Effect of Xylocaine on Tear Production among Young Adults Attending Central Hospital Warri, Delta State, Nigeria

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ABSTRACT

Xylocaine (Lidocain HCL) is a local anesthetic used topically to numb the surface of the eyes; it is used mostly in the removal of foreign body, contact/ applanation tonometry etc. Due to its moderate properties, Xylocain is one of the most versatile agents in anesthesia and as such is often used by optometrists and ophthalmologists alike in different clinical procedures. This study was conducted to determine the effects of Xylocaine on quantitative estimation of tear production using Schirmer's tear test among young adults attending Central Hospital Warri, Delta State, Nigeria. This was an experimental study. A total of 80 subjects participated in this study, out of which 31(38.80%) were males and 49(61.30%) were females. The mean age of the participants was 24±5.21 years and the age range was from 18 – 35 years, being subjects who were free from ocular diseases and not on any systemic drugs. With due ethical considerations, informed consent and demographic information were obtained from the participants. Data was obtained by measuring the tear production for each subject before and after the instillation of Xylocain (2%) using a sterile Schirmer's tear strip. Results showed the mean Schirmer's tear value before instillation of Xylocaine to be 20.68 ± 5.39mm, and value at 2mins after instillation of Xylocaine was 14.00 ± 3.57 mm while values after 10mins post instillation of Xylocaine was 20.59 ± 5.64 mm returning to near baseline value. The findings showed a decrease in baseline Schirmer's tear values after instillation of Xylocaine. Statistical analysis also revealed the effect of Xylocaine on Schirmer's tear test to be significant (P<0.001). The result of this research will enable ocular health workers to know the exact effect of Xylocaine on Schirmer's tear test and take necessary precaution on its use.

Keywords: *Effects; Xylocaine; Tear Production; Schirmer's Test; Adults.*

INTRODUCTION

Xylocaine (Lidocaine HCL) is a local anesthetic used topically on the eyes and mucous membranes to alleviate itching burning and pain from redness or swelling. Anesthetics are drugs which bring about the state of anesthesia, which produces insensitivity to external expression or a reversible lack of awareness which can be general or local. General anesthetics act on all parts of the body while local anesthetic acts on some or a part of the body. When applied in an effective concentration to nerve tissue, local anesthetics reversibly block the conduction of impulses through nerve fibers. The primary action is to prevent impulses conduction. However, they will also block motor nerves in higher concentrations than are normally obtained by topical instillation (Heavner, 2008). Schirmer's test determines whether the eye produces enough tears to keep it moist. It is also known as tear testing or dry eye test. It measures total tear secretions and it is used when a person experiences very dry eyes or excessive tearing of the eyes (Franklin *et al.*, 2013). A research on the comparism of Schirmer's test with and without anesthesia for diagnosing dry eye in China, in a total of 220 eyes among 110 patients diagnosed with dry eye, Li *et al.* (2012) determined that Schirmer's test, after topical anesthesia with 0.5% proparacaine hydrochloride eye drops is more objective and reliable than that without anesthesia in reflecting the status of dry eye. Also, its diagnostic value in patients with Aqueous

Deficiency Dry Eye (ADDE) was higher, making itself a meaningful evidence for the diagnosis and treatment of dry eye. In a comparative analysis of the effects of topical anesthetic agents on tear quantity and tear quality in Edo State, Nigeria, where Schirmer's tear test was used to assess the quantity of tears while tear quality was assessed with Non-Invasive Tear Break-Up Time (NITBUT), George and Omokhua (2010), determined that 0.5% proparacaine hydrochloride had a statistically significant decrease in tear quantity produced after instillation($F=4.43$, $P<0.005$), Tetracaine hydrochloride (0.5%) had a statistically significant effect on tear film stability time ($F=16.78$, $P <0.005$) while 2% Xylocaine hydrochloride had the least effect on tear quality. It was therefore concluded that of the three topical anesthetic agents, 0.5% tetracaine hydrochloride may be the preferred choice in optometric practice particularly in patients with kerato-conjunctivitis sicca (KCS) in order to facilitate their tear film stability; while the use of proparacaine should be discouraged in patients with dry eye syndrome. There are not many studies on the effect of Xylocaine on Schirmer's test among young adults in the Nigerian population. Our study therefore sought to determine the effect of Xylocaine on the volume of tears produced using Schirmer's tear test on young adults attending Central Hospital Warri, Delta State, Nigeria.

