COMPARING INTRAOCULAR PRESSURE AND PACHYMETER ADJUSTED INTRAOCULAR PRESSURE IN A SUBSAHARAN AFRICAN COHORT.

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ABSTRACT

PURPOSE:

To evaluate the effect of Central Corneal Thickness on measured intraocular pressure in a sub-Saharan cohort

METHOD:

Central corneal thickness CCT was measured by means of ultrasound pachymeter (IOPAC, Heidelberg Engineering, Germany) among subjects known to have glaucoma and those who did not have glaucoma. After instillation of topical anaesthetic, eight measurements were taken and the average value was recorded. The cohort of patients was those attending the outpatient department of the eye unit, university teaching hospital. Patients and controls were randomly selected.

The Intra-ocular pressures were measured with Perkins Tonometer, after instillation of topical anaesthetic and flourescein eye drops. A total of 147 eyes were assessed, 50 eyes of which had glaucoma and 97 eyes were "normal"

RESULTS:

The average CCT for all patients was 513.7um ± 52.395. There was a progressive decrease in CCT with age in "normal" and glaucomatous subjects in line with previous studies. No linear relationship between IOP and age could be established among glaucomatous and "normal" subjects.

There is inverse relationship between corneal thickness and IOP in 'normal" and glaucomatous subjects. There was no clinical significant difference between Goldman measured IOP and pachymeter adjusted IOP

CONCLUSION:

There is decrease CCT with age in glaucomatous and non-glaucomatous subjects. There is also an inverse relationship between CCT and IOP leading to underestimation of IOP with thin corneas and vice versa in both "glaucomatous and non glaucomatous eyes. There was no clinical significant difference between IOP measured by Goldmann and Pachymeter adjusted IOP

INTRODUCTION

Intraocular pressure I0P measurement has been used for the diagnosis of glaucoma, and the Goldmann applanation tonometry is considered the most accurate, method. Goldmann and Schmidt assumed a standard corneal thickness would influence the intraocular pressure reading.1 The measurement of central corneal thickness (CCT) is becoming increasingly recognized as a variable in the management of glaucoma and glaucoma suspects. Shih et al, have shown that determining CCT can lead to significant measurement adjustments in intraocular pressure, which in turn may lead to changes in glaucoma management.2 The aim of our study was to determine any significant changes in I0P levels using pachymeter adjusted values in comparison to Goldmann tonometry in this cohort.

MATERIALS AND METHODS:

The patients and controls were recruited amongst patients attending the outpatients department of the eye unit, university of port-Harcourt teaching hospital. Data collection VKO and NC. Patient selection was randomized. No formal ethical committee approval was sort, as it was felt by the investigators that the basis of the study was well established, and the investigations were part of investigations normally conducted in eye clinics worldwide.

The participants were recruited from glaucoma and general ophthalmology clinics, at the university teaching hospital, port- Harcourt, Nigeria.

The patients were classified into glaucomatous (n=25) and non glaucomatous (n=50) groups.

The patients in the glaucoma group, were known/ diagnosed on basis of raised I0P, optic disc changes and visual field changes, and were on one to three medications.

The 'normal' (non-glaucomatous) patients were general ophthalmic patients with no corneal pathology.

Exclusion criteria include those with corneal pathology, young children, Narrow angle glaucoma, and contact lens users.

Patient's written consent was obtained prior to each test. The intra-ocular pressure was checked with the Goldmann tomometer, and then the 10PAC (Heidelberg engineering) was used to measure the corneal thickness.The equipment generically is called a pachymeter, but the particular product used is called IOPAC and manufactured by Heidelberg Engineering of Germany.

