Patients' preference for different tonometers in a tertiary ophthalmic clinic

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Abstract

Background: Intraocular pressure measurement is a routine examination in the Eye clinic, and it is essential in the management of glaucoma.

Aim: To assess the preference of patients for three different types of tonometers used at the Eye clinic of the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.

Methods: This was a comparative cross-sectional study of adults 18 years and older. Their intraocular pressure (IOP) was measured using Perkins applanation tonometer (PAT), Pulsair non-contact tonometer (NCT) and iCare rebound tonometer (RBT). Their preferred tonometer and reasons for their choices were elicited.

Results: There were 69 (75%) male and 23 (25%) female respondents in the study. The mean age was 38.84 ± 13.34 years, with an age range of 18 - 71 years. Majority of participants preferred the NCT (43.4%, 40), followed by PAT (31.5%, 29 while the RBT (20.7%,19) was the least favourite instrument and 4.4% of participants had no preference. There was a statistically significant difference in the preference of the three tonometers, P value = 0.004 (<0.05). With the iCare, most participants preferred it for the following reasons - no pain or discomfort (n=5; 26.3% each) and no eye drops (26.3%). With the NCT, the reasons given were speed (n=7; 17.5%), no pain (37.5%) and no eye drops (10%). For the PAT, the commonest reason for preference was no pain (65.5%).

Conclusion: Majority of the participants in this study preferred the NCT, followed by the PAT and RBT tonometers respectively.

Keywords: Intraocular pressure, preference, Perkins applanation tonemeter, iCare rebound tonometer, Pulsair non-contact tonometer

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Access this article online			
Quick Response Code:	Website:		
	www.phmj.org.ng		
	DOI: https://doi.org/10.60787/ phmj.v18i3.181		

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How to cite this article: Sibeudu OA, Nathaniel GI. Patients' preference for different tonometers in a tertiary ophthalmic clinic. Port Harcourt Med J 2024;18(3):115-121..

INTRODUCTION

Intraocular pressure is the only known easily modifiable risk factor in the treatment hence of glaucoma, its accurate measurement is important in management of the disease.1 Glaucoma management is a lifelong process for patients and for every follow-up, IOP assessment is indispensable in monitoring the effectiveness of the treatment. The contact Goldmann applanation tonometer remains the gold standard for the measurement of intraocular pressure.^{2,3} As an instrument which requires direct contact with the patient's eye, its use is generally inconveniencing for the patient. Generally, patients show preference to noncontact tonometers as shown by several studies.4,5

Worldwide, many ophthalmic practices are increasingly depending on more convenient forms of intraocular pressure measurement other than the gold standard (Goldmann or Perkins).^{2,3, 6}

In our practice at a government-own tertiary health institution, the Perkins handheld applanation tonometer (PAT) was the instrument used for IOP measurement in both the General and Glaucoma clinics until recently when iCare rebound and Pulsair NCT were introduced. Previous studies by Babalola *et al* and Popoola *et al* both in the northern part of Nigeria showed that the patients preferred the NCT to GAT and PAT.^{4,7} This study aims to assess the preference of patients in the southern part of Nigeria for three different tonometers.

MATERIALS AND METHODS

It was a comparative cross-sectional study carried out at the Eye clinic, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria from August 1st to November 1st, 2019. Adults aged 18 years and older attending the Eye clinic and without the underlisted exclusion criteria were included in the study. Participants with severe visual impairment resulting in poor fixation, history of intraocular surgery, refractive corneal surgery, contact lens wear were excluded. Also excluded were participants with corneal pathology such as keratoconus, bullous keratopathy; ocular inflammation, uncontrolled diabetes mellitus and hypertension, and corneal astigmatism exceeding 3 diopters.

A calculated sample size of 92 participants was used and the participants were recruited into the study using systematic sampling techniques. Ethical clearance was obtained from the Research and Ethics Committee of the University of Port Harcourt Teaching Hospital, Port Harcourt. Informed written consent was also obtained from all the participants. In addition, the study was conducted in compliance with the Helsinki tenets for research involving human subjects.⁸

Interviewer administered questionnaires were used to collect the socio-demographic data of the participants and the reasons for the preference for a particular tonometer.

All participants underwent an ophthalmic examination of both eyes including visual acuity (VA) using the Snellen chart, Near chart and Tumbling E chart for illiterate subjects.

Intraocular pressure (IOP) was measured for each eye first with the NCT, then the RBT and finally the PAT. This was because the tonographic effect of the RBT and NCT due to aqueous massage is almost negligible and much less than PAT.⁹⁻¹¹ An interval of 10 minutes was given between measurements using each IOP instrument to improve the accuracy of sequential measurements.¹²

The non-contact Pulsair tonometer (NCT) (Intellipuff USA non-contact tonometer) was used by an Optometrist to measure IOP. The instrument was turned on, the hand piece lifted from the cradle and the eye to be measured was selected on the instrument.

