Original Article

Exploring the Ocular Biometric Changes after Antimetabolite-Augmented Trabeculectomy in Nigerian Adult Glaucoma Patients

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Abstract

Background: Trabeculectomy can induce changes in ocular biometrics, potentially impacting intraocular lens calculation accuracy. While these effects have been documented, primarily in Caucasian populations, limited data exists on how trabeculectomy affects biometrics in individuals of African descent, who may exhibit distinct ocular characteristics. **Aim:** To describe changes in ocular biometrics after antimetabolite-augmented trabeculectomy in an adult Nigerian population. **Methods:** An observational, hospital-based, prospective study involving 52 adult glaucoma patients with Mitomycin-C augmented trabeculectomy for primary glaucoma at the University College Hospital, Ibadan. Ocular biometry parameters such as keratometry (K), axial length (AXL), pachymetry (CCT), and lens thickness (LT) measurements were taken before the surgery, 1 week, and 3 months after surgery. **Results:** The study cohort's mean age (SD) was 49.1 (±14.6) years. In the first postoperative week, the mean baseline AXL values (23.7 ± 0.9) mm decreased (23.4 ± 0.8, *P* <0.001), mean baseline Keratometry values (42.9 ±1.3D) increased (43.2 ±1.5D, *P* =0.004), mean baseline CCT values (543.0 ±44.0 µm) did not differ (544.4 ±55.6 µm, *P* = 0.57) neither did mean baseline LT values (3.8 ±0.7mm) change (3.9 ±0.8mm, *P* = 0.57). At the 3rd postoperative month, the mean AXL was shorter (23.5 ±0.8mm, *P* = 0.007), CCT was thinner (526.3 ±47.5 µm, *P* <0.001), Keratometry was steeper (43.1 ±1.4D, *P* =0.02), while the LT value remained unchanged. The change in AXL was affected by age, preoperative refractive status, glaucoma diagnosis, and degree of reduction of IOP from baseline. There was a positive correlation between thinner pachymetry value and lower IOP, steeper keratometry, and lower IOP values at the 3rd postoperative month. **Conclusion:** The considerable changes in ocular biometric parameters following trabeculectomy should be considered in setting target IOP at follow-up and calculating intraocular lens power for cataract surgery post-trabeculectomy.

Keywords: *African eyes, glaucoma, ocular biometric, trabeculectomy*

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Introduction

Glaucoma is the second most common cause of blindness worldwide.[1] It is of public health concern in Sub-Saharan Africa with its high prevalence rates, earlier onset, and rapid progression.[2,3] Overall, 1.1 to 1.4 million adults in Nigeria have glaucoma.[4] In Africa, challenges with medical treatment of glaucoma include affordability, availability, and compliance, hence surgery has been recommended as a primary treatment.[5-7] Trabeculectomy is the most commonly performed

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glaucoma surgery; and to improve the success rates, releasable sutures and adjunctive treatment with antifibrotic agents have been used.[7]

Glaucoma and cataracts may co-exist. The Nigeria National Blindness and Visual Impairment Survey found that 13% of blindness in persons with glaucoma was preventable by cataract surgery.[8] Increased cataract formation is a known complication of trabeculectomy with a risk as high as 78%.[9] Nigerian studies have documented percentages of 17% at 1 year and 23.4% more than 3 years after trabeculectomy.[6,10]

Several studies have reported a reduction in axial length (AXL), astigmatism, and an increase in lens thickness (LT) after trabeculectomy.[11–15] Central corneal thickness (CCT) may increase, decrease, or remain unchanged after trabeculectomy.[16,17] These changes in ocular biometrics have been noted in the early and later postoperative periods. Studies such as Cashwell LF *et al.*[12] and Bae HW *et al.*[18] have reported the effects of trabeculectomy on the accuracy of IOL calculations and noted these biometric changes influence refractive outcomes after cataract surgery.

The eyes of people of African descent have characteristics such as thinner cornea, aggressive healing, and increased fibrosis, which make it possible that the biometry changes following glaucoma surgery may differ when compared to Caucasians in whom most published data are available.[6,19] This study aimed to describe the short-term changes in ocular biometrics after antimetabolite-augmented trabeculectomy in an adult Nigerian population.

