

Efficacy of Schirmer's Test I and Tear Break Up-Time (TBUT) test among Patients of Type II Diabetes with Dry Eye

FAIZA SHARIF¹, SYED NISHAT AKRAM², HAFSA SHARIF³, RIDA KHALID⁴, ARSLAN SALEEM CHUGHTAI⁵, MUHAMMAD AJMAL CHAUDHARY⁶

¹Optometrist and Orthoptist, Zainab Medicare Center, Haroonabad, Bahawalpur.

²Senior Lecturer, Shalamar Institute Health Sciences Lahore, Pakistan.

³Optometrist, Layton Rahmatullah Benevolent Trust, Sadiqabad.

⁴Optometrist and Orthoptist, Shalamar Medical and Dental College, Lahore.

⁵Senior Lecturer, Shalamar Institute of Health Sciences Lahore, Pakistan.

⁶Orthoptist, Children's Hospital, Lahore

Correspondence to: Faiza Sharif

ABSTRACT

Objective: To determine the efficacy of Schirmer's I test and TBUT test in dry eye changes in type II diabetic patients.

Subjects & Methods: In these prospective study 58 (116 eyes) dry eye patients with diabetes mellitus type II patients with minimum duration of 5 year, with BCVA of 6/12 to 6/6. After baseline examination, TBUT Test and Schirmer's Test I were performed to measure dry eye changes occurred due to DM type II. As the data was not normally distributed therefore Wilcoxon sign rank test were applied using p-value ≤ 0.05 as significant.

Results: In the current study on average duration of diabetes was 5.90 ± 1.17 (Range 5-9) years. 30(50.8%) had 5 years history of diabetes, 15(25.4%) had 6 years, 7(11.9%) has 7 years, 4(6.8%) had 8 years and 3(5.1%) had 9 years history of diabetes. Schirmer's Test I Ocular Dexter (OD) & Ocular Sinister (OS) were 12.90 ± 3.65 mm and 12.56 ± 3.23 mm. Mean difference was statistically significant (p-value 0.022). Whereas mean TBUT of Ocular Dexter (OD) & Ocular Sinister (OS) were 18.81 ± 6.730 and 19.63 ± 7.083 respectively, the mean difference was not statistically significant (p-value 0.342). Differences between TBUT & Schirmer's I test of OD and TBUT & Schirmer's I test of OS were statistically significant (p-value < 0.001).

Conclusion: This study evaluates that TBUT Test are much significant as compared to Schirmer's test because they have so much difference in their Mean \pm Std. Deviation.

Keywords: TBUT Test, Schirmer's Test I, Diabetes type II, Dry Eye.

INTRODUCTION

Kerato-conjunctivitis sicca, commonly known as dry eye syndrome, is prevalent among patients with diabetes mellitus^{1,2}. Dry eye is frequent among diabetic retinopathy patients. But the symptoms are similar as found among non-diabetic patients³, which include decreased visual acuity, photophobia, itching and tearing. Alpha lipoic acid, A natural and universal antioxidant, can be a drug of choice for its treatment as it has anti-inflammatory effect and protects the retinal cells.⁴

There is a mix opinion about pathophysiology of dry eye and diabetes. Literature shows that poor glycaemic control affects the Lacrimal Function Unit (LFU) which leads to decreased production of tears and increased evaporation of tears⁵⁻⁷. Liu et al., 2019 found significantly increase in level of epidermal growth factor (EGF) in tears among diabetic patients with dry eye. He also documented the positive correlation of EGF with corneal fluorescein staining (CFS) and inverse relation with the Schirmer I test.⁸ A prospective, case control study conducted by Sandra Johanna et al., 2019 reveals that glycaemic index (HbA1c) was directly correlated with OSDI whereas Meibomian glands dysfunction was inversely correlated with Non-Invasive tear film break-up time (NIBUT)⁹.

