



ORIGINAL RESEARCH PAPER

Education

ANALYSIS OF BASAL TEAR PRODUCTION IN EYE PATIENTS ATTENDING THE EYE CLINIC OF THE BSUTH, MAKURDI, NORTH-CENTRAL NIGERIA

KEY WORDS: Basal, tears, Schirmer's test, Benue

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ABSTRACT

INTRODUCTION: The tear fluids provide the cornea with nourishment and smooth optical surface for ideal visual function. Patients' demographics, internal and external factors can have influence on the tear secretions.
AIM: To analyse the demographics of tear secretion in Benue State residents attending the eye clinic at the Benue State University Teaching Hospital, Makurdi, Nigeria
METHODOLOGY: This is a prospective study of one hundred patients resident in Benue State who attended the eye clinic of the Benue State University Teaching Hospital, Makurdi between March 2018 and July 2018. All cases had their levels of tear production measured using the modified Schirmer's Test 1 method. Analyses were carried out along the lines of the patient's demographics.
RESULTS: In our study, 51 cases were males and 49 were females. The mean tear secretions for both sexes were 19.5mm and 21.8mm in the male and females respectively. 95% and 89% of the right and left eyes respectively, had normal tear secretions.
CONCLUSION: Our study does not appear to be in consonance with most studies elsewhere. For instance, there is fairly normal tear secretion in all sexes and ages as against most other studies elsewhere.

INTRODUCTION:

Tear fluids are important to the eye in several ways. Tears cover the ocular surface and provide lubrication to the ocular surface including the corneal and conjunctival epithelium. The tear fluid also provides the corneal epithelium which is avascular with nourishment and a smooth optical surface for ideal visual function^{1,2}. A lot of factors and conditions can cause decrease or excess tear secretion including the environment, age, sex and even the vocation of the individual³. The typical volume of tears in normal eyes ranges from 3.4 to 10.7 l per eye⁴. Schirmer found a 24- hour basal tear production to be around 0.50 -0.75 grams however other writers like Magard measured a larger amount of tears⁵.

Various attempts to develop a simple, reproducible clinical test for the measurement of functional tear production date as far back as over 100 years⁶. At the present time, use of both traditional tests [such as tear clearance/fluorophotometry, Schirmer's test, break-up time, ocular surface and phenol red threads] and innovative non-invasive procedures [including tear meniscus height measurement, corneal topography, functional visual acuity, tear interferometry, tear evaporimetry and tear osmolarity] are all recognized as applicable methods^{6,7}. However, each of these techniques appears to have limitations that may prevent their accurate clinical interpretations and usage.

The Schirmer's test is among the most commonly used clinical test for detection and diagnosis of dry eye. It aims at measuring the quantity of tear production⁷. The Schirmer's test developed by Otto Schirmer more than a century ago is fairly easy to perform and less costly. It can be performed in any medical facility and by any medical or paramedical personnel available. It also does not require any special equipment⁸. It was therefore our preferred choice for the above reasons in this study.

There are two variations of the Schirmer test: Schirmer I measures total tear secretion (basal and reflex). Schirmer II is a measure of reflex secretion only and involves nasal stimulation following insertion of the strip. A variation of the Schirmer I that may allow measurement of basal secretion involves the application of topical anesthetic prior to strip

insertion. Although performing the Schirmer I with anesthetic may provide a more accurate picture of basal secretion, the utility and overall effectiveness of anesthetic administration in conjunction with the Schirmer strip is controversial⁶. A Schirmer's test wetting greater than 10mm on application of topical anaesthesia is generally considered to be normal⁹. In our study we chose the Schirmer's test type 1 with anaesthesia.

There are various studies to assess the effects of ocular diseases on tear secretions^{7,10,11} and some others have tried to assess relationship of some systemic diseases or conditions on tear secretion^{12,13,14}. There are however very few studies done in our own environment, thus the need for such a study here in Benue state, Nigeria.