The procedure involved placing a drop of topical anaesthetic [amethocaine], the tonometer is then placed in contact with the central aspect of the cornea, the resultant intraocular pressure is read off the graticule on the equipment. Following this, the pachymeter [IOPAC] is placed perpendicular with the optical centre of the cornea. The IOPAC automatically records 8 readings of the thickness of the cornea, following this; the recorded intraocular pressure is inputed into the IOPAC, which then automatically adjusts the intraocular pressure level, taking into consideration the thickness of the cornea. The new and old values of the intraocular pressure were then recorded by the investigator.

The 10PAC then adjust the pressure automatically, and the average of eight readings was recorded. It features a 20 MHz probe capable of + or -2 milimirons. The measurement takes one to two seconds. A successful measurement is announced by a high – pitch tone.

Data analysis was with Epi-info statistical software version [6.02].

RESULTS:

There were 50 non-glaucomatous and 25 glaucomatous patients in our study. The age range of the patients in the study is shown below in table 1.The difference in numbers was as a result of variation on the days the data was collected, on the type of clinic on the day .No formal matching was done for age or sex.

AGE RANGE	<20	20-44	45-64	>64
Non-Glaucoma	11	24	12	2
Glaucoma	-	12	8	5

Average Central Corneal thickness distribution in our study is shown in the histogram below in (FIG. 1) for the glaucoma group and (FIG. 2) for the non-glaucoma group.

FIGURE 1: CCT CATEGORY BY AGE GROUP FOR

GLAUCOMATOUS.

Unit of measurement is in microns.

