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Prevalence and Distribution of Dry Eye Syndrome among University Students in Owerri, Imo State Nigeria.

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Abstract:
Background: *The humaneye has a number of structures that serve as protective mechanisms from foreign bodies and external irritants, some of which are; lacrimal gland, lacrimal passages, tear film, eyelids and so on. A compromise in any of these protective structures could lead to eye conditions, sometimes chronic, that requires examination and treatment. One of such compromises is the dry eye syndrome. Dry eye syndrome is a chronic eye condition characterized by persistent evaporation of tears or reduced tear secretion in the tear-film that causes friction between the globe and lids which could in turn lead to injuries in the cornea if not well treated. This study was carried out to determine the prevalence and distribution of dry eye syndrome among university students in Owerri, Imo State.*
Materials and Methods*:This cross-sectional study was carried out on students of Imo State University, and Federal University of Technology Owerri. The students were randomly selected from various disciplines across the campuses. The research was carried out from August 2019 to March 2020. A total 400 healthy subjects; both male and females of ages 18-37 years were enrolled for this study. The Schirmer 1 and the Tear-Break-Up-Time (TBUT) tests were both used to access the dry eye symptoms. The Schirmer 1 test was used to assess the quantity of tears produced by the two eyes of each patient. It evaluates aqueous tear production, which is accomplished by using a 35mm by 5mm strips of filter paper.The Tear Break-up Time (TBUT) Test was done next as it involved the manipulation of the eyelids and the instillation of fluorescein dye into the lower conjunctival fornix[12]. The TBUT is used to evaluate tear film stability. For the Schirmer1 test, a value less than 5mm was suggestive of a true dry eye state[12] while normal value was more than 10mmm. The normal TBUT is between 15seconds and 45seconds while in Caucasians, it is considered to be 10seconds or more. A break-up time less than 10seconds was indicative of an unstable tear film[12].*
Results*: The prevalence of dry eye syndrome among university students in Imo State was recorded as 26% (95% confidence interval 6.9- 10.6). Out of 400 people examined, 13 people had dry eye syndrome. This would give a positive test rate of 26%.Assessment of signs showed an abnormal Schirmer score in 3.23 Standard Deviation of the population and Tear-Break-Up-Time 2.70 SD with respect to female gender. The prevalence of dry eye syndrome was higher in females than in males but was not statistically significant (P>0.05). Dry eye syndrome was not also significantly associated with age (P= 0.291)*
Conclusion:*Basedon the findings, it was concluded that the prevalence of dry eye amonguniversity students in Owerri is low. This may have been as a result of the age group of the study population. The prevalence was also higher in females, although not statistically significant. While the reason may not have been fully clear, we attribute it to the constant use of contact lenses both for aesthetics and as a prescription, more common with the female subjects as specified in their questionnaire. Dry eye syndrome tended to increase with age but was also not found to be statistically significant.*
Key Word*:Dry eye; Schirmer; Tear film; Tear-Break-Up-Time (TBUT); Osmolarity.*

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I. Introduction

The eyes are like windows to the outside world but their intricacies and functionalities are far more extensive than those of any given glass window. As a result, the eye has a number of structures that serve as protective mechanisms for instance; it is well protected from injury by the bony orbit in which it rests. The brow shields it from the extraneous rays of the sun and sweat while the lids protect it from foreign bodies. The lacrimal glands located within the upper outer rim of each orbit secrete tears across the entire surface of the eye. The optical integrity and normal function of the eye are dependent on an adequate supply of fluid covering its surface. Nature provides this perfect tear film. Lid blinking is essential in moving the tear fluid which keeps the

cornea moist; this also tends to push away any debris on the surface of the eye.Dry eye is a disorder of the tear film which occurs due to tear deficiency or excessive tear evaporation. It causes damage to the inter-palpebral ocular surface and is associated with a variety of symptoms reflecting ocular discomfort[1]. Dry eye syndrome, also known as keratoconjunctivitis sicca (KCS), is a common condition reported by patients who seek ophthalmologic care and is characterized by instability of the tear film that can be due to insufficient amount of tear production or due to poor quality of tear film, which results in increased evaporation of the tears. The tear film lubricates the eye, maintains nutrition and oxygenation of ocular structures, acts as a refractive component and helps remove debris from ocular surface. The main symptom of dry eyes is dry and gritty feeling in the eyes. The additional symptoms include burning or itching in the eyes, foreign body sensation, excess tearing, pain and redness of the eyes and photophobia in some cases[4]. Sometimes, it is also associated with a stringy discharge and blurred, changing vision. Symptoms are found to worsen in dry weathers, with low humidity and higher temperatures[5].