Benue state is one of the North central states in Nigeria (see map 1). It lies within the lower River Benue trough with its geographic coordinates between longitude 7° 47' and 10° 0' East and Latitude 6° 25' and 8° 8' North. Benue State generally, has good humidity levels on the average^{15,23}



AIM: To analyze the demographics of tear secretion in Benue State residents attending the eye clinic at the Benue State University Teaching Hospital, Makurdi, Nigeria

METHODOLOGY: This was a prospective study of one hundred patients resident in Benue State who attended the eye clinic of the Benue State University Teaching Hospital, Makurdi between March 2018 and July 2018. Approval was obtained from the hospital's ethical committee and Informed consent was obtained from all the subjects before performing the procedure.

For the purpose of this study the modified Schirmer's Test I method was performed for all the subjects. After detailed history and examination, all patients that attended eye clinic within the study period were included in the study except those with inflammatory ocular diseases, naso-lacrimal duct obstruction and ocular surface diseases. All patients had two drops of local anaesthetic (amethocaine) instilled in each of their eyes and after 2 minutes. A Schirmer's strip folded at its notch was gently inserted into the inferior fornices in the lateral one-third of the lower lids of the patients' eyes. The patients were thereafter asked to close their eyelids for 5 minutes. On the expiration of the 5 minutes the strips were removed and the moistened segments measured in millimetres.

For this study, all readings greater than 10mm were considered normal and readings less than 10mm were considered abnormal.

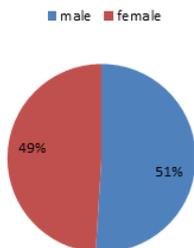
Analyses were carried out along the lines of the patient's demographics.

RESULTS:

Out of the 100 patients that were, 51 were males and 49 were female (see Fig.1). A total of 100 cases were recruited for this study and out of these, majority fell within the 4th to 5th decades. 51 cases were males [51%] and 49[49%] were females (see Fig.1).

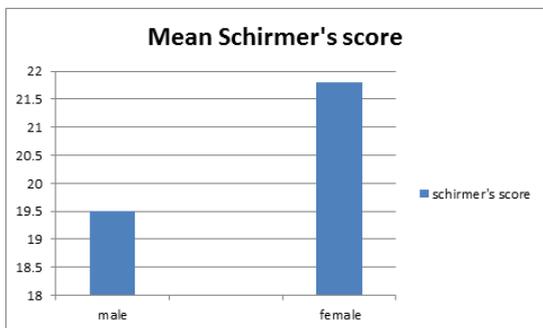
Figure 1. Percentage of sex distribution

MALE TO FEMALE CASES



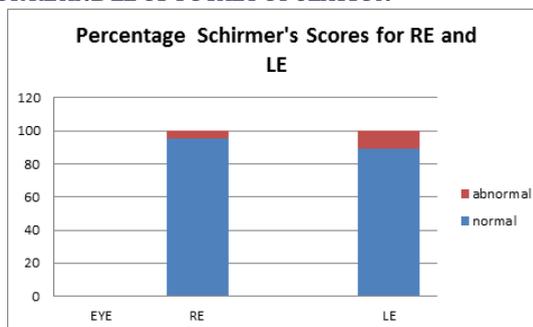
The mean tear secretions for both sexes were 19.5mm and 21.8mm in the male and females respectively (See Fig.2)

Figure 2. Mean Schirmer's score for males and females



For the right eyes, a total of 95 [cases 95%] had a normal Schirmer's test while 5 cases [5%] had abnormal value. For the left eyes there were a total of 89 cases [89%] with normal Schirmer's values while 11 cases [11%] had abnormal Schirmer's tests. (See Fig.3 & Table 1).