MATERIALS AND METHODS
Study Design
This study was an experimental method design which involved comparing the baseline value of tears (obtained using the schirmer test) before instillation of xylocaine on the subjects and the induced value of tear production obtained after the instillation of xylocaine.

Inclusion Criteria and Exclusion Criteria
The subjects involved in this study were adults from the ages 18 to 35 years, both males and females who consented to the eye examinations, and who were available on the days of the tests. Whereas adults with ocular pathologies / eye diseases, or those with a history of surgical procedure in the eye, or who were not within the ages of 18 -35 years, or those who didn't give their consent or who were sick and on systemic medication were all excluded from the study.

Sample Size and Sampling Technique
Convenient Sampling was used for this study. Subjects were sampled from the young adults attending the Central Hospital Warri, who were within the ages of 18-35 years and was examined within the period of this research. A total of 80 young adults were examined and results were collected and recorded.

Instrumentation
Direct ocular examinations were applied for this study, and the instruments used for collection of data included; Penlight, Ophthalmoscope, Stop watch, Tear strips (Schirmer sterile tear strips), Cotton wool (wisps), Xylocaine (2%).

Data Collection Procedure

Patient's Case History was taken for each subject and a complete patient profile indicating the patient's age and gender were recorded. Thorough eye examination was conducted on each subject to rule out any form of ocular pathology. The measurement of the tear flow was carried out using the Schirmer's tear strips. This was achieved by folding the tear strip 5mm at one end, which was inserted at the junction of the middle and outer third of the lower lid. The subject was asked to keep the eyes open and blink as necessary after two minutes, the tear strip was removed and the amount of wetting noted from the calibrated tear strips. The length of the moistened area was recorded indicating normal tear production for the given subject in millimeters. Individuals with tear production values of 10mm and below were contraindicated for this research, as such, values were considered as deficient tear production values and a probability of the presence of dry eye. Xylocaine was then topically instilled by everting the lower lid of one eye and two drops instilled in the inferior cul-de-sac of the same eye. The test was then repeated two minutes after the instillation of the Xylocaine to allow for elapsing of the stinging sensation or irritation associated with topical anesthetics, and the value for the tear production after anesthetic was recorded. Ten minutes after, the test was repeated and the value was recorded as described above.

Diagnostic Criteria

One drop of xylocaine (2%) solution renders the cornea anesthetized within 30-60 seconds and effect lasts for about 10 minutes. On topical instillation however it causes marked stinging sensation for 30 seconds (Daniel & Kenneth, 2006). By assessing tear production using strips of blotting paper, more than 10mm of moisture on the Schirmer's tear strip on or before 5 minutes is normal, and were used for the study. All values of 5-10mm are suggestive of moderate to mild Kerato-conjunctivitis Sicca (KCS) and less than 5mm are suggestive of severe Kerato-conjunctivitis sica (KCS) also known as dry eye, and these were not included in the study.

Ethical Consideration

The study protocol was approved by the Head of Optometry Department. It was then approved by the Committee on Human Research and Ethics of Madonna University Nigeria. Approval was sought and obtained from the Research and Ethics committee of Central Hospital, Warri, Delta State. Permission was also sought and obtained from the head of Ophthalmology Department and the head of Optometry unit in particular to carry out the research within acceptable days. The participants' consents were solicited after detailed explanations of the study and its purpose were made. Consent information and acceptance form for participants were made available for participants to fill and sign.