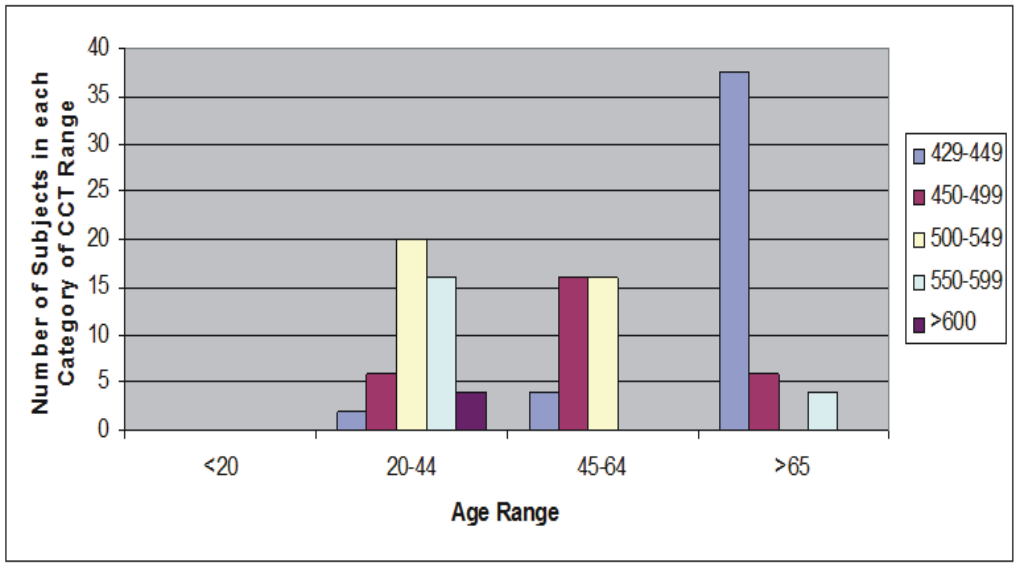
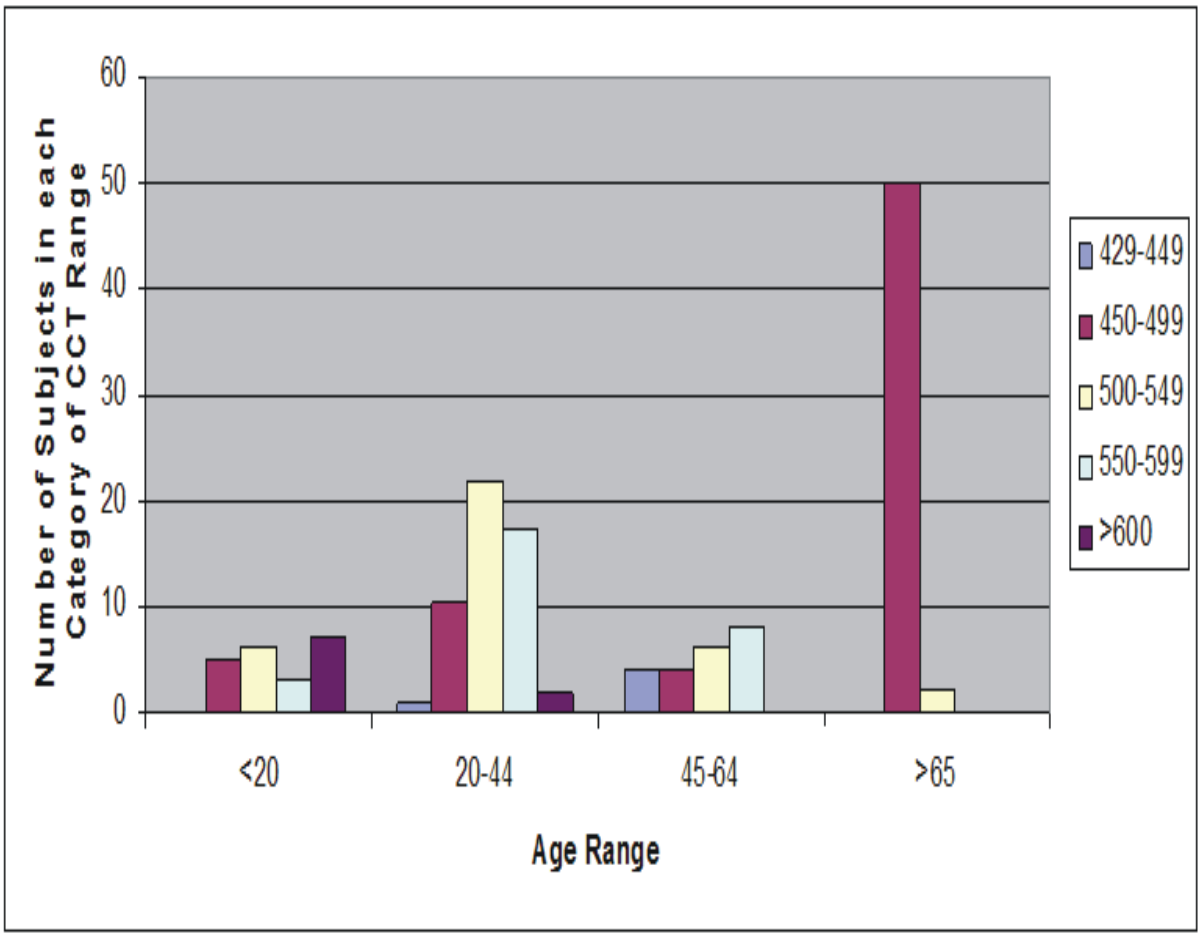


FIGURE 2: CCT CATEGORY BY AGE GROUP

FOR NON GLAUCOMATOUS



There was an inverse relationship between central corneal thickness and intra-ocular pressure in the normal