When the unit became active the green LED prompted the examiner. From about 30cm the examiner looked through the eye piece to locate the eye of the subject seated in an upright position and then advanced the hand towards the maintaining piece eve red reflex and alignment until the subsequently a black alignment appeared at about 5cm from the eye. The device shot automatically when this image was centered. The reading was then displayed on the screen.

The iCare tonometer (RBT) (TA01i – Tiolat Oy. Helsinki, Finland) was used by the first author (O.A.S) by loading the probe into the machine and priming it. The participant sat upright, and the tonometer stabilized on the patient's forehead. The participant was given a straight-ahead target to fixate on while the probe was held about 4mm from the corneal apex. The operational button was pushed 6 times until the beeping sound was heard and the IOP displayed on the screen.

The hand-held Perkins applanation (PAT) (Mk 2 Haag-Streit Diagnostics) tonometer was used by an Ophthalmic resident after instilling a drop of a freshly prepared mixture of 0.4% amethocaine and 2% fluorescein into the conjunctival sac. The head rest was placed on the forehead of the subject seated in an upright position, then the instrument turned on and its dial was preset at 1(10mmHg). The tonometer prism was then advanced till it just touched the corneal apex. While looking through the eye piece, the inner margins of the two semicircular mires were aligned and the 1OP was obtained by multiplying the figure read off on the dial by 10.

Central corneal thickness (CCT) (Sonomed Pac Scan 300 AP+) was measured by an Ophthalmic resident using an ultrasound pachymeter. Topical 0.4% amethocaine drops were instilled in the conjunctival sac. The pachymeter probe was placed on the centre of the cornea with the patient looking at a target straight ahead and the mean of 5 readings was taken as the CCT. The correction for IOP was done automatically by the algorithm embedded in the device.

Data collected were analyzed using the Statistical Package for Social Sciences (SPSS) version 23. (SPSS for windows version 23.0; SPSS Inc, Chicago, Illinois). Results were presented in tables and pie charts. Continuous variables were summarized with mean and standard deviation while categorical variables were expressed with frequency and percentage.

Chi square was used to determine the significance of the preference of the tonometers. P-value less than 0.05 was considered to be statistically significant in all cases.

RESULTS

There were 69 (75%) male and 23 (25%) female respondents in the study; most of whom were within the age group of 40-49 years, constituting 34 (37%) of the total respondents. The mean age was 38.84 ± 13.34 years, with an age range of 18 -71 years. Few of the respondents had attained tertiary degree, but the majority, (n=70; 76.1%) had secondary level of education. There was a similar proportion of married and single respondents, about 48.9% (n=45)and 45.7% (n=42)respectively. Majority of respondents were either semi-skilled, unemployed or students (Table 1).

Characteristics of corrected IOP measurement by the various tonometers The mean CCT corrected IOP using NCT in

The mean CCT corrected IOP using NCT in the right eye was 15.48 ± 3.55 mmHg and 15.55 ± 3.41 mmHg in the left eye. Using PAT, the mean CCT corrected IOP was 15.03 ± 4.17 mmHg in the right eye and 14.16 ± 3.53 mmHg in the left eye. For RBT, the mean CCT corrected IOP was $16.54 \pm$

117

4.51 mmHg in the right eye and 16.75 \pm 4.09 mmHg in the left eye (Table 2).

Tonometer preference of participants

Table 1: characte

Table 2: Descriptive characteristics of corrected IOP values from tonometers in the study