The prevalence of dry eye syndrome increases with age. Dry eye syndrome is a common disorder of eyes affecting a significant percentage of the population, especially those older than 50 years of age[2]. Middle-aged and older adults are the most commonly affected group because of the high prevalence of contact lens usage, systemic drug effects, autoimmune diseases[3].The estimated number of people affected by dry eye syndrome ranges from 25 to 30 million all over the world. Research also shows that dry eye syndrome can affect any race and is more common in women than in men[7]. In women, it occurs at the age of 50-52 when menopause usually sets in caused by an imbalance occurs between the oestrogen and androgen hormones. This excites inflammation in lacrimal gland and ocular surface, disrupting the normal homeostatic maintenance of the lacrimal gland and ocular surface[17]. Up to 20% of persons with rheumatoid arthritis have keratoconjunctivtis Sicca[8]. Other individuals which are likely to be affected include patients with Helicobacter pylori[9], computer users, and long-term contact lens wearers[10]. Among University students, dry eye syndrome has been found highly prevalent and is mostly associated with self-medication with over-the-counter eye drops, allergies, use of oral contraceptive, windy conditions, very low humid areas, air conditioned rooms, and sex[11].

In order to diagnose dry eye, certain tests are required to be performed, they include; Tear Film-Break up Time (TBUT), Epithelial staining, Schirmer test, Tear Function test (TF), Tear Osmolarity, Impression Cytology, Symptom questionnaire and other tests. The results of diagnostic tests above poorly correlate with symptoms[6]. Though the literature emphasizes hyperosmolarity as a global mechanism of dry eye disease, indicating tear osmolarity measurement as a gold standard for diagnosis, unfortunately no single qualitative/quantitative test is capable of assessing integrity of tear film and severity of disease, therefore the results of multiple abnormal tests can be used to diagnose dry eye syndrome accurately. The table below displays the various diagnostic test and their normal values.

Table 1: Diagnostic tests and normal values.

Test	**Normal values**
Tear film breakup time (TBUT)	>10 sec
Noninvasive breakup time (NIBUT)	40 sec–60 sec
Epithelial staining	No visible staining
Schirmer test (basic)	>5mm after 5 minutes
Schirmer I test (without topical anesthesia)	>10mm after 5 minutes
Schirmer II test/Jones test (with anesthesia)	>15mm after 5 minutes
Tear function index	>96
Tear osmolarity	<312–318mOsm/L
Impression cytology	Normal appearance of cells
Tear fluid protein immunoassay	Total lysozyme reactivity TLR <1.0
	Lactoferrin 1.42mg/mL (abnormal value <1)

With the persistent rise in screen time among young people as well as other predisposing factors, there has been an upsurge in cases of dry eye reported in clinics in Nigeria. Dry eye symptoms are very bothersome and lead to decreased quality of life, reduced work capacity and poorer psychological health to perform activities that require visual attention. This is the reason most individuals seek immediate care once they experience any of the symptoms.The current study aims to build growing awareness of dry eye manifestations in Owerri Nigeria by determining the prevalence among university students.

Objectives of the study: This study sought to;

- To determine the prevalence of dry eye syndrome among different age groups of students.
- To determine if the prevalence dry eye syndrome among the university students is based on age.
- To determine if the prevalence dry eye syndrome among the university students is based on gender.

The study was concluded with a view to test the following research hypothesis: -

1. Null hypothesis: There is no statistically significant variation in prevalence of dry eye syndrome among university students in Owerri.
2. Null hypothesis: There is no statistically significant variation in prevalence of dry eye syndrome among university students in Owerri with respect to age.
3. Null hypothesis: There is no statistically significant variation in prevalence of dry eye syndrome among university students in Owerri with respect to gender.

Scope and the Limitation of the Study: This research work is limited to university students in Owerri, Imo State Nigeria between the ages of 18-37years including male and female whom were randomly selected.

II. Material and Methods

This cross-sectional study was carried out on students of Imo State University, and Federal University of Technology Owerri. These students were randomly selected from various disciplines across the campuses. The research was carried out from August 2019 to March 2020. A total 400healthysubjects; both male and females of ages18-37 years were enrolled for this study.

