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Assessment of dry eye using Schirmer test in patients attending a tertiary hospital eye clinic in Nigeria

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Abstract

Background: Dry eye disease (DED) is a frequently encountered ocular morbidity seen among adult patients attending ophthalmic clinics in Nigeria. It can be assessed using different methods although there is differing consensus on reliable tests for accurate diagnosis.
Aim: The aim of this study was to assess DED using Schirmer 1 without anaesthesia among adult patients attending the Eye Clinic in a tertiary hospital in Calabar.
Methodology: This was a cross sectional study among adult patients who attended the Eye Clinic of University of Calabar Teaching Hospital who were recruited consecutively from January 1st to March 31st, 2019. All consenting participants had comprehensive eye examination and were assessed for DED using the Schirmer 1 Test. Test values of less than 10mm were diagnostic of aqueous tear deficiency. Initial data categorization yielded frequencies, percentages and proportions. Categorical variables were analysed using Chi-square test and continuous variables using Student's t-test. Statistical significance was found where p-values were <0.05 at one degree of freedom.
Results: Overall, 73 participants were included in the study 29 males and 44 females with male-female ratio of 1:1.5, and the prevalence of DED was 28.8%. Most participants had normal distance visual acuity in both eyes. There was a statistically insignificant inverse linear relationship between age and Schirmer 1 test. The relationship between gender and Schirmer 1 test values and consequently for dry eye was statistically significant, p 0.04.
Conclusion: This study showed no significant association between DED and age. Female gender was associated with a higher risk of DED but a significant association between DED compared to the male gender. Its assessment in persons with other ocular complains is important. Primary and secondary prevention strategies are recommended.

Key words: *Dry Eye Disease, Schirmer's Test, Calabar*

Introduction

The tear film is primarily responsible for maintaining a smooth optical surface between blinks. It also functions to remove pathogens and irritants from the ocular surface, and its varied components help to control the normal ocular flora. Tears dilute toxins and allergens and allow for diffusion of oxygen and other nutrients to the cornea. Maintenance of the tear film is, therefore, key to normal corneal function.

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The tear film is composed of aqueous, mucinous, and lipid components in a uniform gel structure.[1] An alteration in any of the components of the tear film can result in dry eye disease (DED).
Generally, DED is a multifactorial disease of the tears and the ocular surface that results in symptoms of discomfort, visual disturbance, and tear film

instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.[2] It is broadly classified into the aqueous-tear deficient dry eye and evaporative dry eye.[2]

It is one of the most frequently encountered ocular morbidities presenting to eye care practitioners, with about 25% of patients who visit ophthalmic clinics reporting dry eye symptoms.[3,4,5] This, therefore, makes the disease a growing public health problem.[3,4,5] Appropriate primary and secondary prevention strategies targeted at controlling the causes and risk factors of DED among susceptible populations have been shown to result in a reduction in the chronic morbidity associated with the development and progression of DED.[4] Generally, these effective strategies include (but are not limited to) targeted health education, screening for risk factors and for DED, lifestyle and workplace modifications, prophylactic eye care and medical therapy where indicated. Effective prevention can lead to a significant reduction in the overall incidence of DED.[4]

An assessment of DED can be performed using several methods, including through the application of a variety of questionnaires like the McMonnies Dry Eye History, Ocular Surface Disease Index (OSDI), Salisbury Eye Evaluation, Standard Patient Evaluation of Eye Dryness (SPEED) questionnaire,[6] and myriads of objective tests, including tear Break-up Time (TBUT), ocular surface staining with vital ophthalmic dyes, and Schirmer test, amongst others.[2] However, no single diagnostic test can be performed in the field or the clinic that can reliably differentiate people who have DED from those who do not.[2] It is noteworthy that although there are various diagnostic tests in common clinical usage, there is no agreement on which combination of tests should be used to define the disease, either in the clinic or for research purposes.[2] A major setback has been the reported lack of correlation between patients' irritative ocular symptoms and the results of selected clinical tests for DED.[2]

Schirmer test is one of the diagnostic tests used in measuring tear production and in assessing aqueous-tear deficiency. It is one of the most commonly done DED evaluation test. It was described in 1903 by Schirmer and has evolved with varied methods of performing the test.[7] There are two basic types of Schirmer test viz; Schirmer 1 and Schirmer 2. Schirmer 1 test is further subdivided into Schirmer 1 without anaesthesia and Schirmer 1 with anaesthesia.[7] The Schirmer 1 test without anaesthesia measures total tear secretion, including reflex and basal tear secretion and this method was utilized in this study.