Data Analysis

All examination forms were cross-checked in the field for completeness. Data was entered and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). The quantitative estimation of the effect of Xylocain on tear production was calculated in millimeters with time duration in minutes. Also, a two-tailed

Table 1a: Demographic Profile of Participants

Z-test and one-way analysis of variance (ANOVA) were utilized to investigate relationships and presented in tables as descriptive statistics. A P<0.05 was considered statistically significant and all results are expressed in mean ± standard deviation (SD).

RESULTS

Gender	Age Range	Mean Age (years)	Standard Deviation	N (No. of Participants)	Percentage (%)
Male	18-35	23.10	5.31	31	38.80
Female	18-35	25.61	4.96	49	61.30
Total	18-35	24.08	5.21	80	100.00

Demograghics

A total of 80 participants were enrolled for this study. The ages of participants range from 18 to 35 years with a mean age of 24.08 (SD = ± 5.21) years. Out of the 80 participants, 31 (38.80%) were males and 49 (61.30%) were females. The mean age for males was 23.10 (SD = ±5.31) years while mean age for females was 25.61 (SD = ±4.96).

Table 1b: Frequency Distribution of Participants by Age Group

AGE (years)	No. of Participants (N)	Percentage (%)
18 – 23	43	53.8
24 – 29	19	23.8
30 – 35	18	22.5
Total	80	100.0

EFFECT OF XYLOCAINE ON SCHIRMER'S TEST

From the results, as shown in Table 2a, there is a significant difference in Schirmer tear test values before and after Xylocaine instillation. The mean Schirmer test value before Xylocaine instillation was 20.68 ± 5.39 mm while after 2 minutes of Xylocaine instillation the mean Schirmer test value decreased to 14.00 ± 3.57 mm. The mean Schirmer test value after 10 minutes of Xylocaine instillation increased to 20.59 ± 5.64 mm as shown in Table 2a below.

Table 2: Mean Schirmer test values before and after instillation of Xylocaine.

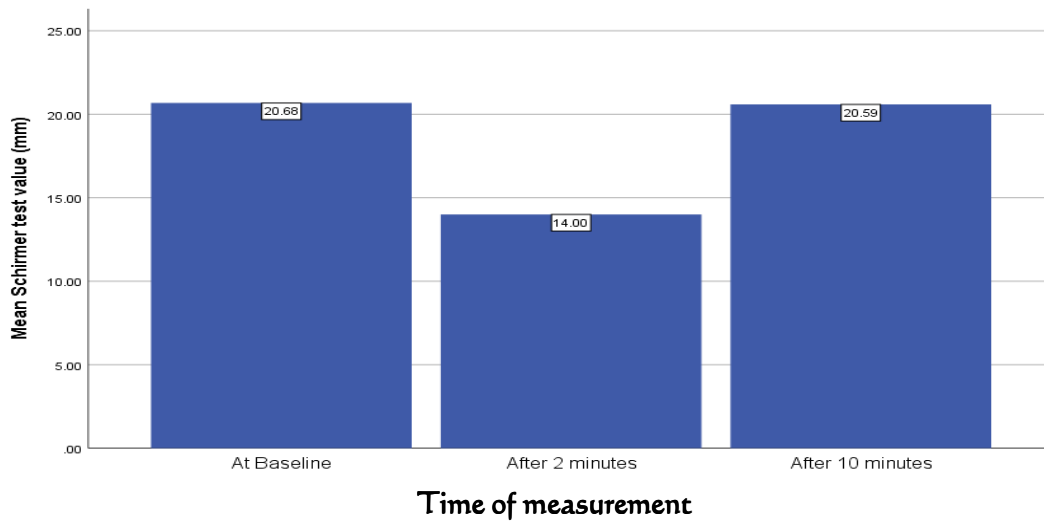| Time	No. of Participants (N)	Schirmer test values (mm)		
		Range	Mean (mm)	S.D
Before anesthetic instillation	80	12-32	20.68	5.39
After 2 minutes	80	8-27	14.00	3.57
After 10 minutes	80	10-35	20.59	5.64

Figure 2: Showing the mean Schirmer test Values before and after Xylocaine instillation.
With significance level considered at $p < 0.05$, these differences in mean Schirmer test values at baseline, after 2 minutes and after 10 of xylocaine instillation were found to be significantly different from each other, $X^2 (2) = 133.211$, $p < 0.001$. Thus, the null hypothesis was rejected.