Dry eye is diagnosed by tear film break-up time (TBUT) test, Schirmer's Test Epithelial Staining and Impression cytology¹⁰. TBUT is the time which is taken by the tear film to break up following a blink. Normal range is 10-15 secs below to 10 secs is considered dry eye¹¹. Although quantity of the aqueous tears production are normal. TBUT is done to assess the tear film stability. Schirmer's type I is performed for detecting dry eye with Special No. 41 Whatman filter paper of size 5×35 ¹². It is placed in the conjunctiva and its wetting is noted after 5 minutes. Greater than 10 mm of wetting the filter paper after 5 minutes is considered normal. 6 mm or less, it is documented as dry eye¹³.

The aim of this study was to compare the results of Schirmer's test and TBUT test in type II diabetic patients to measure which test has good efficacy. It is performed to assess the tear film production changes of dry eye due to the increase in the diabetic duration and to evaluate the tear film integrity on the ocular surface.

METHADODOLOGY

This Cross-Sectional Study was conducted from Oct 2021 to Dec 2021 in the Eye OPD of Shalamar Hospital, Lahore. During the time period 58 participants (116 eyes), sample size was calculated assuming Schirmer's type I 6.38 ± 3.54 and Tear film break-up Time (TBUT) 9.25 ± 5.52 ¹⁴, were selected using non probability, purposive sampling. Subjects aged between 40-50 years of either sex with the minimum duration of 5 years of Diabetes Mellitus with best corrected visual acuity between 6/12 or more. After the baseline examination, Fluorescein strip for TBUT, was placed in the inferior fornix of the both eyes at the same time and the tear film was observed in Seconds between the last blink and the appearance of the first dry spot under a cobalt blue illumination. For Schirmer's Type I, Schirmer's strip was also instilled inside the lower fornix of the both eyes at the same time. Patient was asked to close their eyes for 5 minutes and result was recorded in mm.

The data was collected and analysed using SPSS 25.0 version. Frequencies were calculated for qualitative data (such as gender) whereas mean and standard deviation was computed for quantitative variables (such as visual acuity and age). 5% level of significance was used for all statistical tests. Wilcoxon sign rank test was used for the comparison of qualitative variables and p-value ≤ 0.05 was taken as significant.

RESULTS

Mean age of Type-II Diabetes with dry eye was 47.2 ± 2.062 . Among them 32(54.2%) were male and 27(45.8%) were Female. Right side visual acuity of 31(52.5%) subjects was 6/6, 21(35.6%) was 6/9 and 7(11.9%) subject's right eye visual acuity was 6/12. Similarly Left side visual acuity of 27(45.8%) 6/6 were present in individuals, 6/9 were seen in 19(32.2%) subjects and 6/12 was in 13(22.0%) patients in left eye. There was weak and inverse correlation of Age and Duration of Diabetes with Visual Acuity, TBUT OS (seconds) and Schirmer's Test I OD (mm) (Table 1)

Average TBUT of Right Eye (OD) was 12.90 ± 3.652 min (range 3-19) and Left Eye (OS) 12.56 ± 3.228 min with range of (range 3-17). Mean Schirmer's I Test for right eye (OD) was 18.81 ± 6.730 mm (range 4-32) and for left eye (OS) was 19.63 ± 7.083 mm (range 3-35)

Table 1: Comparison of TBUT or Schirmer's Test type I in OD & OS eyes.

	Duration of Diabetes Mellitus (Years)	Visual Acuity	Visual Acuity Left Eye (OS)	TBUT OD (Sec)	TBUT OS(sec)	Schirmer's Test I OD (mm)	Schirmer's Test I OS(mm)
Age(in years)	0.560**	0.320*	0.392**	-0.187	-0.274*	-0.207	-0.215
Duration of Diabetes Mellitus (Years)		0.139	0.103	-0.168	-0.217	-0.206	-0.190
Visual Acuity			0.724**	-0.010	-0.020	0.068	0.098
Visual Acuity Left Eye (OS)				-0.109	-0.209	-0.063	-0.044
TBUT OD (Sec)					0.815**	0.642**	0.601**
TBUT OS(Sec)						0.610**	0.628**
Schirmer's Test I OD (mm)							0.930*

*Correlation significant at 0.05, **Correlation significant at 0.01

Table 2: Gender wise comparison of Tear Breakup Time (TBUT) and Schirmer's I test