Methodology

This was a hospital-based, longitudinal, prospective single-group cohort study involving patients undergoing trabeculectomy for primary glaucoma at the University College Hospital (UCH), Ibadan, Nigeria between January 2021 and July 2022. After approval was obtained from the University College Hospital and University of Ibadan (UCH/UI) ethical review committee (UI/EC/20/0359), written informed consent was obtained from each patient before enrollment. The study adhered to the tenets of the Declaration of Helsinki.

Study participants were 18 years and older and had used antiglaucoma medications before undergoing the trabeculectomy procedure. Patients were excluded if they had congenital glaucoma; failed to give informed consent; corneal opacity, anterior staphyloma, corneal ectasia, suspected collagen disorders; had a history of previous intraocular, corneal, or refractive surgeries; had lens opacities grading of ≥ nuclear cataract (NUC)-3; or were to undergo combined cataract and trabeculectomy procedure.

One investigator conducted all clinical examinations including autorefraction, slit lamp examination, gonioscopy, tonometry, fundoscopy, and ocular biometric examinations including A-scan biometry, keratometry, and pachymetry before trabeculectomy. These ocular biometric examinations were repeated by the investigator at the scheduled intervals of 1 week and 3 months after trabeculectomy. Keratometry was performed using a KR-8900 autorefractor-keratometer (Topcon Corporation, Tokyo Japan). Axial length, lens thickness, and pachymetry values were obtained using the Appascan MAX AP 0518-AP-064 ultrasonic biometer (Appasamy associates Chennai-600106, India). Hypermetropia was defined as the spherical equivalent of +0.50D or greater and myopia as the spherical equivalent of −0.50D or greater.

Other data collected include surgical procedures, use of antimetabolites, intraoperative complications, postoperative complications, and onset, or progression of cataract after glaucoma surgery.

Trabeculectomy

Trabeculectomy was performed via a fornix-based conjunctival flap. After xylocaine was injected into the superior subconjunctival space to balloon out the conjunctiva, careful conjunctiva periotomy and blunt dissection of the conjunctiva about 8-10 mm posteriorly and laterally avoiding radial incisions at the sides was performed. A 4 × 5 mm triangular partial scleral flap was dissected leaving an uncut sclera 1 mm behind the limbus at the margins but dissected into a clear cornea centrally. Four pieces of 3 × 3 mm cellulose surgical sponges saturated with Mitomycin-C (0.4 mg/ml) were placed in the subconjunctival area and underneath the scleral flap for 3 minutes after which they were removed, and the surgical site was thoroughly irrigated with 30 ml of normal saline. A rectangular deep sclerotomy and a peripheral iridectomy were performed after anterior chamber paracentesis. The scleral flap was closed with two 10-0 nylon releasable sutures, at the apex and to one side of the triangular flaps. The conjunctiva was closed with 9-0 nylon sutures ensuring a watertight bleb at the end of surgery. A 0.1 ml of preservative-free moxifloxacin (0.5%) was given intracameral. Subconjunctival injections of dexamethasone (0.5 ml of 4 mg/ml) and gentamycin (0.5 ml of 20 mg/ml) were given as well as atropine (1%) drops. All surgeries were performed by the same surgeon. Post-operative medications include dexamethasone eyedrops and antibiotic drops.

Data management

A minimum sample size of 49 patients was calculated using the sample size formula for testing a hypothesis with continuous variables involving paired data.[20]

We used a standard normal variate corresponding to the level of significance at 5% type 1 error and a power of 80%. The standard deviation and effect size were from a previous study.[13]

Demographic data and clinical characteristics were summarized using frequency counts, mean, and standard deviation. Paired *t*-test, independent *t*-test, and one-way ANOVA were used to explore the difference in mean values of the ocular parameters. *Post hoc* Tukey tests were also performed. Pearson's correlation analysis was used to evaluate the relationships between biometry changes in the ocular parameters (AXL, CCT, K, LT) and clinical and demographic characteristics. Simple linear regression and multiple regression analyses were used to evaluate the associations between the individual dependent (ocular biometric parameters) and the independent clinical variables. A *P* value less than 0.05 was taken as statistically significant. The data was analyzed using IBM Statistical Package for the Social Sciences (IBM SPSS) for Windows software version 22 (SPSS Inc., Chicago, IL, USA).