Study Design: A cross-sectional clinical study to determine the prevalence and analyze the distribution of dry eye syndrome across various age groups and gender. It was carried out at Imo State University eye clinic.

Study Location: These are tertiary institutions in Owerri Imo State Nigeria. Imo State University is located within the city of Owerri bounded by Uratta, Orji and Owerri municipal headquarters. Federal University of Technology Owerri is located in Owerri-West Area of Imo State, bounded by the communities of Eziobodo, Umuchima, Ihiagwa and Obinze.

Study Duration: February 2019 to September 2019.

Sample size: 400 subjects (800 healthy eyes)

Sample size calculation: The sample size was estimated on the basis of a single proportion design. The target population from which we selected our sample was considered 10,875. We assumed that the confidence interval of 10% and confidencelevel of 95%. The sample size obtained for this study was 400 subjects with 2 healthy eyes (obtained using the Taro Yamen Formular) $n = \frac{N}{1} + (e)$which were divided for both sexes (male and female).

Subjects & selection method: The study population was drawn from university students who were randomly selected across all the disciplines. The subjects underwent thorough and comprehensive eye examination to rule out any pathological interference before the test was conducted.

Inclusion criteria:

1. Either sex
2. Aged 18 – 37 years,
3. Subjects having healthy eyes free from ocular diseases.

Exclusion criteria:

1. Pregnant women
2. Subjects with anterior and/or posterior segment ocular pathology.
3. Subjects having diabetes and hypertension.
4. Subjects who have had intraocular surgery.
5. Subjects on systemic and/or ocular medication.

Procedure methodology

Firstly, a written informed consent was obtained from the prospective subjects, after which a well-designed questionnaire was used to collect the data of the recruited subjects. The questionnaire included socio-demographic characteristics such as age, gender, occupation, and phone number. Medical and ocular history as well as current medication were also noted. Also symptom-based questions to ascertain dry eye syndrome were included and filled by every patient.

Visual Acuity: The visual acuity for both far and near using Snellen's chart was taken and recorded. Testing was done with the right eye before the left eye, and then, binocularly.

External and Internal Examination:This was conducted using a pen-torch. Ophthalmoscope was also used for the internal examination of ocular structures of the eye to check for any abnormality. Structures like cornea, conjunctiva, and lid margins were also examined including the fundus of the eye.Each subject's palpebral and bulbar conjunctiva was assessed for signs of malfunction, chemosis and hyperemia. Chalazion and foreign body presence were investigated.Pupil size was measured with the PD rule; its equality and reaction to light and accommodation were noted.

Ocular Surface Evaluation:The routine diagnostic techniques used in testing the students for dry eye syndrome were Schirmer 1 test, and Tear Break-Up Time (TBUT) test using Fluorescein dye.

The Schirmer 1 test was used to assess the quantity of tears produced by the two eyes of each patient. It evaluates aqueous tear production, which is accomplished by using a 35mm by 5mm strips of filter paper. The strip is folded at the tip before opening, approximately 120^0.The subjects were seated erect and comfortably, then asked to look up while the lower lid was gently pulled down and temporally inserted the strip into the lower conjunctival fornix.

The time was measured using a stop watch. The two eyes were done simultaneously, after 5 minute, the strips were removed, and the length of wetting in millimeters recorded for both eyes. During the test, the subject was instructed to continue looking up and blinking normally, or simply close the eyes if it was more comfortable, and also not to squeeze the eyes shut. Every care was taken to avoid touching the cornea with the strips, so as not to stimulate reflex tears which will contaminate the result of the measurement.

Interpretation: A value less than 5mm was suggestive of a true dry eye statewhile normal value was more than 10mmm[12].

The Tear Break-up Time (TBUT) Test was done next as it involved the manipulation of the eyelids and the instillation of fluorescein dye into the lower conjunctival fornix[12]. The TBUT is used to evaluate tear film stability. An unstable tear film is one of the most common findings in patients with ocular irritation caused by either reduced aqueous tear production (Sjogren's syndrome and Non-Sjogren's syndrome) or increased tear production, as in the case of Meibomian Gland Dysfunction (MGD).The fluorescein dye strip was wetted with normal saline solution and instilled into the lower fornix of the subject as he/she was seated comfortably in front of the slit lamp bio-microscope. The subject was asked to blink severally to distribute the dye evenly and instructed not to blink again. The ocular surface was then observed using the wide beam (2-3mm) parallelopipe and cobalt blue filter of the bio-microscope and 16x magnification. The tear film then appeared as a fine green film due to the fluorescein dye. The subject held the eyes open without blinking. The stop-watch was started after the last full blink while viewing through the bio-microscope and was stopped on the appearance of the first black spot which was denoted as the tear break-up time(TBUT) in seconds. The test was repeated three times for each eye with the right eye first and the average taken. The black spots or streaks on the fluorescein dye were as a result of areas of dewetting on the tear film, these include ocular damage caused by unstable tear. During the test, care was taken to avoid touching the fluorescein strip on the cornea of the subject.