			Gender		Total
			Male	Female	
Tear Breakup Time (TBUT)	Right Eye	Suspicious Tear Film	9(28.1%)	7(25.9%)	16(27.1%)
		Normal	23(71.9%)	20(74.1%)	43(72.9%)
	Left Eye	Suspicious Tear Film	8(25.0%)	6(22.2%)	14(23.7%)
		Normal	24(75.0%)	21(77.8%)	45(76.3%)
Schirmer's I test	Right Eye	Aqueous deficient dry eye	4(12.5%)	5(18.5%)	9(15.3%)
		Normal	28(87.5%)	22(81.5%)	50(84.7%)
	Left eye	Aqueous deficient dry eye	3(9.4%)	5(18.5%)	8(13.6%)
		Normal	29(90.6%)	22(81.5%)	51(86.4%)

According to right eye positive predictive value of Schirmer's I test as compared to TBUT was 6(66.7%) whereas negative predictive value was 40(80.0%) overall accuracy of both tests was 77.97%(95% C.I. 67.39% to 88.54%). According to left eye positive predictive value of Schirmer's I test as compared to TBUT was 6(75.0%) and negative predictive value was 43(84.3%) overall accuracy was 83.05% (95% C.I. 73.48% to 92.62%)

DISCUSSION

Diabetes is a metabolic disease due to insulin secretion deficiency or defection in its response. So it leads to many systemic, neurological and ocular complications and one of them is Dry eye as the DM duration increases with the passage of time. According to the results refractive error severity was in between mild to moderate. This study depicts that TBUT Test and Schirmer's test were significant in DM patients BCVA was also restricted means very near to easily manageable vision.

Li, Deng et al. 2012 compared only Schirmer's test I (to check basal secretion of tear film) and II results to (observe basal and reflex secretions) and their functions with dry eye symptoms. It showed that Schirmer's test type I and II both are significant for dry eye diagnosis¹⁵⁻¹⁹

Lyu, Zeng et al. 2019evaluated Schirmer's Test I on the type II diabetic group, further divided into two groups according to duration of diabetes mellitus less than 10 yearsand more than 10 years, and non-DM group.Schirmer's test I results were not significant among dry eye patients with diabetes less than 10 years while other groups had high results²⁰.It was also observed that DM type II have also dry eye symptoms in less than 10 years of DM duration. This could be reason of low efficacy of Schirmer's test I in our study.Schirmer's test due to high false negative rate always have been a debate or conflict in diagnosis dry eye but in this research it measured significant results. But overall over results are compare able with the Kaštelan, Tomić et al. 2013²¹.

Kesarwani, Rizvi. et al. 2017reported that TBUT ,Schirmer's test I and CIC(Conjunctival Impression Cytology) and RBC measurements were significant in diabetic group as compared to control group. In this study TBUT Test has good significance than other tests that were performed²². Similarly (Alves, Reinach. et al. 2014) research showed explained that TBUT , Schirmer's I Test are best Dry eye diagnosing tests with 99.3% accuracy, specificity 95% and sensitivity 100%¹².

In the current study the overall duration of diabetes was less than 10 years²⁰ that could be the reason that no statistically

significant relationship of diabetes was found with visual acuity, tear break up time test and tear production assessment test. Therefore it is also recommended for future researchers that consider the duration of diabetes as well as complaint of dry eye.

CONCLUSIONS

Diabetes is a metabolic disorder which causes dry eye as the duration of diabetes increases. Our study indicates that dry eye chances also occurs,if duration of diabetes mellitus is less than 10 years. This also depicts the comparison of TBUT and Schirmer's type I tests with each other, However both tests are significant for dry eye disease but TBUT is more effective as compared to Schirmer's test according to differences in their mean and standard deviation.