Table 1: Distribution of patients according to sociodemographic and clinical factors

Characteristics	Frequency (%)	Mean age (years)	*P*
Gender			
Male	31 (59.6%)	50.4±14.1	0.43#
Female	21 (40.4%)	47.2±15.5	
Glaucoma diagnosis			
POAG	32 (61.5)	55.7±9.1	<0.001*
JOAG	13 (25.0)	29.4±6.9	
PACG	7 (13.5)	55.6±13.5	
Preoperative visual acuity			
≥6/12	39 (75)		
<6/12–6/18	5 (9.6)		
<6/18–6/60	8 (15.4)		

#Independent *t*-test, *ANOVA

Results

A total of 52 patients were included in the analysis. The mean age was 49.1 (±14.6) years, range 20–74 years. Other sociodemographic and clinical characteristics are reported in Table 1.

The mean preoperative spherical equivalent was −0.6D (±2.6). The median refractive error was Plano. Of the patients, 22 (43.1%) were hypermetropic. The mean spherical equivalent in the myopic patients was −3.1 ± 2.7D (median -2.0D) and + 1.3 ± 1.1D (median +1.0D) in the hypermetropic patients. A diagnosis of JOAG was associated with a myopic refractive error. All patients were on medical therapy in the eye to be operated on. The mean number of medications was 3.4 ± 0.8. The mean preoperative intraocular pressure was 21.2 (±8.3) mmHg on medication. The mean preoperative IOP in POAG (22.2 ± 7.7 mmHg), PACG (20.7 ± 6.4 mmHg), and JOAG (19.2 ± 10.2 mmHg) did not differ significantly according to the subgroups ($P = 0.53$).

The AXL was significantly longer ($P = 0.02$) in patients with JOAG (24.2 mm) in comparison with those who had POAG (23.6 mm) and PACG (23.2 mm). The AXL was also significantly longer in myopic eyes when compared with hypermetropic eyes. Pearson's correlation analysis revealed a strong negative correlation between preoperative AXL and the spherical equivalent of the refractive error [$r = -0.565$, $P \leq 0.001$]. As the eye tended towards higher degrees of myopia, the AXL was longer.

Trabeculectomy outcomes of patients

Surgery was performed in the left eye at a slightly higher frequency, 28 (53.8%) compared to the right. Intraoperative complications consisting of transient hyphema, occurred in 3 (5.8%) of the patients. Postoperative complications of varied severity were present in 16 (30.2%) patients. There was transient hyphema in 3 (5.8%), shallow AC in 3 (5.8%), and

Table 2: Ocular biometric parameters at baseline and after surgery

Ocular biometric Parameter	Preop	Postop week 1	Change at 1 week postop	*P*	Postop month 3	Change at 3 months postop	*P*
AXL (mm)							
Mean (SD)	23.7 (±0.9)	23.4 (±0.8)	−0.33 (±0.5)	<0.001	23.5 (±0.8)	−0.13 (±0.3)	0.007
CCT (µm)							
Mean (SD)	543.0 (±44.0)	544.4 (±55.6)	1.4 (±39.4)	0.573	526.3 (±47.5)	−17.6 (±25.5)	<0.001
Keratometry (D)							
Mean (SD)	42.9 (±1.3)	43.2 (±1.5)	0.32 (±0.8)	0.004	43.1 (±1.4)	0.26 (±0.7)	0.02
LT (mm)							
Mean (SD)	3.8 (±0.7)	3.9 (±0.8)	0.1 (±0.9)	0.568	3.9 (±0.7)	0.1 (±0.7)	0.30

AXL - Axial length, CCT - Central corneal thickness, LT – Lens thickness, SD - Standard deviation, *P* of paired *t*-test comparing postoperative values with preoperative values, Preop – preoperative, Postop – postoperative