Post Hoc Test
A Post hoc test with Wilcoxon signed-rank tests was conducted and the results of this analysis indicated that mean schirmer's test value before xylocaine instillation ($M=20.39 \pm 5.39$ mm) reduced to a mean of 14.00 ± 3.57 mm after 2 minutes of Xylocaine instillation, $z = -7.784$, $p<0.001$). The mean Schirmer test value ($M=14.00 \pm 3.57$) at 2 minutes increased significantly to a mean Schirmer test value of ($M=20.59 \pm 5.64$) after 10 minutes of xylocaine instillation, $z = -7.783$, $p<0.001$ (Exact Sig. 2-tailed). There was no statistically significant difference found between the mean Schirmer test value ($M=20.39 \pm 5.39$) before Xylocaine instillation and the mean Schirmer test value ($M=20.59 \pm 5.64$) after 10 minutes of Xylocaine instillation, $z = -0.584$, $p=0.565$ (Exact Sig. 2-tailed).

EFFECT OF XYLOCAINE ON SCHIRMER TEST IN RELATION TO GENDER
There is no significant difference in schirmer tear test values between males and females at baseline, after 2 minutes and after 10 minutes of xylocaine instillation. At baseline, the mean Schirmer test values for males ($M = 19.51 \pm 5.66$) was not significantly different from the mean Schirmer test values for females ($M = 21.41 \pm 5.14$), $p = 0.054$. After 2 minutes of Xylocaine instillation, the mean Schirmer test values for males ($M = 13.81 \pm 3.96$) was not significantly different from the mean Schirmer test values for females ($M = 14.12 \pm 3.33$), $p = 0.496$. After 10 minutes of xylocaine instillation, the mean Schirmer test values for males ($M = 19.68 \pm 6.22$) was not significantly different from the mean Schirmer test values for females ($M = 21.16 \pm 5.23$, $p = 0.144$. Table 3a shows the mean schirmer test values before and after Xylocaine instillation by gender. Figure 3 Shows mean Schirmer test values before and after Xylocaine instillation by Gender.

Table 3a: Mean Schirmer test Values before and after Instillation of Xylocaine by Gender.

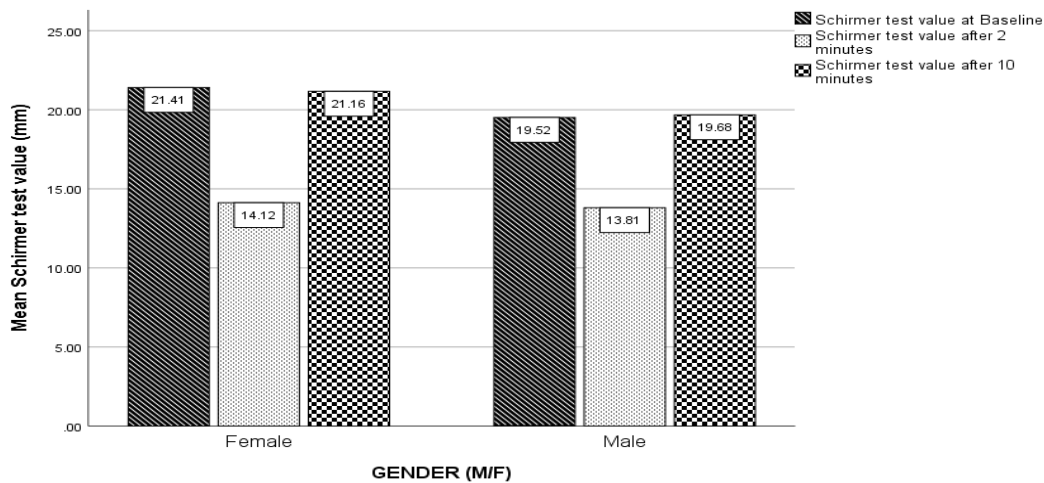| Schirmer test	Male	Female	P
Baseline	19.51 ± 5.66	21.41 ± 5.14	0.054
After 2 minutes	19.68 ± 6.22	21.16 ± 5.23	0.496
After 10 minutes	13.81 ± 3.96	14.12 ± 3.33	0.144