REFERENCES

- Baig MA, Munir R. Dry eye disease and diabetes mellitus. Pakistan Journal of Ophthalmology. 2020;36(3).
- Lemp MA, Foulks GN. The definition and classification of dry eye disease. Ocul Surf. 2007;5(2):75-92.
- Najafi L, Malek M, Valojerdi AE, Aghili R, Khamseh ME, Fallah AE, et al. Dry eye and its correlation to diabetes microvascular complications in people with type 2 diabetes mellitus. Journal of Diabetes and its Complications. 2013;27(5):459-62.
- Ajith TA. Alpha-lipoic acid: A possible pharmacological agent for treating dry eye disease and retinopathy in diabetes. Clinical and Experimental Pharmacology and Physiology. 2020;47(12):1883-90.
- Yeh TN, Graham AD, Lin MC. Relationships among tear film stability, osmolarity, and dryness symptoms. Optometry and vision science: official publication of the American Academy of Optometry. 2015;92(9):e264.
- Zhang X, Zhao L, Deng S, Sun X, Wang N. Dry Eye Syndrome in Patients with Diabetes Mellitus: Prevalence, Etiology, and Clinical Characteristics. Journal of Ophthalmology. 2016;2016:8201053.
- Seifart U, Stempel I. [The dry eye and diabetes mellitus]. Ophthalmologie. 1994;91(2):235-9.
- Liu R, Ma B, Gao Y, Ma B, Liu Y, Qi H. Tear Inflammatory Cytokines Analysis and Clinical Correlations in Diabetes and Nondiabetes With Dry Eye. American Journal of Ophthalmology. 2019;200:10-5.
- Sandra Johanna GP, Antonio L-A, Andrés G-S. Correlation between type 2 diabetes, dry eye and Meibomian glands dysfunction. Journal of Optometry. 2019;12(4):256-62.
- Craig JP, Tomlinson A. Importance of the lipid layer in human tear film stability and evaporation. Optometry and vision science. 1997;74(1):8-13.
- Kallarackal G, Ansari E, Amos N, Martin J, Lane C, Camilleri J. A comparative study to assess the clinical use of Fluorescein Meniscus Time (FMT) with Tear Break up Time (TBUT) and Schirmer's tests (ST) in the diagnosis of dry eyes. Eye. 2002;16(5):594-600.

12. Alves M, Reinach PS, Paula JS, Vellasco e Cruz AA, Bachellet L, Faustino J, et al. Comparison of diagnostic tests in distinct well-defined conditions related to dry eye disease. *PloS one*. 2014;9(5):e97921.
13. Khanal S, Tomlinson A, McFadyen A, Diaper C, Ramaesh K. Dry eye diagnosis. *Investigative ophthalmology & visual science*. 2008;49(4):1407-14.
14. Karampatakis V, Karamitsos A, Skriapa A, Pasiadis G. Comparison between normal values of 2-and 5-minute Schirmer test without anesthesia. *Cornea*. 2010;29(5):497-501.
15. Li N, Deng X-G, He M-F. Comparison of the Schirmer I test with and without topical anesthesia for diagnosing dry eye. *International journal of ophthalmology*. 2012;5(4):478.
16. Negi A, Vernon SA. An overview of the eye in diabetes. *Journal of the Royal Society of Medicine*. 2003;96(6):266-72.
17. Derakhshan A, Abrishami M, Khajedaluae M, Omidtabrizi A, Moghaddam SG. Comparison between tear film osmolar cocentration and other tear film function parameters in patients with diabetes mellitus. *Korean Journal of Ophthalmology*. 2019;33(4):326-32.
18. Sirang Z, Chaudhry TA. Dry eye symptoms among diabetics: an exploratory study on knowledge, attitude, and practice. *Ophthalmology Journal*. 2019;4:105-8.
19. Kaiserman I, Kaiserman N, Nakar S, Vinker S. Dry eye in diabetic patients. *American journal of ophthalmology*. 2005;139(3):498-503.
20. Lyu Y, Zeng X, Li F, Zhao S. The effect of the duration of diabetes on dry eye and corneal nerves. *Contact Lens and Anterior Eye*. 2019;42(4):380-5.
21. Kaštelan S, Tomić M, Salopek-Rabatić J, Novak B. Diagnostic procedures and management of dry eye. *BioMed research international*. 2013;2013.
22. Kesarwani D, Rizvi SWA, Khan AA, Amitava AK, Vasenwala SM, Siddiqui Z. Tear film and ocular surface dysfunction in diabetes mellitus in an Indian population. *Indian Journal of Ophthalmology*. 2017;65(4):301.