Table 3: Changes in mean AXL, CCT, K, and LT values according to gender, glaucoma diagnosis, and preoperative refractive errors

Parameter	Δ1-AXL		Δ1-CCT		Δ1-K		Δ1-LT	
1 week postoperative								
	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*
Gender								
Male	−0.29 (±0.44)	0.50	0.03 (±39.34)	0.51	0.34 (±0.91)	0.85	−0.03 (±1.04)	0.36
Female	−0.39 (±0.63)		6.68 (±27.73)		0.30 (±0.55)		0.20 (±0.55)	
Glaucoma type#								
POAG	−0.23 (±0.38)	0.01	3.13 (±38.34)	0.98	0.38 (±0.90)	0.76	−0.07 (±0.96)	0.13
PACG	−0.12 (±0.50)		4.14 (±21.71)		0.32 (±0.45)		0.70 (±1.02)	
JOAG	−0.70 (±0.68)		1.17 (±33.94)		0.18 (±0.57)		0.12 (±0.26)	
Preoperative refraction								
Myopia	−0.54 (±0.60)	0.01	2.11 (±30.23)	0.75	0.17 (±0.71)	0.17	−0.07 (±0.99)	0.29
Hypermetropia	−0.16 (±0.40)		5.28 (±39.84)		0.48 (±0.84)		0.21 (±0.78)	
3 months postoperative								
	Δ2-AXL		Δ2-CCT		Δ2-K		Δ2-LT	
Gender								
Male	−0.11 (±0.22)	0.69	−18.93 (±27.13)	0.69	0.32 (±0.60)	0.37	0.12 (±0.76)	0.89
Female	−0.15 (±0.42)		−15.84 (±23.79)		0.14 (±0.78)		0.09 (±0.66)	
Glaucoma type#								
POAG	−0.10 (±0.30)	0.44	−20.66 (±27.77)	0.32	0.33 (±0.62)	0.02	0.12 (±0.80)	0.98
PACG	−0.27 (±0.22)		−4.29 (±13.82)		−0.39 (±0.90)		0.12 (±0.88)	
JOAG	−0.12 (±0.40)		−18.07 (±23.96)		0.48 (±0.44)		0.07 (±0.24)	
Preoperative refraction								
Myopia	−0.16 (±0.32)	0.62	−17.54 (±26.60)	0.95	0.24 (±0.81)	0.99	0.15 (±0.40)	0.90
Hypermetropia	−0.10 (±0.32)		−18.04 (±23.09)		0.23 (±0.59)		0.12 (±0.90)	

AXL - Axial length, CCT - Central corneal thickness, K – keratometry, LT – lens thickness, SD - Standard deviation, Δ1 – difference between preoperative and postoperative values at the 1st postoperative week, Δ2 – difference between preoperative and postoperative values at 3 months #one way ANOVA

Table 4: Mean changes and association with patient characteristics

Ocular biometry parameter	Variable	*r*	*P*
ΔAXL at 1st week	Age	−0.32	0.024
	SE of refractive error	−0.38	0.006
	Preoperative AXL	0.33	0.018
	Change in IOP at week 1	0.15	0.327
	Postoperative IOP at week 1	-0.35	0.018
ΔAXL at 3rd month	Preoperative AXL	0.32	0.03
	Postoperative IOP at week 1	−0.42	0.006
	Change in IOP at 3rd month	0.32	0.04
ΔCCT at 3rd month	Change in IOP at 3rd month	0.16	0.32
	Postoperative IOP in 3rd month	−0.33	0.04
Δ Keratometry at 3rd month	Change in IOP at 3rd month	0.30	0.07
	Postoperative IOP in 3rd month	−0.33	0.04

AXL - Axial length, CCT - Central corneal thickness, Δ – difference between preoperative and postoperative values, *r* – Pearson coefficient, *P*=Statistical significant (<0.05)

imminent aqueous misdirection in 3 (5.8%) patients. Only 8 (15.4%) had secondary procedures performed. The commonest were bleb needling 3 (5.7%) and AC reformation 2 (3.8%). Others were 5-FU injection 1 (1.9%), conjunctiva resuturing 1 (1.9%), and iris incarceration release in 1 (1.9%). All complications were successfully managed without sequelae. Postoperatively within the study duration, no eye had endophthalmitis, hypotony maculopathy, posterior synechiae, cataract progression, or retinal detachment.