Figure 3. PERCENTAGE SCORES OF SCHIRMER'S TESTS FOR RE AND LE OF TOTAL POPULATION



The frequency distribution of normal and abnormal test results across the age groups for RE and LE is represented in the table 1 and Fig.3. This suggests that in either of the eyes, whether RE or LE the Schirmer's is far above normal across the age groups

Table 1. PATTERN OF SCHIRMER'S RESULT FOR VARIOUS AGE GROUP IN RE AND LE RESPECTIVELY

Age	Total frequency	Normal RE	Abnorm RE	Normal LE	Abnorm LE
0 -15	3	3	0	3	0
16 - 30	19	19	0	17	2
31 - 45	28	27	1	26	2
46 - 60	36	33	3	30	6
> 60	14	13	1	13	1
TOTAL	100	95	5	89	11

Figure 4: AGE GROUP DISTRIBUTION OF SCHIRMER'S SCORES IN MALES

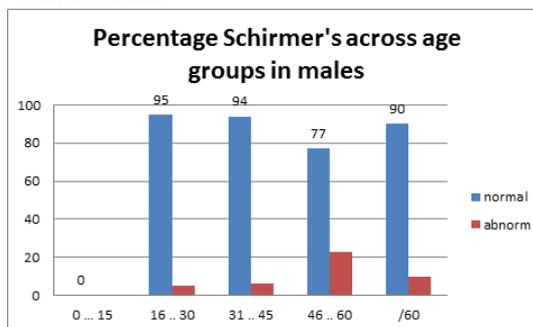
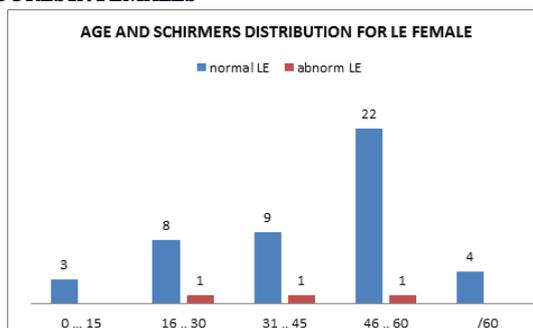


Figure 5: AGE GROUP DISTRIBUTION OF SCHIRMER'S SCORES IN FEMALES



DISCUSSIONS:

The human tears are a multilayered fluid that is chemically complex providing both lubrication and protection of the cornea¹. The human tears harbour quite a lot of immunological and antimicrobials including immunoglobulins, cytokines, lysozymes, defensins, lipocalins, surfactant -A and -D, etc^{1,2}. There are basically three types of tears namely; basal, reflex and emotional or psychic tears usually secreted by two major types of glands^{1&6}. The basal secretions composed of mucinous and the lipid secretions are produced by the accessory tear glands

including the Krause, Wolfrin, Manz, Goblets, etc. The basal secretions are responsible for coating of the aqueous layer and providing the hydrophobic barrier that stabilises the aqueous layer of the tear film³. The reflex tear secretion is mainly done by the main lacrimal gland and produces the aqueous layer of the tear film which mainly aids in spreading the tear film, controls the osmotic process and the infectious agents on the ocular surface³.

A lot of conditions can result in either hypo-tear secretion or hyper-tear secretion. It is a known fact that low levels of androgens and high levels of estrogen can lead to low tear secretion and ultimately dry eyes. Increasing age, female gender, sleep deprivation, ethnic factors and some systemic drugs have also been implicated in low tear secretion^{3,4,10,11}.

Patients receiving S1- Monotherapy (combination of tegafur/gimeracil/potassium oxonate experience increased tearing⁵ Dysfunction of the lacrimal gland may result from inflammation, aging, radiation, or infection. This will result to insufficient tear production with attendant consequences of dry eye^{6,7}. Low humidity can result in dry eye disease with resultant decreased wetting of the Schirmer strip^{8,13}. Elderly women particularly are said to more prone to decreased tear secretion with resultant dry eyes⁸.

In our own study however this analogy is not the same. Our study seems to be conflicting with other studies elsewhere and we are compelled to thinking that our location in the Benue Valley may have an influence on our study outcome in view of its fairly humid weather²³.

