Relationship between anterior chamber angle, IOP, corneal curvature and refractive status in young Caucasian adults

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Abstract

Purpose: To investigate the relationship between anterior chamber angle (ACA) measurement, intraocular pressure (IOP) and refractive status of the eye in a young adult population with good ocular health.

Methods: Autorefractor (AR) captured data on corneal curvature and refractive errors in group participants and enabled comparison across refractive groups, gender, and age. Refractive errors were calculated in diopters as the spherical equivalent (SE). IOP was taken by Pulsar non-contact tonometer. All patients underwent the same optometric examinations of anterior eye data on corneal curvature, anterior chamber angle and corneal thickness captured with Topcon Maestro optical coherence tomography (OCT). Slit lamp was used for Van Herick method.

Results: Measurements were obtained from 118 eyes (right), of 26 males and 92 females aged 19–40 years with no ocular disease. There was no significant change in ocular profile across age range or by sex, apart from slightly steeper corneal profile for females (p=0.03).

There was no significant correlation between IOP and ACA (p> 0.05), nor IOP and SE (p>0.05); however, when those with hyperopic SE were examined separately, there was a significant decrease in IOP with higher levels of hyperopic SE (p <0.05).

Conclusion: This study reports mean values for ACA were 39,39°, which gives a value of the open anterior chamber angle in young Caucasian adults. There was no significant relation between IOP, ACA or SE in the sample of young adults. However, higher level of hyperopic SE has a significant decrease in IOP and should be further investigated due to small sample of hyperopic subjects.

Keywords: anterior chamber angle, anterior segment parameters, central corneal thickness, corneal curvature, refractive error, spherical equivalent, intraocular pressure

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Introduction

Ocular coherence tomography (OCT) is a retinal imaging technique that is rapidly becoming a key tool in primary and secondary eyecare as an important means to detect and monitor disease. Spectral domain OCT acquires 50,000 axial line scans per second and can yield high-resolution cross-sectional images of the retina and the anterior eye. Knowledge gaps exist in establishing how OCT measures of the anterior eye compare with conventional techniques. There is little in the literature describing the normal range of anterior chamber angle measures and how this relates to qualitative methods of estimating anterior chamber angle (ACA) by Van Herick technique, nor the relation between ACA, refractive error, and corneal curvature. Campbell et al. (2015) investigated the repeatability of Van Herick technique, gonioscopy and AS-OCT in n=80 subjects over 40 years and found that AS-OCT had the highest specificity, but they acknowledged a limitation of their study was the limited quality of their AS-OCT device.

ACA is related to intra-ocular pressure (IOP) of the eye, which is a key measure in the detection and diagnosis of primary open-angle glaucoma (POAG) and primary angle closure glaucoma (PACG). Regarding the refractive error, those with hyperopia have shorter eyes (axial length) and there tends to be a narrower ACA. This predisposes those with hyperopia to PACG, but there are no established criteria to identify this prior to the onset of the disease. A study conducted in China investigated these parameters in a large sample of older adults (Xu et al. 2008), but there is a paucity of information regarding the ACA and ocular structure in younger adults from Caucasian populations. We need to gain a better understanding of these measures prior to the onset of ocular disease in order to stratify the risk of those predisposed to PACG and established normative data for ACA measurement as the application of AS-OCT becomes more widespread in clinical practice.

The depth of the ACA varies with age and refractive error. It can be expected that young myopic patients tend to have grade 4, older myopic and young hyperopic patients have 3 or 4 angles, and older hyperopic patients may have grade 2 or even grade 1 angles. During visual development, as the eyeball grows in childhood, the ACA tends to increase in depth, despite the gradual increase in thickness of the crystalline lens as new lens fibers form. However, at approximately the age of 20 years, a continuous increase in the thickness of the crystalline lens causes the depth of the anterior chamber to gradually decrease with age. Accordingly, the vast majority of children and teenagers have an angle of 3 or 4, unless they have hyperopia of a high magnitude or an ocular condition predisposed to a narrower ACA.

The swelling of the crystalline lens has its own effect on ACA. In the early stages of age-related cataract, the lens thickness tends to increase, leading to the lens 'pushing' anteriorly on the iris, causing a narrowing of the anterior chamber angle. Even an older person with myopia that would be expected to have a relatively wide angle can be found to have a grade 2 or 1 angle in the presence of age-related early cataract. Thus, a narrow ACA combined with a cataract should suggest a referral for ophthalmological and optometric assessment.