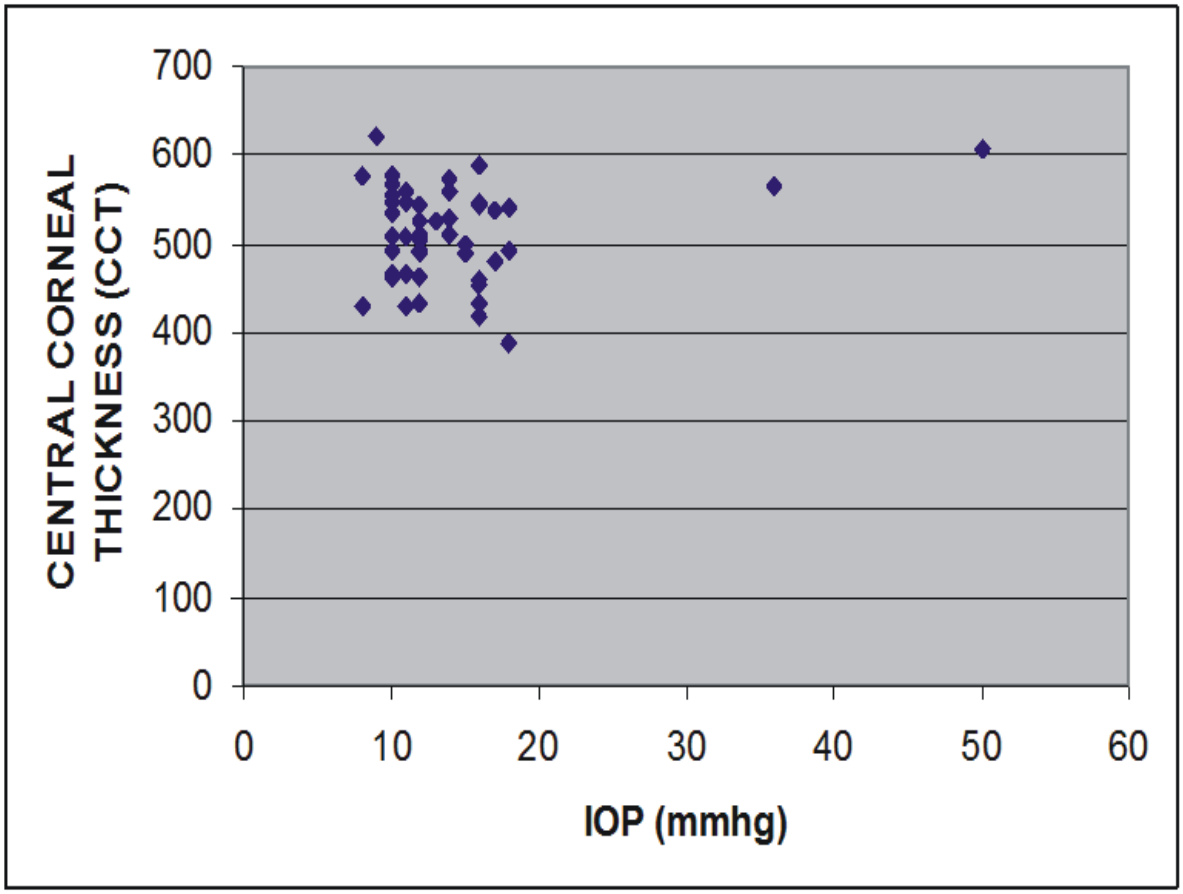
subjects, as shown below.

FIGURE 3: DISTRIBUTION OF CCT VALUES

WITH IOP FOR GLAUCOMATOUS

(r=0.34; r2=0.12)

subjects, as shown below.

