye Syndrome is related with Diabetic Retinopathy in patients with Type-2 Diabetes Mellitus. ***Methodology:*** This cross-sectional observational study was conducted in the Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University from october 2016 to february 2019 to assess relation of Dry Eye Syndrome with type-2 Diabetic Retinopathy patients. Patients attending into Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University, who were diagnosed as a type-2 diabetic retinopathy, were the study population of this study. ***Results*:** we analyzed 95 diabetic retinopathy patients with type 2 diabetes mellitus of which 61.1% patients were male and 38.95% were female. Out of the 95 patients, 66.3% patients had dry eye and 33.7% patients had no dry eye. After categorization according to severity 17.5% patients had mild, 61.9% had moderate and 20.6% patients had severe dry eye. Study findings showed Dry Eye participants mean (SD) age in years was 56.03 (6.63). The reflex secretion of tears, as measured by Schirmer's I method, decreased significantly with increasing age and significant influence was seen in Type 2 diabetes patients after 50 year of age. In the present study, 58.7% of dry eye in diabetic retinopathy patients were males and 41.3%% were females. TBUT was found to be less than10 second in 66.3% dry eye patients but normal TBUT in 33.7% patients. Most of the dry eye patients (71.4%) with type 2 diabetic retinopathy had very poor control of diabetes. In this study, 7.9% patients of mild NPDR, 17.5% patients of moderate NPDR, 57.1% patients of severe NPDR and 17.5% patients of PDR had dry eye. A statistically significant ($P \leq 0.000$) association was found between type-2 diabetic retinopathy and dry eye. ***Conclusion:*** Statistically significant correlation was found between dry eye syndrome and diabetic retinopathy in type-2 diabetes mellitus.

Keywords: Diabetes mellitus, Diabetic retinopathy, Dry eye syndrome, Schirmer's test, Tear film breakup time.

INTRODUCTION

Diabetes is one of the most common medical conditions worldwide and approximately 347 million people in the world are suffering from diabetes mellitus [1]. In Bangladesh, there were 7.1 million case of DM in 2015 and prevalence in adult was 7.4% [2]. Diabetes mellitus has received widespread attention in that it causes life-threatening or debilitating complications in heart, kidney, brain, and eye [3]. In the eye, diabetic retinopathy (DR), cataract, glaucoma, keratopathy, chronic dry eye, and refractive abnormalities are the diseases associated with diabetes [4]. Normal tears consist of three layers: outer lipid layer that prevents evaporation from the surface of the eye, middle aqueous layer made of water mostly and inner mucus layer [5]. A quantitative shortage or qualitative abnormality or pathology in any of these three layers can result in symptoms of dry eye [6]. In one study a correlation was found between the glycated hemoglobin (HbA1C) and the presence of dry eye syndrome. The higher the HbA1c values, the higher the rate of dry eye syndrome [7]. In another study founded that diabetic patients had lower values of tear secretion and values of tear film break up time test (TBUT) than control group [8].

Another hospital-based study showed that DES is more prevalent in individuals with DR and/or

clinically significant macular edema and both DES and retinopathy were associated with HbA1c [9]. Although DR is one of the major diabetic complications and the leading cause of blindness in the working age population worldwide [10], and in Bangladesh prevalence of DR is 21.6% [11, 12]. The ocular surface disorders in the patients with DR have not acquired as much attention [10]. Early diagnosis of dry eye syndrome in diabetic retinopathy patients is important for beginning of treatment in early stages. The present study aims to find out the relation of dry eye syndrome with diabetic retinopathy as its early detection would prevent further progression.

OBJECTIVE

General objective

To assess the relation of dry eye syndrome with diabetic retinopathy in patients with type -2 diabetes mellitus.

Specific objective

- To detect dry eye in diabetic retinopathy patients.
- To detect different types of diabetic retinopathy in patients with type -2 diabetes mellitus.
- To explore the relationship of dry eye syndrome with different types of diabetic retinopathy in patients with type -2 diabetes mellitus.

METHODS AND MATERIALS

Type of study **:** Cross sectional Observational study.
Place of study **:** Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU).
Period of study **:** October 2016 to February 2019.
Study population **:** Different types of type-2 diabetic retinopathy Patients of either sex attended in the Department of Ophthalmology, BSMMU.

Criteria of study population

The selection was done on the basis of the following criteria:

Inclusion criteria

- Both male and female DR patients with DM type-2 wanted to participate in the study.
- Age group = patients of 45years and older had type-2 DM with retinopathy (As adults aged from 45 to 64 years are the most diagnosed age group for type-2 diabetes according to the Centers for Disease Control and Prevention in year 2012).

Exclusion Criteria

- Patients who had undergone ocular surgery in the past.
- Patients who wear contact lens.
- Patients who were on local or systemic medication known to cause dry eye (antihistamines, tricyclic antidepressants, oral contraceptives, hormone replacement therapy and some antihypertensives).
- Patient with other ocular surface disease including meibomean gland dysfunction and systemic disease which known to cause dry eye other than diabetic mellitus. (Allergies, Sjogren's syndrome, Rheumatoid arthritis, Parkinson, Lupus).
- Pregnant women.