Ocular biometric parameters at baseline and after surgery

The mean (SD) preoperative, 1 week postoperative, and 3 months postoperative AXL was 23.7 (±0.9) mm, 23.4 (±0.8) mm, and 23.5 (±0.8) mm, respectively. The change in AXL at each postoperative period from the preoperative value was statistically significant with $P < 0.001$ and $P < 0.007$ at 1 week and 3 months postoperative respectively. Trabeculectomy-related changes in ocular biometric parameters are reported in Table 2.

The mean spherical equivalent of the refractive error in all the patients was -0.5 (±2.2) D and median of

Table 5: Simple linear regression analysis results of patient characteristics related to predicting change in AXL

Predictor INDEPENDENT variable	Predicted DEPENDENT variable					
	Change in AXL at 1 week			Change in AXL at 3 months		
	Regression	*t*	*P*	Regression	*t*	*P*
Patient age	R^2=0.100, F=5.451	−2.335	0.024	R^2=0.003, F=0.125	-0.354	0.725
Preoperative spherical equivalent	R^2=0.146, F=8.371	−2.893	0.006	R^2=0.090, F=4.425	-2.104	0.041
Preoperative AXL	R^2=0.108, F=5.948	2.439	0.018	R^2=0.101, F=5.038	2.244	0.030
Postoperative IOP at 1 week	R^2=0.121, F=6.035	−2.457	0.018			
Postoperative IOP at 3 months				R^2=0.056, F=2.322	-1.524	0.136
Change in IOP at week 1	R^2=0.022, F=0.984	0.992	0.327			
Change in IOP at 3 months				R^2=0.104, F=4.546	2.132	0.039

AXL - Axial length, IOP – Intraocular pressure

Plano at week one, and -0.6 (±2.9) D with a median of -0.25D at 3 months. The mean preoperative IOP was 21.22 (±8.27) mmHg and postoperative means were 8.0 (±5.8) mmHg, and 11.9 (±4.8) mmHg at the 1st week and 3rd-month visits, respectively without medications. The mean change from baseline was 13.4 (±10.3) mmHg (median = 12 mmHg) and 9.8 (±10.4) mmHg (median = 8 mmHg,) at the 1st week and 3rd month postoperative visits.

Changes in mean biometric values compared with gender, glaucoma diagnosis, and preoperative refractive errors

At 1 week postoperative evaluation, the reduction in AXL of a value of 0.70 mm from the preoperative value in the JOAG subgroup was statistically significant (P = 0.01) compared to the reduction noted in the POAG and PACG subgroups of 0.23 mm and 0.12 mm, respectively. At 3 months postoperative evaluation, the mean K value for glaucoma type revealed a statistically significant difference (P = 0.02), where PACG had a reduction of mean K value of 0.39 but POAG and JOAG had an increase in value of 0.33 and 0.48 respectively. Details of the mean values of the changes in the ocular biometric parameters compared based on subgroups of the participants' clinical characteristics—gender, spherical equivalent of preoperative refraction, and glaucoma diagnosis are reported in Table 3.

JOAG patients had more mean shortening in AXL at the 1st postoperative week. A Tukey *post hoc* analysis showed that patients with JOAG had a longer mean change in AXL of 0.47 mm compared with patients who had POAG (P = 0.01). JOAG patients had a longer mean change in AXL of 0.58 mm compared with patients who had PACG (P = 0.04). Patients with PACG had flattening of cornea curvature in the 3rd postoperative month. A Tukey *post hoc* analysis revealed PACG eyes had flatter cornea curvatures of − 0.72D compared with POAG (P = 0.03) and JOAG (P = 0.02).

Correlation between the IOP and changes in the ocular biometric parameters

Analysis of the correlation between the IOP and changes in the ocular biometric parameters showed some relevant correlation [Table 4]. Younger age at surgery and a higher degree of myopic refraction were associated with higher degrees of change from baseline values for AXL at the 1st postoperative week. Simple linear regression was used to predict changes in ocular biometric parameters based on patient demographic characteristics.