Figure 3: Showing mean Schirmer test Values of Males and Females

EFFECT OF XYLOCAINE ON SCHIRMER TEST IN RELATION TO AGE
There are no significant differences in Schirmer tear test values between various age groups at baseline, after 2 minutes and after 10 minutes of Xylocaine instillation. Results from kruskal-Wallis one-way ANOVA test analysis revealed that the mean schirmer test values at baseline for the various age groups (M = 22.41 ± 5.27, 17.11 ± 3.03, 20.28 ± 5.88) were significantly different, H (2) = 14.304, p = 0.001. The mean values after 2 minutes of Xylocaine instillation for the various age groups (M = 14.60 ± 3.59, 12.79 ± 2.66, 13.83 ± 4.15) were not significantly different, H(2) = 3.847, p = 0.146. The mean Schirmer's test values after 10 minutes for the various age groups (M = 22.16 ± 5.42, 17.32 ± 3.68, 20.28 ± 6.53) were found to be significantly different, H(2) = 10.468, p = 0.005.

Table 4a: Mean Schirmer Test Values before and after Instillation of Xylocaine by Age Group.

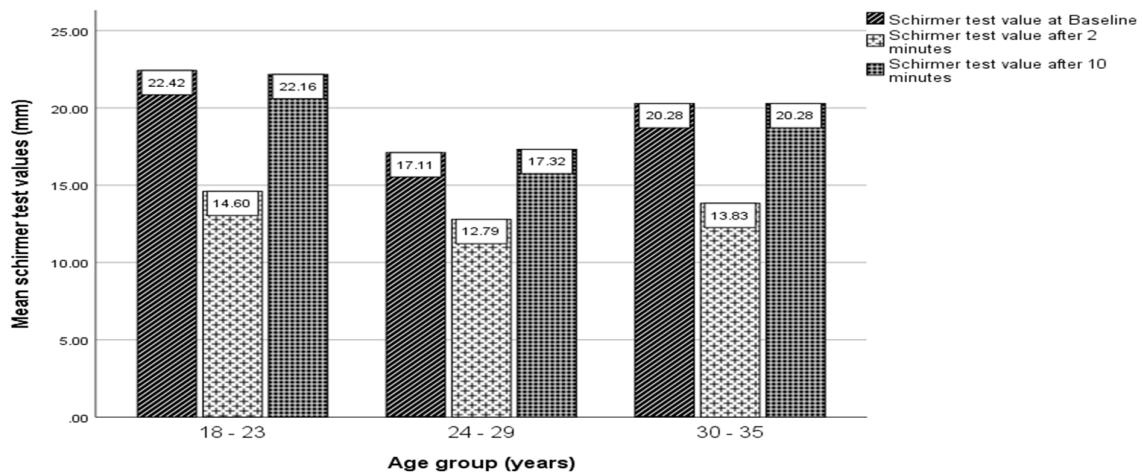| Age group	N	Mean Schirmer test Values (mm)		
		At Baseline	After 2 minutes	After 10 minutes
18 – 23	43	22.41 ± 5.27	14.60 ± 3.59	22.16 ± 5.42
24 – 29	19	17.11 ± 3.03	12.79 ± 2.66	17.32 ± 3.68
30 – 35	18	20.28 ± 5.88	13.83 ± 4.15	20.28 ± 6.53
P		0.001	0.146	0.005

Figure 4: Showing Mean Schirmer Test Values for Various Age Groups.