This study was aimed at assessing DED using Schirmer 1 without anaesthesia in patients attending eye clinic in a tertiary hospital in Calabar.

Patients and Methods

The study was conducted at the Eye Clinic of the University of Calabar Teaching Hospital (UCTH), Calabar. Located in Calabar Metropolis, the UCTH offers tertiary health care services to people living in Cross River State and its environs. Patients attending the Eye Clinic and who consented to participate in the study were recruited consecutively. The study was conducted between January and March, 2019.

Inclusion Criteria: All consenting treatment-naïve adult patients presenting to the Eye Clinic of the University of Calabar Teaching Hospital during the study period. These patients were consecutively recruited.

Exclusion Criteria: Adult Eye Clinic attendees who had undergone ophthalmic surgical procedures 6 months or less from the study period and patients who had acute ocular surface disease (including corneal disease) during the study period were excluded. Also excluded were eligible patients who declined consent to participate in the study and patients who used contact lenses. Patients with ocular prosthesis were similarly excluded from the study.

Patients' socio-demographic information was obtained and a comprehensive ocular examination was done. The presence of DED in each participant was assessed using Schirmer test 1 without anaesthesia. The process of testing was explained to the patients and then Schirmer testing was carried out by inserting a Schirmer test strip (Batch No.6959134700093), a Whatman Number 41 filter paper, into the temporal lower conjunctival sac at the junction of the inner two-thirds and outer one-third of the lower eyelids, avoiding contact with the cornea. Patients were then instructed to gently close

the eyelids, without squeezing. Both eyes were tested at the same time and any excess moisture from the patient's eyelid margin and the fornix was removed with cotton-tipped applicator. After 5 minutes, the strip was removed from the eye, and the length of the wetted strip was recorded in millimetres and read off. Test values of less than 10mm were diagnostic of aqueous tear deficiency. The diagnosis and Schirmer test values were then entered into Excel Spreadsheet and analysed using STATA version 14, by StataCorp LLC 2015, Texas USA.

Data were subsequently categorized by socio-demographic and clinical variables and subjected to descriptive statistical examination to yield frequencies, percentages, and proportions. Test for significance of categorical variables was conducted using Chi-square, and continuous variables using the student's t-test. Logistic regression was performed to determine significant associated factors. All p-values <0.05, at one degree of freedom, were considered statistically significant.

Results

Socio-demographics

A total of 146 eyes of 73 participants were enrolled in the study, with 29 males and 44 females, giving a male-female ratio of 1:1.5. The mean age was 55.2 years with a range of 32-84 years. The gender distribution of study participants is shown in Figure 1.

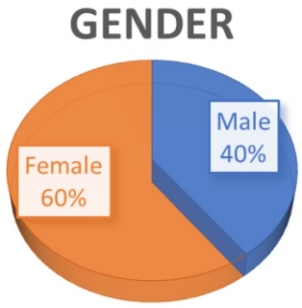

Figure 1: Gender distribution of participants

Table 1: Best corrected visual acuity (BCVA) of study patients

BCVA Category	VA	**Right Eye** Frequency (Percentage)	**Left Eye** Frequency (Percentage)
Normal	6/5->6/12	29(30.4)	36(49.3)
Mild	6/12->6/18	13(17.8)	25(34.3)
Moderate	6/18->6/60	21(28.8)	25(34.3)
Severe	6/60-3/60	6(8.2)	1(1.4)
Blindness	<3/60	4(5.5)	2(2.7)