Sampling Technique

Purposive sampling technique was applied to collect the sample from the study population**.** The patients, who met the criteria of inclusion, were selected.

Sample Size

In this study around 95 cases were taken because of limited time frame.

Study Procedure and design

The study was a cross sectional observational study. The study protocol was adhered to the tenets of the Declaration of Helsinki. Population of the study was type-2 diabetic retinopathy patients attending into the department of ophthalmology, Bangabandhu Sheikh Mujib Medical University. Different types of DR patients with DM type-2 of either sex were screened for dry eye over a period of 15 months. The Individual eyes from study population which met the criteria of inclusion were selected.

Data Collection, processing and analysis

The demographic information, relevant history, examination findings, Investigation reports, fundus examination of all the study subjects were recorded in the data collection sheet. After compilation, the data was presented in the form of tables, figures and graphs, as necessary.

Statistical analysis of the results was done by using computer based software, SPSS (SPSS Inc., Chicago, IL, USA). Descriptive statistics: Mean SD, Frequency and Percentage. A probability ‘P’ value of 0.05 or less was considered as significant.

RESULT

This cross-sectional observational study was conducted in the Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University from October 2016 to February 2019 to assess the relation of Dry Eye Syndrome with type-2 Diabetic Retinopathy patients. Patients attending into Department of Ophthalmology, Bangabandhu Sheikh Mujib Medical University, who were diagnosed as a type-2 diabetic retinopathy, were the study population of current study.

Table-I: Distribution of study participants according to age (n=95)

Current age	**Dry Eye**		**No Dry Eye**	
(in years)	#	%	#	%
<50	12	19.0	17	53.1
50-60	36	57.1	12	37.5
>61	15	23.8	3	9.4
Total	**63**	**100.0**	**32**	**100.0**
Mean (SD)	***56.03 (6.63)***		***51.94 (6.47)***	
p=.002				

Table I presents study participants' age in years. Study findings indicate mean (SD) age in years of Dry Eye group is 56.03 (6.63) and No Dry Eye is 51.94 (6.47) years. These findings are statistically significant.

Table-II: Distribution of study participants according to occupation

Occupation	**Dry Eye**		**No Dry Eye**	
	#	%	#	%
House hold work	26	41.3	10	31.3
Businessman	17	27.0	8	25.0
Working	11	17.5	10	31.3
Not working	9	14.3	4	12.5
Total	**63**	**100.0**	**32**	**100.0**
p=.481				

Table II shows study participants' present occupational status.

Table-III: Distribution of study participants HbA1c level (n=95)

HbA1c Level	**Dry Eye**		**No Dry Eye**	
	#	%	#	%
<7.50	2	3.2	4	12.5
7.50-8.50	16	25.4	21	65.6
>8.50	45	71.4	7	21.9
Total	**63**	**100.0**	**32**	**100.0**
Mean (SD)	**8.79 (.60)**		**8.10 (.89)**	
p=.000				

Table III presents study participants HbA1c level. Mean (SD) HbA1c level 8.79 (.60) for Dry Eye group and 8.10 (.89) for No Dry Eye group and this is highly statistically significant.

Table-IV: Distribution of study participants Schirmer's test findings (n=95)

HbA1c Level	**Dry Eye**		**No Dry Eye**	
	#	%	#	%
<7.50	2	3.2	4	12.5
7.50-8.50	16	25.4	21	65.6
>8.50	45	71.4	7	21.9
Total	**63**	**100.0**	**32**	**100.0**
Mean (SD)	**8.79 (.60)**		**8.10 (.89)**	
p=.000				

Table IV shows study participants' Schirmer's test results. These findings are statistically highly significant.

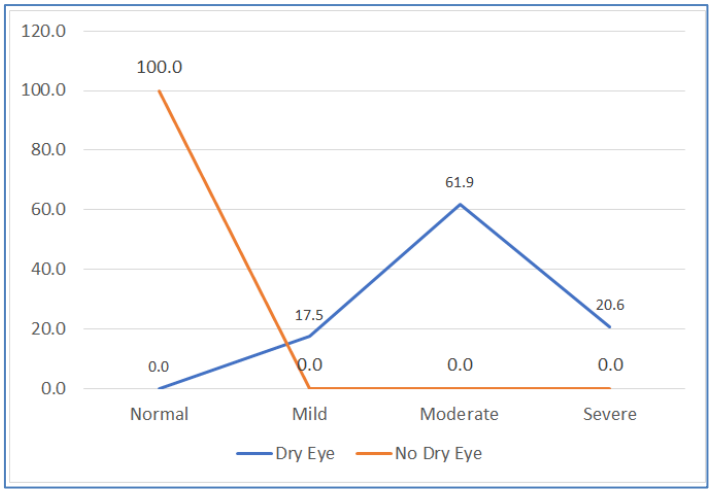

Fig-4: Line chart of study participants Schirmer's test findings

DISCUSSION

Diabetic retinopathy and dry eye syndrome appear to have a common relationship. Diagnosis of dry eye syndrome was based on symptoms, signs and diagnostic tests which included TBUT and Shirmer's test and a large number of type-2 diabetic retinopathy patients had symptoms or signs of ocular surface damage, abnormal TBUT and Schermer's test values.