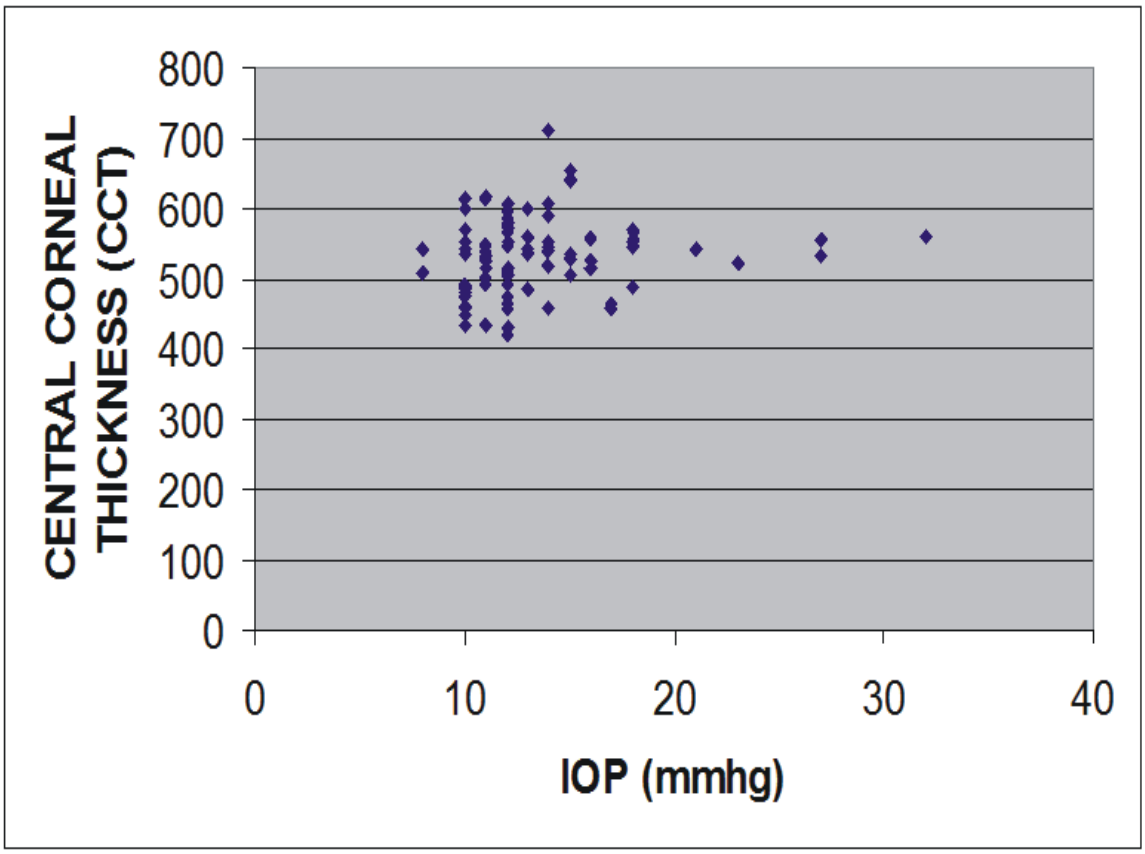


A similar pattern was found in the glaucoma group.

FIGURE 4: DISTRIBUTION OF CCT VALUES

WITH IOP FOR NON GLAUCOMATOUS

(r=0.13; r2 =0.02)



No linear relationship between intra-ocular pressure and age was found, however our study showed a decline in central corneal thickness with age in both groups, as shown in figs 5 and 6.