Post Hoc Pairwise Comparison

The results from this analysis showed that at baseline and 10 minutes after Xylocaine instillation, the mean Schirmer's test values for 24 – 29 age group were significantly different from the mean for 18 – 23 years age group, t = 23.901, p = 0.001 and t = 20.360, p = 0.004 (with Bonferoni adjustment). Pairwise comparisons at baseline and after 10 minutes of xylocaine instillation between age groups of 24 – 29 and 30 – 35 years were not significant, p > 0.05. Also comparisons at baseline and after 10 minutes of Xylocaine instillation between age groups of 30 – 35 and 18 - 23 years were not significant, p > 0.05.

DISCUSSION

In this study, we aimed to determine the effect of Xylocaine on tear production using Schirmer's tear test. Such information is important to ocular health workers who perform minor surgeries on the eyes (e.g. Removal of foreign bodies) or in carrying out contact intraocular pressure measurements (Tonometry) using Xylocaine. Findings in this study showed a decrease in normal Schirmer's tear value after instillation of Xylocaine. Analysis of data showed values from mean Schirmer's tear value before instillation of Xylocaine to be 20.68 ± 5.39mm, while the mean Schirmer's tear value, 2mins after instillation of Xylocaine was 14.00 ± 3.57mm and 10mins post instillation of Xylocaine, the mean Schirmer's tear value was 20.59 ± 5.64mm, returning back to near baseline value. This result is in line with Nwaji and Barrah's (2005) work which also had a mean reduction of the baseline after the instillation of Lignocaine and the greatest percentage of reduction was 2mins after instillation. They noticed that the total mean tear production reduced two minutes post instillation of Lignocaine (189.54mm to 170.59mm). The reduction in tear production was transient as the reading went back to near baseline 10minutes post instillation of Lignocaine. Mean reduction in tear production 2 minutes after instillation of anesthetic (Lignocaine) was about 7.56mm with a percentage reduction of 9.06% approximately. At 10minutes post instillation, it was 1.74mm with percentage reduction

tear production of approximately 6.69%, thus returning towards baseline value. These major findings go a long way to confirm that Xylocaine measures only basic secretion thus reducing normal tear production/secretion, which is both reflex and basic. This could be attributed to the fact that Xylocaine has an adrenergic potentiating effect and because Lacrimal fluid receives a preganglionic parasympathetic supply from Lacrimal muscles and leave the facial nerve to synapse in the Sphenopalatine Ganglion before running into the Lacrimal gland, its stimulation produces secretion of tears (reflex secretor). Statistical analysis of the data obtained from 80 subjects showed that Xylocaine caused a significant ($p < 0.001$) reduction in normal tear production. This agrees with the alternate hypothesis which states that Xylocaine has a significant effect on Schirmer tear test. Gender has no significant relationship with normal tear reduction (Table 3a) ($p > 0.05$).This disagrees with the alternate hypothesis which states that Gender has a significant effect on Schirmer tear test. There was a slight decrease in normal tear production with increase in age. (Table 4a).

CONCLUSION

Based on the results of this study, it was concluded that there was a significant decrease in normal Schirmer tear test value after instillation of Xylocaine, the effect of Xylocaine on Schirmer tear test does not vary with Gender and the effect of Xylocaine on Schirmer tear test does not vary with Age.

RECOMMENDATION

It is therefore recommended as follows;

That Xylocain should not be instilled on adults manifesting symptoms of dry eyes and adequate expert supervision is necessary in the eventual use of Xylocain as a topical anesthetic. It is also recommended that further studies be carried out in this area among adults of other Cities with varying gender and age group

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