Interpretation: The normal TBUT is between 15seconds and 45seconds while in Caucasians, it is considered to be 10seconds or more. A break-up time less than 10seconds was indicative of an unstable tear film[12].

The stain was removed after the examination by irrigating the eyes with normal saline and the external adnexa wiped with cotton wool. Then a drop of artificial tear was instilled into each eye to soothe them.

Ethical Consideration

A permission letter from the Head of Department of Optometry was obtained in order to carry out this study on study subjects. Prior to the tests, subjects' consent was sought after informing them about the procedures and the need for the tests.

Statistical analysis

The data obtained were presented in tables for easy calculation and explanation. Statistical analysis was performed with 'Decision Analyst STATS^{TM} 2.0 version' at 95% confidence interval. The proof of hypotheses was tested using the Z- test. The standard and mean deviation of the test results were also evaluated.

III. Result

After 7 months of collecting data, the results were gathered and tabulated according to age and gender. The data was further evaluated to determine the mean and standard deviation for the Schirmer 1 and Tear-Film-Breakup-Time tests. The hypotheses were tested and analyzed using the Decision Analyst software.

Table no 1: Shows the age distribution of study subjects

Age	Frequency	% Frequency
18-21	82	20.50
22-25	97	24.25
26-29	142	35.50
30-33	76	19.00
34-37	3	0.75
Total	**400**	**100**

Table 1 above showed age distribution of subjects used for the study. Their mean age was 23.82 years ± 2.00 years with standard deviation of 1.06. Age group of 22 – 25 years had the highest number of subjects representing 33.5%; followed by 18 – 21 age group with 31%, 26 – 29 age group with 21%; others include 30 – 33 age groups with 13%, and the least 34 – 37 age group with 1.5%.

Table no 2: Shows the gender distribution of study subjects.

Age	Male (% frequency)	Female (%frequency)	Total
18-21	43 (52.4)	39 (47.6)	82
22-25	26 (26.8)	71 (73.2)	97
26-29	75 (52.8)	67 (47.2)	142
30-33	38 (50.0)	38 (50.0)	76
34-37	2 (66.7)	1 (33.3)	3
Total	**184 (46.0)**	**216 (54.0)**	**400**

Table 2 shows gender distribution of the study subjects. Out of the total of 200 subjects, 43.5% were males and 56.5% were females. The highest of males and females used for this study belonged to age group of 22 – 25 years with 29.9% and 35.45% as percentage frequencies respectively; this was followed by age group of 18 – 21 years with percentage frequencies of 26.4% for males and 34.5% for females. Age group of 26 – 29 years had the third highest number of subjects for males and females with percentage frequencies of 20.7% for males and 21.2% for females; others include age group of 30 – 33 years with percentage frequencies of 19.5% and 85 for males and females respectively, and the age group with the least number of males and females was 34 – 37 years.

Table no 3: Shows the distribution of mean results of Schirmer test and TBUT with respect to age.

	Schirmer (mm)		TBUT (Sec)	
Age	**≤5.0mm**	**>5.0mm**	**≤10.0 secs**	**>10.0 secs**
18-21	5.0	18.5	-	20.1
22-25	4.5	18.0	7.2	18.3
26-29	4.0	14.8	6.9	15.7
30-33	4.6	12.4	6.4	15.3
34-37	4.0	11.3	6.0	13.2
Mean	**4.4**	**15.0**	**5.3**	**16.5**
SD	**0.43**	**3.23**	**3.00**	**2.70**

Table 3 shows the distribution of mean results of Schirmer test and TBUT with respect to age. The base line for Schirmer results were ≤5mm as abnormal and >5.0mm as normal, while for TBUT values ≤10secs was regarded as abnormal while >10secs was recorded as normal.

Table no 4: Shows the distribution of mean results of Schirmer test and TBUT with respect to male gender.