FIGURE 5: DISTRIBUTION OF CCT VALUES WITH AGE FOR GLAUCOMATOUS

(r= -0.53; r2= 0.37

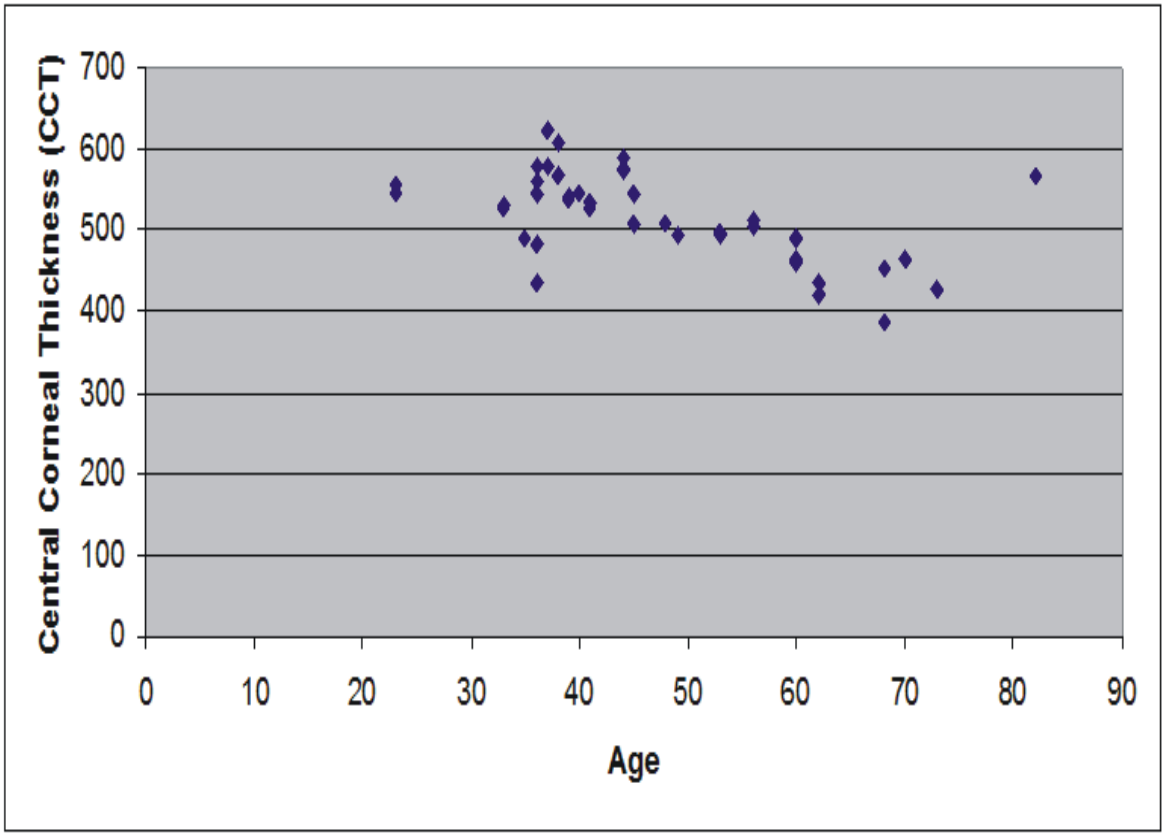
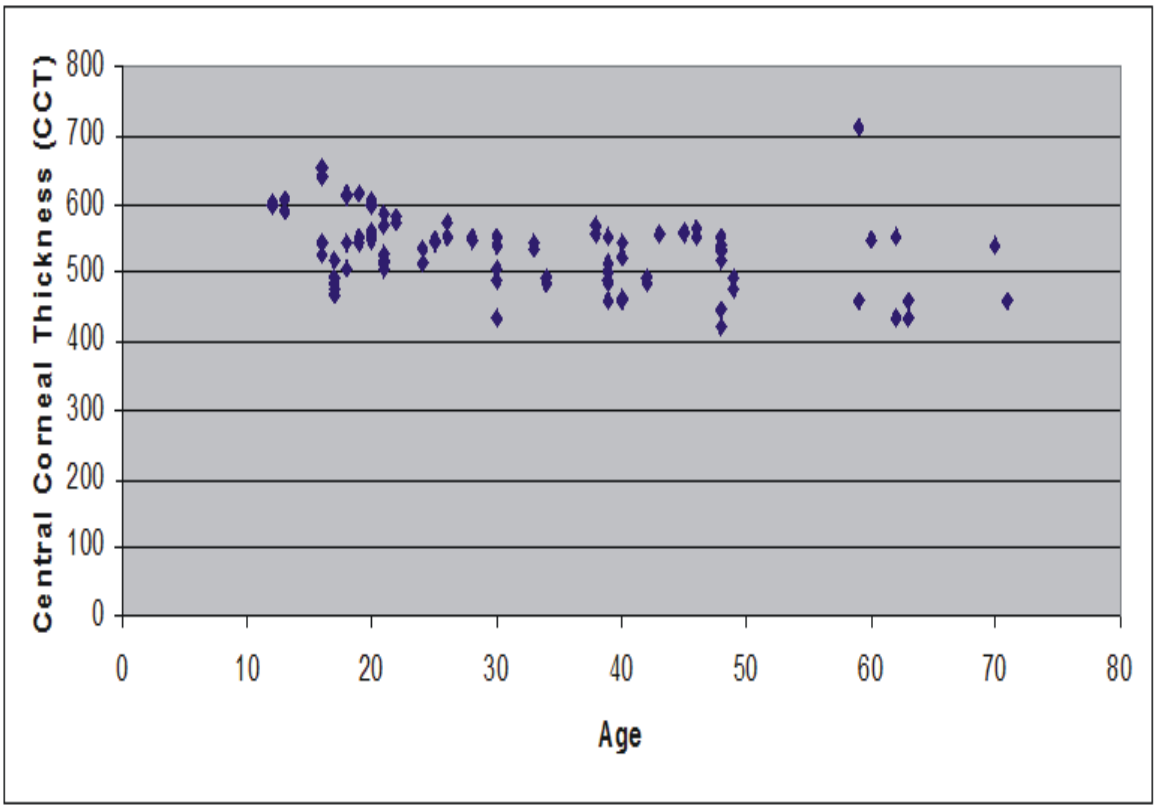