A number of tests are available for testing of tear secretion including the Schirmer test, Phenol Red Thread Test (PRT), fluorophotometry, etc. While available in most centres, the Schirmers' test has its disadvantages of poor reproducibility and the possibility to stimulate the cornea and increase reflex tearing. While the Schirmer's test takes 5 minutes, the PRT takes only 15 seconds to do and it causes less reflex tearing. The Fluorophotometry appears to be the best method out of the three methods as it gives more reliable and objective results. The fluorophotometry is however more costly due to the cost of instruments used in quantification of results including, the modified slit lamp (i.e. the Fluorotron Master)⁹. The Schirmer's test developed by Schirmer more than a century ago is fairly easy to perform and less costly. It can be performed in any medical facility and by any medical or paramedical personnel available. It also does not require any special equipment⁹. It was therefore our preferred choice for the above reasons in this study. A Schirmer test score >10 mm in 5 minutes is widely accepted as the normal value, whereas a score <5 mm is indicative of tear deficiency. In our study we applied the same principle. Two types of Schirmer's tests exist namely the type 1 and the type 2. The type 1 can be performed with or without topical anesthesia^{9,12}.

Three layers of the tear film have been described. The *Mucus layer* which is the innermost of the tear film consists of mucin secreted by conjunctival goblet cells and glands of Manz. It converts the hydrophobic corneal surface into hydrophilic surface. The aqueous layer secreted by the main lacrimal glands contains water and proteins. It acts as a physiological barrier and prevents infections to the eye. The third outermost layer is the lipid layer secreted by meibomian gland, glands of Zeis and Moll, acts as a physiological barrier and prevents tears overflow^{4,16}.

The Mean Schirmer test values in healthy eyes exhibit wide variability among different investigators, ranging from 8.1 to 33.1 mm without anesthesia and from 3.5 to 11.9 mm with anesthesia¹⁷. It has been shown in some studies that topical anesthesia reduces Schirmer's test values by 40 to 56.5% compared to unanesthetized eyes¹⁷. In our study the mean values for both males and females for anesthetized eyes were

way above the findings in other studies [see fig.2]. The exact cause is not known but it is thought that the concept of basal tears is questionable. "Pure" basal tears might not be measured even in anesthetized eyes, where stimulation of the lid margin can increase the tear turnover rate by 300 percent and in addition various factors like the change in light, humidity and temperature and patient anxiety may interfere with the tear reflex which may explain the wide variability of results among studies¹⁷.

A lot of conditions can result in either hypo-tear secretion or hyper-tear secretion. It is a known fact that low levels of androgens and high levels of estrogen can lead to low tear secretion and ultimately dry eyes. Increasing age, female gender, sleep deprivation, ethnic factors and some systemic drugs have also been implicated in low tear secretion. Dysfunction of the lacrimal gland may also result from inflammation, radiation, or infection. This will result to insufficient tear production with attendant consequences of dry eye^{3,6,8,14,18,19}. Patients receiving S1- Monotherapy (combination of tegafur/gimeracil/potassium oxonate experience increased tearing²⁰ Low humidity can result in dry eye disease with resultant decreased wetting of the Schirmer strip^{21,22}. Elderly women particularly are said to more prone to decreased tear secretion with resultant dry eyes²¹. In our own study however this analogy is not the same, because here in our study females of all age have normal tear secretion, almost as the males (see Figs.4&5) Since low humidity affects tear secretion and our environment seems to be a bit more humid than other environments in Nigeria^{18,23}, we are compelled to think that our location in the Benue Valley may have an influence on our study outcome.

CONCLUSION

Our study seems to be suggesting that there is normal tear secretion in both sexes and in all ages in our environment. This suggests also that low tear secretion is not a common problem in our environment. This perhaps can be explained by the weather in this environment. There is however room for further investigations or studies in this regard.

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