Patient characteristics predicting change in AXL

Changes in AXL were predicted by some variables using simple linear regression analysis [Table 5]. Younger age results in a greater change in AXL at the 1-week postoperative period (P = 0.024). Longer preoperative AXL results in a greater change in AXL at both 1-week (P = 0.018) and 3-month (0.03) postoperative periods. Further predictive modeling with multiple linear regression did not yield a reliable model as the t-statistics of either variable did not achieve statistical significance.

Discussion

In this longitudinal prospective study, the ocular biometric parameters of 52 patients who had trabeculectomy for primary glaucoma were compared pre- and post-operatively at predetermined time intervals. It revealed a statistically significant increase from baseline values of keratometry readings while a decrease from baseline was noted for AXL and CCT. A significant drop in IOP in the early postoperative period could be an important factor. We found a positive moderate correlation between the magnitude of reduction in IOP and mean shortening in AXL at the 3rd postoperative month, hence we suggest that the magnitude of the IOP change could be responsible for AXL shortening, especially in patients who had JOAG.

The AXL remained significantly shorter for all postoperative visits compared with baseline measurement. In evaluating the clinical and demographic factors in the present study, younger patients, a greater amount of myopia, JOAG diagnosis, longer preoperative AXL, and lower postoperative IO*P* values were associated with greater AXL reduction. The results of other studies align with ours notwithstanding slight differences in the magnitude of change in AXL following trabeculectomy.[13–15,21,22] Studies have reported similar findings to ours with mean AXL shortening in their report ranging from 0.10 to 0.54 mm in the 1st postoperative week,[14,21,23] and at the 3rd month postoperative visit with mean shortening ranging from 0.21 to 0.83 mm.[13–15]

The decreased AXL suggests that the inner volume of the eye is reduced following trabeculectomy. The current study found an association between the magnitude of IOP reduction and a relative decrease in AXL in the 3rd postoperative month, this supports the hypothesis that AXL shortening results from IOP reduction. Francis *et al.,*[24] reported that larger IOP reduction correlated with shorter AXL after trabeculectomy. Beyond ocular volume changes, marked IOP decrease causes choroidal thickening which is associated with AXL reduction.[23,25,26] There is also a tendency for eyes with JOAG to be longer, with thinner, stretched, less rigid sclera. It has been hypothesized that scleral wall shrinkage, scleral relaxation, and other scleral biomechanical properties could be responsible for the AXL shortening following trabeculectomy.[26,27] This may explain the exaggerated responses seen in eyes with JOAG.

In this current study, there was no significant change from baseline in the mean CCT value by the 1st postoperative week. By the 3rd postoperative month, a significant thinning was observed or noted. A comparison of results from previous studies showed varying reports. In the 1st week postoperatively no difference was found by Cunliffe *et al*.[28] In contrast to the present study, a significant increase from baseline at 1 week postoperatively was noted in the study by Simsek *et al*.[17] While other studies reported no change at 3 months postoperatively.[17,29,30] Demographic, clinical factors, study methodology, surgical technique, wound construction, and flap suturing could lead to varied results obtained. In the current study, the mean IO*P* value was significantly positively correlated with the mean postoperative CCT measurement in the 3rd postoperative month. A reduction in IOP following successful trabeculectomy may be responsible for this reduction in CCT in our cohort. Simsek *et al.,*[17] have suggested that the decrease in IOP following trabeculectomy as well as improved endothelial function may be responsible for the reduction in CCT after the early postoperative period.

This present study suggests that trabeculectomy surgically alters corneal curvature as there was a significant increase in keratometry values at the two postoperative visits. Additionally, a slight decay in cornea curvature increase was noted between those two visits. Trabeculectomy has been documented to affect cornea curvature at varying follow-up periods in many studies.[14,28,31–34] A mean increase of 0.36D–0.58D has been documented in the 3rd postoperative month.[15,34] In contrast, no significant difference in keratometry was found in Japan.[35] The differences in study methodology could account for the contrast with this present study as they excluded eyes with irregular corneal astigmatism, eyes needing additional interventions, and eyes in which a different surgical technique was used.

