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COMPARISON OF INTRAOCULAR PRESSURE MEASUREMENTS WITH THE GOLDMANN APPLANATION TONOMETER AND PERKINS TONOMETER
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COMPARISON OF INTRAOCULAR PRESSURE MEASUREMENTS WITH THE GOLDMANN APPLANATION TONOMETER AND PERKINS TONOMETER

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ABSTRACT

***Objective*: To compare the intraocular pressure measurements with the Goldmann Applanation Tonometer and that of Perkins Tonometer.**
***Design*: A prospective descriptive study.**
***Setting*: Anya Specialist Hospital, Umuahia**
***Subjects*: One hundred consecutive consenting patients comprising of 50 males and 50 females that presented in the facility from January 2019 to June 2019were included in the study.**
***Results*: The right eyes of 100 subjects were analysed. The mean intraocular pressure measurement by the Goldmann Applanation Tonometer was 16.36mmHg, while that for Perkins was 16.56mmHg. Analysis of the findings using linear regression analysis showed a coefficient of determination (r^2) = 0.976 which is close to 1.**
***Conclusion*: There is no statistically significant difference between IOP readings obtained with GAT and Perkins. Perkins is a good alternative to GAT and should be used to measure and monitor IOP of patients especially those who may not be able to adapt to the GAT measurement.**

INTRODUCTION

Tonometry is the measurement of intraocular pressure (IOP), of which normal values in humans range from 11-21mmHg. The gold standard of measurement is the goldmann applanation tonometre(GAT) , but its use is often not practical for all patients. The standardization was also done using caucasian eyes. There is a need to compare the results of the GAT with Perkins tonometer in a black African population.

Tonometry is the measurement of intraocular pressure (IOP), with normal range from 11-21mmHg in humans (1). For almost 50 years, the gold standard for measuring IOP has been the Goldmann Applanation Tonometer (GAT) (1, 2). A number of factors are known to affect IOP measurement and these factors include circadian variation, heartbeat, body position, fluid intake, central cornea thickness etc. (2). GAT measurements are particularly affected by central corneal thickness (CCT). Limitations such as mentioned above have led to innovations geared at arriving at new methods of tonometry like the rebound tonometer which may not be dependent on corneal curvature, thickness and biomechanics (3). The rebound tonometer is a method of IOP measurement based on the analysis of motion parameters of a bouncing probe after colliding with the cornea (4, 5). In spite of its documented limitations the GAT is still most commonly used by majority of ophthalmologists because of its proven high level of accuracy and precision (6). Perkins tonometer is a portable form of applanation tonometry which may be a good substitute for GAT for patients who cannot be adapted to the slit lamp if readings from both instruments are found to be comparable. The aim of this study is to compare IOP readings from a newly acquired Perkins tonometer to those from GAT in a black African population so as to find out if there are significant differences in their readings. Due to paucity of data on comparison of these two instruments on African eyes, this study has become necessary to enable us find out if the correlation found in studies done in other countries is applicable to Black Africans. This may provide further information on use of Perkins as a useful alternative to GAT in the care of Black African glaucoma patients.

MATERIALS AND METHOD

Two hundred eyes of one hundred consecutive patients (50 males and 50 females) 18 years and above who consented, were recruited for the study. Each patient had ocular examinations including a visual acuity test, examination of the anterior segment and dilated fundoscopy. The IOP measurements were taken at least 24 hours after the dilated ocular examination. Each patient had intraocular pressure measurement first by the Perkins tonometer (HS CLEMENT CLARKE INTERNATIONAL, CE 0120) with the patient in the upright sitting position, then by the Goldman's applanation tonometer with the patient seated against the slit lamp, after a 20-minute interval.

Data was obtained using a questionnaire containing biodata, sociodemographic characteristics, ophthalmic history and examinations, blood pressure, weight and height. Data were entered and analysed using the statistical package for social sciences (SPSS) version 20.0 (SPSS Inc, Chicago, IL, USA). The significance level for association between variables was $P<0.05$

Ethical approval was from the Abia State University Uturu Human Ethics and Research Committee.

RESULTS

Table 1

Comparison of mean IOP between GAT and Perkins measurements

	GAT	Perkins
Mean IOP of 100 eyes	16.36mmHg	16.56mmHg

Two hundred eyes of 100 patients were studied, while values of the right eyes (100) were analysed. The mean intraocular pressure measurement by the Goldman applanation tonometer was 16.36mmHg, while that for Perkins was 16.56mmHg. Analysis of the findings using linear regression analysis showed a coefficient of determination (r^2) = 0.976 which is close to 1. This implies that intraocular pressures measured with Perkins tonometer correlates 97.6% of times, with the intraocular pressure measured by Goldman's tonometer.

DISCUSSION

Measurement of intraocular pressure forms an integral part in the routine examination of patients who visit the eye clinic. More importantly it is useful in care of patients who have glaucoma (7,8,9). Intraocular pressure is the only modifiable risk factor for glaucoma (10). Fluctuations in intraocular pressure has been noted to play a role in glaucoma progression (11,12). Therefore, accurate measurement of intraocular pressure is an important part of glaucoma management. The gold standard for measurement of intraocular pressure is the slit lamp mounted Goldman applanation tonometer (2, 13). Some patients' IOP cannot be measured with the GAT hence the need to use an alternate but accurate method.

Our study found no significant difference in mean IOP values between the GAT readings and the Perkins readings. We found that if 100 patients each had intraocular pressure measured using both GAT and Perkins, that the readings will correlate 97.6% of the times. This is similar to findings of other studies that compared readings from these two instruments (14, 15). Baskett in his study (14) found a correlation of +0.91 between the GAT and Perkins measurement of 103 eyes, while Arora et al (15) in his study of 100 eyes found a correlation of +0.85 between GAT and Perkins. In another study where three different tonometers (Perkins, Tono-Pen XL and Reichert 7CR) were compared to GAT, the Perkins showed the highest correlation to GAT (16).

Hatley and Song (17) noted that Goldmann slit-lamp mounted applanation resulted in lower IOP (0.29mmHg; ϱ = 0.649) readings compared with Perkins hand-held applanation tonometers. However, this difference is very low and was found to non-significant.

Our study was done in a black African population and had the highest correlation of 0.976. This could mean that the Perkins is nearly as accurate as the GAT in Black African eyes and could easily be used an alternative for IOP measurements especially in conditions where use of GAT is impractical (bedridden patients, younger children, in theatre and outreach settings).

CONCLUSION

There was no significant difference in the intraocular pressures when measured with either the Goldman applanation or Perkins tonometer in black Africans.

RECOMMENDATIONS

Perkins tonometer is reliable and can be used as a good alternative to Goldman applanation tonometer in intraocular pressure measurement especially in black patients who cannot easily be adapted to a slit lamp for GAT.

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