Majority of participants preferred the NCT (43.4%) , while the RBT was the least favourite instrument and 4.4% of		Descriptives	otives Corrected Aver IOP		verage	
participants h	ad no preference	(Figure 1).		NCT	PAT	RBT
Table 1: Soci	o-demographic		RIGHT EYE			
characteristics of the study participants		Mean	15.48	15.03	16.54	
Variables	Frequency (n=92)	Per cent (%)	Median	15.25	14.30	16.30
Sex	(Std. Deviation	3.55	4.17	4.51
Female	23	25.0	Interquartile range	3.40	4.35	4.92
Male	69	75.0	Minimum	9.80	7.10	9.40
Age Group (years)			Maximum	36.00	39.00	41.50
<30	26	28.3				
30 - 39	18	19.6				
40 - 49	34	37.0	Mean	15.55	14.16	16.75
≥50	14	15.2	Median	15.20	13.55	16.20
(M±SD)	e 38.84±13.34 years, Age range 18-71 years		Std. Deviation	3.41	3.53	4.09
Education	2		Minimum	9.90	7.00	9.10
level			Maximum	28.40	28.10	32.10
education	2	2.2				
Primary	16	17.4	Significance of to	nometer	r prefe	rence
Secondary	70	76.1	among study participants and reason			
Tertiary	4	4.3	for participants' preference of tonometers			of
Marital Status			There was a st difference in the p	tatistically	y signi of the	ificant three
Single	42	45.7	tonometers, P value = 0.004 (<0.05) (Tab 3)			(Table
Married	45	48.9	With the iCare, most participants preferred it for the following reasons - no pain			
Widowed	3	3.3				
Separated/di vorced	2	2.2	discomfort (n=5; 26.3% each) and no eye drops (26.3%). With the Pulsair, the reasons given were speed $(r=7, 17.5\%)$			o eye easons
Occupation			(37.5%) and no eye	drops (1)	10%). Fo	or the
Professional	10	10.9	PAT, the commonest was no pain (65.5%)	reason (Table 4)	for prefe	erence
Skilled	24	26.1				





Figure 1: Tonometer preference of study participants

Table	3:	Significance	of	tonometer
prefere	ence	among study p	artic	ipants

Variable	Tonometer Preference		X²/ Fisher's Exact	P Value
	Yes (%)	No (%)		
Tonometers			11.044	0.004
PAT	29 (31.5)	63(68.5)		
NCT	40 (43.5)	52(56.5)		
RBT	19(20.7)	73(79.3)		

Table4:Reasonsforparticipants'preference of tonometers

	RBT n (%)	NCT n (%)	PAT n (%)
No pain	5(26.3)	15(37.5)	19(65.5)
No discomfort	4(21.1)	14(35)	3(10.3)
Fastest	3(15.7)	7(17.5)	0(0)
No startling Sound	1(5.3)	0(0)	6(20.7)
No bright light	1(5.3)	0(0)	1(3.5)
No eyedrops	5(26.3)	4(10)	0(0)
Total	19	40	29

DISCUSSION

In this study, more patients preferred the NCT to either PAT or RBT and this was found to be statistically significant. Only 4.4% felt that there was no difference between all three instruments.

The reasons for preference of NCT by majority of respondents was because it was fast, not painful and less stressful/discomforting as there was no contact with the eye or need for eye drops, however some found the red light bothersome and were startled by the jet of air.

Majority of the respondents who preferred PAT did so because they felt nothing during the test (because of the topical anaesthesia, and there was no startling sound or bright light. However, others found the contact of the probe with the eye to be bothersome and the eyedrops messy. Those who preferred iCare did so because it was fast, had no need for eyedrops, no bright light and they felt no pain or discomfort.

These findings are like by Babalola et al, Adebayo's and Vernon et al who reported that more patients prefer the NCT to GAT.^{4,13,5} However, in Vernon's study, significantly more patients felt there was no difference between both methods.⁵ This was probably because the subjects used were post-operative patients who may have been less sensitive than normal patients, though the type of surgeries were not specified. Contrary to this study, Kontiola et al reported that patients preferred RBT to the NCT, because they felt no pain and thought RBT was faster than NCT.¹⁴ Pakrou et al's study subjects on the other hand preferred RBT to GAT because it was more comfortable and didn't require eyedrops.¹⁵

Vernon *et al* found 10 of 45 patients preferred the NCT, 7 the GAT, and 28 had no preference and felt there was no significant difference between the instruments.⁵ Babalola *et al* found the order of preference to be: NCT 33 (38%), GAT 22

119

(25%), no preference 19 (22%) and no opinion 14 (16%).⁴ Pakrou *et al* compared RBT and GAT and found 2/38 (5.3%) patients preferred the GAT, and 8/38 (21%) indicated no preference for either method, the rest favoured RBT.¹⁵

Kontiola *et al* compared NCT and RBT 95%, of respondents did not feel any pain and 85% did not feel any discomfort (P=0.18) with RBT. 85% did not feel any pain and 64% did not feel any discomfort with NCT.¹⁴ NCT caused discomfort more often than RBT (p=0.01), but of those who complained of pain or discomfort with NCT, 78% rated it as slight.

We did not consider the influence of demographic factors such gender and age on the preferences of the respondents, and we considered it as a limitation of this study.

CONCLUSION

Majority of the participants in this study preferred the non-contact tonometer (NCT), followed by the Perkins applanation (PAT) and iCare rebound (RBT) tonometers respectively. For all three tonometers, the non-perception of pain and discomfort were the major reasons the participants gave that influenced their preferences.

Financial support and sponsorship Nil

Conflicts of interest

There are no conflicts of interest.

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121