Keeping blood sugar levels as tightly controlled as possible is the first step in preventing and remedying dry eye syndrome associated with diabetes mellitus. Not only does chronically high blood glucose lead to autonomic neuropathy affecting the tear gland, it also affects the quality of tears by increasing the amount of glucose in those tears and disrupting their normal chemical composition, a factor that also contributes to symptoms of dry eye syndrome.

Current study analyzed 95 diabetic retinopathy patients with type -2 diabetes mellitus and found 66.3% of patients had dry eye syndrome and 33.7% patients had no dry eye. Various studies had previously reported increased incidence of dry eye syndrome in diabetic patients [13]. In 2008 found that 54.3% of patients with type-2 diabetic retinopathy suffered from dry eye syndrome and which was higher than patients without diabetic retinopathy. A study by Seifart and Strempel in1994 showed that 52.8% of diabetic subjects complained of dry eye symptoms [7]. They concluded that close monitoring of diabetic patients and good blood sugar regulation was important for the prevention of dry eye syndrome and retinopathy. High prevalence of dry eye disorder could be explained by low tear production in DM patients related to dysfunction of the autonomic nervous system [14]. After categorization according to Schirmer's test current study showed that 17.5% patients had mild, 61.9% had moderate and 20.6% patients had severe dry eye.

There were certain aspects of tear physiology change with age, such as tear volume, tear film stability, and reflex secretion by the lacrimal gland. The secretion of tears, decreased significantly with increasing age was observed by Schirmer in 1903. Kaiserman *et al.* in 2005 have reported that the prevalence of dry eye increased with age [15]. In the beaver dam eye study, the ageing effect was significant after 65 years of age [17, 18]. Current study findings indicated that mean (SD) age of dry eye patients was 56.03 (6.63) year and significant influence was seen in Type-2 patients after 50 year of age. The majority (57.1%) of diabetic retinopathy in Type-2 DM patients in the age group of 50-60 years had dry eye syndrome. Therefore, in the present study, increased of dry eye in age group 50-60 could be because of DM.

In current study, out of 95 diabetic retinopathy patients with type-2 diabetes mellitus 61.1% patients were male and 38.95% patients were female. Among the patients with dry eye syndrome in DR in type-2 DM, 58.7% were male and 41.3% were female which was similar to the finding of a population study done by Lee *et al*. [19]. In 2002 that showed the prevalence of dry eye was 1.4 times higher for men than women. But Moss *et al*. in 2000 reported a higher incidence (16.7%) of dry eye syndrome in type-2 diabetic women [20]. Higher incidences DES in male in this study could be as female diabetic retinopathy patients using OCP and hormone replacement therapy were ruled out.

Most of the dry eye patients (41.3%) were household worker, 27% patients were businessmen, 17.5 involved in other works and 14.3% patients were not involve in any work. The previous study including current study could not found any statistically significant relation between dry eye in diabetic retinopathy and occupation.

Most of the dry eye syndrome patients (71.4%) with type 2 diabetic retinopathy had very poor control of diabetes. This finding was similar to the study done by Chulyoon *et al.* in 2004 that suggested poor metabolic control, presence of diabetic retinopathy

stages were risk factors for tear film and ocular surface disorder in DM [21]. In addition, Nazafi *et al*. in 2013 found that both dry eye and diabetic retinopathy had significant correlation with HbA1c [25].

In the current study, TBUT was found to be less than10 second in 66.3% dry eye syndrome patients of which 47.6% patients had 7 second, 31.7% had 8 seconds and 20.6% had 9 seconds of TBUT but normal TBUT in 33.7% no dry eye patients. Devi and Gowda in 2016 showed that TBUT was found to be less than10 second in 65% patients which was similar to current study finding [16]. In Jin study 100 patients with type-2 diabetes were compared with 80 normal healthy controls and TBUT was significantly lower in type 2 diabetic patients [23].

In the present study, 7.9% patients of mild NPDR, 17.5% patients of moderate NPDR, 57.1% patients of severe NPDR and 17.5% patients of PDR had dry eye. It was comparable with the study by Tanushree and Gowda in 2014 that showed 44.44% patients of mild NPDR, 22.22% patients of moderate NPDR 16.67% patients of severe NPDR and 5.56% patients of PDR had dry eye [18]. In a study by Manaviat *et al*. in 2008 showed that Dry eye syndrome was more frequent in diabetic patients with DR (P = 0.02). They found 17.1% patients with mild NPDR, 17.1% patients with moderate NPDR, 11.1% patients with severe NPDR and 25.1% patients with PDR which was more than the current study [13].

CONCLUSION

DM and dry eyes appear to have common association. Statistically significant correlation was found between dry eye and diabetic retinopathy. The findings of the study may be used as a baseline study for further research and will provide essential information to improve the facilities for the treatment of patients.

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