Table 2: Regression analysis of age and Schirmer 1 test

Age	**Coefficient**	**95% Confidence Interval**	**p-value**
	-0.09	-0.19 -0.18	0.92

Table 3: Association of Schirmer 1 test with gender

Sex	Mean± Standard Deviation	T-test	95% Confidence Interval	p-value
Male	3.17± 0.39	-2.06	3.05-3.30	0.04*
Female	2.99± 0.34		2.87-3.11	
Combined	3.06± 0.38		2.98-3.15	

**Statistically significant*

Proportion of study participants with dry eye disease

Of the 73 study participants, 21(28.8%) had DED using Schirmer test.

Visual acuity of participants was categorized based on the World Health Organisation (WHO) classification of blindness and visual impairment. The majority of the participants had normal distance vision in both eyes, with two participants having severe visual impairment in their left eyes. This is presented in Table 1.

Relationship between Schirmer 1 test and age

Table 2 below shows the linear regression analysis between age and the Schirmer 1 test. There was an inverse linear relationship between age of study participant and the Schirmer 1 test. For every unit increase in age, the Schirmer 1 test decreased by a coefficient of -0.01. This relationship was, however, not statistically significant (95% Confidence Interval: -0.19-0.18, p-value: 0.92).

Association of Schirmer 1 test with gender

An independent t-test was done to compare the means of the Schirmer 1 test values between males and females, as displayed in Table 3 below. There is a statistically significant relationship between gender and Schirmer 1 test values; showing that gender is a significant predictor for Schirmer 1 test values and consequently for DED.

Discussion

A multifactorial disease, and several methods have been utilized in assessing DED. The assessment of DED can be done subjectively using questionnaires and objectively using a variety of testing methods with the Schirmer's tests being one of the simple,

readily available testing methods worldwide.

This study showed no significant association between DED and age. This finding is similar to a study in Saudi Arabia which showed no difference in dry eye prevalence with respect to age.[8] It is, however, contrary to findings by Shanti et al.[6] who reported that DED was more prevalent in subjects older than 45 years and by Moss et al. in the Beaver Dam Eye Study cohort.[9] The findings were also not in agreement with reports of other studies in Nigeria,[10] and in other countries like the US, China, Japan, and Spain, where some studies have shown that DED increases with age.[11-15] Aging usually leads to impaired Meibomian gland function, promoting tear film instability and evaporative dry eye. There is also a reduction in androgen levels with age, contributing to the development and increased prevalence of DED.[12] This may be due to a reduction in flow and tear volume. In addition, increased evaporation, which leads to increased tear film osmolarity has been observed in older people. Reasons for the disparity between our findings and what has been earlier reported are unknown and studies on DED and age in our environment may provide answers.

This study found a significant association between DED and sex. This is comparable to another study in South-South Nigeria.[16] It is also in agreement with the study by Shanti et al,[6] which reported that DED was associated with sex, where females were shown to be at 1.5 times higher risk of developing DED than males. The result of a meta-analysis of data on DED in China among persons aged 40 years and above, and a study in Japan showed that DED was more common in females than in males.[13,14] The findings were, however, in contradistinction to another hospital-based study in Nigeria by Onwubiko et al.[10] Studies by Schein et al[17] and Lin et al[18] also did not find DED to be significantly associated with sex. The reasons for the conflicting findings may be due to differences in the population selection, the sampling method, and the criteria and method of diagnosing dry eye.

Limitations of study

Assessment of DED was limited to Schirmer 1 test only. The application of other testing modalities may have provided the substrate for a more elaborate discussion. A larger sample size and a longer study period may provide more generalizable inferences.

Conclusion

The frequency of DED in this study was 28.8%. DED was found to be significantly associated with sex but not with age. It is important to assess for DED in persons who may present with other ocular complaints. Due to its high prevalence in our study population, we recommend the timely institution of primary and secondary prevention strategies in the management protocol of patients who are at risk of the development or progression of DED in our environment.

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