	Schirmer (mm)		TBUT (Sec)	
Age	**≤5.0mm**	**>5.0mm**	**≤10.0 secs**	**>10.0 secs**
18-21	4.5	18.0	-	18.8
22-25	4.8	18.7	8.4	18.0
26-29	4.6	16.0	6.3	16.6
30-33	4.0	13.3	6.8	14.9
34-37	4.4	12.1	6.6	11.8
Mean	**4.5**	**15.6**	**7.4**	**16.0**
SD	**0.30**	**2.88**	**1.20**	**2.79**

Table 4 shows the distribution of mean results of Schirmer test and TBUT with respect to male gender. The base line for Schirmer results were ≤5mm as abnormal and >5.0mm as normal, while for TBUT values ≤10secs was regarded as abnormal while >10secs was recorded as normal.

Table no 5: Shows the distribution of mean results of Schirmer test and TBUT with respect to female gender

	Schirmer (mm)		TBUT (Sec)	
Age	**≤5.0mm**	**>5.0mm**	**≤10.0 secs**	**>10.0 secs**
18-21	4.8	20.1	-	20.0
22-25	4.3	19.4	7.9	19.1
26-29	4.6	15.3	7.1	16.7
30-33	4.0	13.0	6.7	16.3
34-37	4.2	11.1	6.1	14.7
Mean	**4.4**	**15.0**	**5.3**	**16.5**
SD	**0.43**	**3.23**	**3.00**	**2.70**

Table 5 shows the distribution of mean results of Schirmer test and TBUT with respect to female gender. The base line for Schirmer results were ≤5mm as abnormal and >5.0mm as normal, while for TBUT values ≤10secs was regarded as abnormal while >10secs was recorded as normal.

IV. Discussion

Dry eye syndrome has been a cause of concern within the university community. It is one of the most common ocular surface disorders affecting many of the university students irrespective of their age and gender. Dry eye syndrome limits and degrades visual performance, including the conduction of some vision related daily activities[13].The prevalence of dry eye syndrome among university students in Owerri, Imo State was recorded as 26%. Out of 400 people examined, 13 people had dry eye. This would give a positive test rate of 26%. The low prevalence recorded conforms to the epidemiological studies by Schein[18] recorded to be 27%. Estimating the prevalence of dry eye disease is problematic because there is no consensus on diagnostic criteria. Another reason for the variation in prevalence estimates may be a true heterogeneity in dry eye prevalence in different populations. In this study, the prevalence of dry eye syndrome had no significant association with age (P= 0.291), however, results showed the condition to increase with age. Some studies have demonstrated a lack of association between age and the prevalence of dry eye syndrome[11]. Other studies revealed dry eye syndrome to be associated with aging[1415]. Dry eye syndrome was also found to be higher in the females but was not statistically significant (P> 0.05). While the reason may not be fully clear, we can attribute it to the constant use of contact lenses both for aesthetics and as a prescription, more common with the female subjects as specified in their questionnaire. However, several studies [16 17]have found dry eye syndrome to be higher and statistically significant in women. This is more common in menopausal women because menopause causes estrogen deficiency and a consequent change in the local hormonal miler of the lacrimal gland. It is thought to decrease tear production and occurrence of dry eyes in women.

A review of several large studies conducted by the epidemiological sub-committee of the 2007 Dry Eye Workshop (DEWS) in Pakistan showed that the prevalence of dry eye syndrome ranges between 5% and 30% in people ages > 50 years[19]. This shows an increase of prevalence with respect to age. Considering the different definition used in these studies, the DEWS group concluded that time that prevalence of moderate to severe dry eye lies somewhere close to the lower end of the range, whereas inclusion of mild or episodic cases would bring the estimate closer to higher estimates reported.It is recommended that optometric practice creates awareness of dry eyes among all age groups andincorporates dry eye evaluation and assessment in clinical routine examinations. Caution should also be exercised when prescribing contact lensesby carefully carrying out tests for dry eye before giving cosmetic or corrective contact lenses.

V. Conclusion

From the analysis of the findings of the study, it can be concluded that the prevalence of dry eye among university students in Owerri is low. This may have been as a result of the age group of the study population. The prevalence was also higher in females, although not statistically significant. While the reason may not have been fully clear, we attribute it to the constant use of contact lenses both for aesthetics and as a prescription, more common with the female subjects as specified in their questionnaire. Dry eye syndrome tended to increase with age but was also not found to be statistically significant.

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