Based on the results of our correlation analysis, we found that mean postoperative IOP values in the 3rd month were negatively correlated with the mean change in keratometry values from baseline. The change in keratometry from our study could be IOP-mediated. Surgical technique may also have an important role in keratometry changes. Suturing techniques that anchor the conjunctiva at the limbus with two wing sutures have been associated with significantly more surgically-induced astigmatism in the early postoperative period.[36] Other reasons for the changes observed in the cornea curvature following trabeculectomy include the partial-thickness scleral flap followed by deep block excision producing a type of wound gape that may reduce the vertical radius of curvature of the cornea, excessive cautery at surgery, suture tension, a large drainage bleb or induced ptosis, the pressure of the eyelid and bleb on the cornea, use of MMC, digital massage.[14,28,31–33,37]

There was a negligible change in lens thickness following trabeculectomy in the current study. In contrast, Rasooly *et al*.[37] were able to demonstrate an increase in LT within the first week after trabeculectomy. Their study sample was very small as only six eyes were studied.

These results are important and could influence decision-making in many clinical settings. In glaucomatous eyes with a low postoperative target IOP the possibility of a more marked AXL, keratometry, and CCT change should be considered. One scenario would be in patients who have glaucoma surgery followed by cataract extraction. Cataract surgery timing should consider possible AXL fluctuations especially as relates to intraocular lens (IOL) power calculation. Another scenario is when a combined cataract extraction and glaucoma filtering surgery is planned. An AXL decrease may occur in these eyes which may translate to a postoperative hypermetropic error. Another situation involves glaucoma surgery performed after cataract surgery, which may also result in a hypermetropic shift. These would be important considerations in young myopes where the degree of AXL reduction is higher.

The clinical implication of a change in corneal curvature applies to a plan that would affect cataract surgery with IOL implantation in the future which may need to be delayed until keratometry measurements are stable. In patients post-trabeculectomy, IOP measurements may be under-estimated as the CCT is lower than preoperative values. This highlights the need to consider CCT values to decide how aggressively to determine the target pressure level following glaucoma surgery.

A limitation of this study was that it was conducted in a single site which may make the results less generalizable as surgical techniques may differ across surgeons. The possibility that some anti-glaucoma medications could influence ocular biometrics was also not accounted for in this study.

In conclusion, we observed clear, definite, and dynamic changes in ocular biometric parameters such as AXL, CCT, and K in adult Nigerian eyes after trabeculectomy. Some demographic and clinical characteristics noted to affect these changes include younger patients, a greater amount of myopia, JOAG diagnosis, longer preoperative AXL, and lower postoperative IOP. Our study shows that there is shortening of AXL, thinning of central cornea, and steepening of cornea curvature in the short term after trabeculectomy. Considering the importance of these findings in determining prognosis and evaluating the response to treatment, an understanding of ocular biometric changes after trabeculectomy may help us make appropriate clinical decisions in patients post-trabeculectomy.

We recommend further studies on the biometric changes following trabeculectomy involving a larger sample size, in different types of glaucoma, multiple study sites, and an extended follow-up. This can provide more information on the mutual relationship between different surgical methods of glaucoma and biomechanical changes. More information is needed to create a model to predict both short-term and long-term ocular biometric changes in indigenous Africans post-trabeculectomy.

Ethics approval

obtained from the University of Ibadan/UCH Ethical Review Committee. **20/0359**

Author contribution statement

EOO was responsible for Conceptualization; Study design; Data curation; Formal analysis; Funding acquisition; Methodology; Resources; Visualization; Writing – original draft; Writing – review and editing. TFS was responsible for Conceptualization; Study design; Formal analysis; Methodology; Resources; Supervision; Visualization; Writing – review and editing. OO was involved in Conceptualization; Study design; Formal analysis; Methodology; Resources; Supervision; Visualization; Writing – review and editing. COB was involved in Conceptualization; Methodology; Resources; Supervision; Visualization; Writing – review and editing.

All authors approve the final version and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Conflicts of interest

There are no conflicts of interest.

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