FIGURE 6: DISTRIBUTION OF CCT VALUES WITH AGE FOR NON GLAUCOMATOUS (r= -0.21; r2=0.05)



DISCUSSION:

The Goldman's application has been a generally accepted method of measuring intra-ocular pressure. However the intra-ocular pressure is affected by physical properties of the cornea. Goldmann stated that the innate resistance of the cornea to flattening at the chosen applanation area of 3.06mm would be counter balanced by the force of capillary reaction drawing the tonometer to the wet cornea1.

With the two forces, innate corneal resistance to flattening and capillary attraction cancelling each other, the measured force of applanation would directly reflect intraocular pressure, according to Imbert Ficks law In making their calibration, Goldmann and Schmidt assumed an average corneal thickness of 550um and that the corneal thickness did not vary greatly in the population. They noted however that when variation did occur, this would affect the accuracy of the intra-ocular pressure, as a thicker cornea yields falsely high intra ocular pressure and thinner ones yield falsely low intraocular pressure.

This we were able to establish from our study as the corneal thickness had inverse relationship with adjusted intraocular pressure.

Our studies also have shown the central corneal thickness to decrease with age3. Ehlers et al4, calculated that true intra-ocular pressure of 20mmhg, applanation tonometry would produce mean underestimation of 5.2mmhg in eyes with CCT of 450um and an overestimation of 4.7mmhg if the CCT was 590mmg. Again this was corroborated in our study, overestimations of 37% intraocular pressure was found in normal eyes with 450um CCT and 72% overestimation in glaucoma subjects and in subjects with CCT 550um, there was a 7.6% underestimation in normal subjects in contrast to 4.4% underestimation in glaucoma subjects.

Our study also did not show a clinically significant difference between IOP measured with Goldmann applanation and pachymeter adjusted intraocular pressure using the IOPAC, in both the glaucoma and non glaucoma group of patients.

De Saint Sardos et al in their paper did not find any clinically significant relationship between CCT and intraocular pressure5. We feel one explanation for our findings may be because of the small number of patients in the study with glaucoma, in combination with the variance and proportion statistically of the figures.Although the subjects were recruited from glaucoma clinics and hospital setting; this did not introduce a bias.

CONCLUSION:

The results of our study show that there is a role for pachymetry in evaluating glaucoma patients in a hospital setting.

However there was no clinically significant difference in the group of patients in our study. For this group of patients and given the limited financial resources in the health sector, and lack of political will to invest in health, the use of pachymetry may not be essential in managing glaucoma.

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