ACA imaging and anatomical landmark measurement are considered useful in glaucoma risk assessment, diagnosis, and therapeutic decisions. The benefit of OCT and its evolution to spectral domain (SD) systems, means that we can move away from gross grading conventions such as Van Herick technique, but there is a lack of knowledge and understanding of the assessment of ACA using anterior-segment OCT and what are the expected normative values in European Caucasian adults. Thus, the aim of this study is to investigate the relationship between ACA measurement, IOP and refractive status of the eye using advanced AS-OCT imaging in an adult population with good ocular health.

Materials and methods

This study was designed to investigate the relation between anterior chamber angle, IOP, corneal curvature and refractive status in young Caucasian adults and its normal values. The study protocol was developed, along with a participant information sheet and consent form, and these were submitted to the Ulster University

Biomedical Sciences Research Ethics filter committee. Ethical approval was granted in February 2021 from this committee.

This research project included one hundred and eighteen patients (26 males, 92 females) aged 19–40 years with no ocular disease. Patients were recruited and examined in the Optometry department at the University of Applied Sciences Velika Gorica.

All patients underwent the same optometric examinations including anterior and posterior segment examinations with optical coherence tomography and slit lamp, intraocular pressure (IOP) measurements with a noncontact tonometer and objective refraction measurements by autorefractor.

Assessment of refractive error and corneal curvature with Autorefractor

Autorefractor Speedy (Righton™) is a device for measuring refractive error, with the ability to measure the refractive power of the eye, keratometry, and pupil size.

All patients were measured with an autorefractor in a semi-darkened room.

Autorefractor measured on the principle of multiple measurements, fife for refractive error, and three for keratometry measurements and gave the mean value of all data, from spherical, cylindrical error, degrees, and the mean value of keratometric values output in a radius of curvature (mm) and Dioptric units with n=1.3375.

For analysis, refractive errors were calculated in diopters as the spherical equivalent of spherical refractive error plus 0.5 × cylindrical refractive error.

Assessment of anterior eye data with OCT

Anterior segment optical coherence tomography (AS-OCT) serves to produce real-time, noncontact, high-resolution, cross-sectional imaging of the anterior segment and its anatomical structures of the eye.

Measurements of the anterior segment with OCT were captured with the Topcon Maestro OCT. The Maestro OCT has the added advantage of Anterior Segment OCT scanning capability, along with retinal OCT, without the need for an additional expensive/external lens. By simply adding the anterior headrest support, the Maestro can capture corneal and chamber angle scans together with the ability to measure corneal thickness using the integrated caliper tools.

Topcon Maestro OCT captures anterior eye data on corneal curvature, corneal thickness (Figure 2), and anterior chamber angle (Figure 1) was measured manually on the nasal side of the eye. Due to the manual adjustment of the angle, there is the possibility of a subjective view of the examiner.

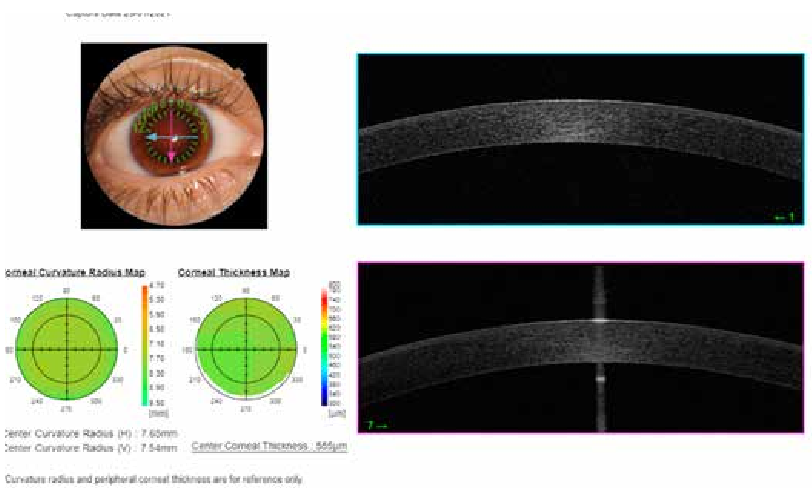

Figure 2. **OCT capture picture of anterior radial report of corneal curvature and corneal thickness assessment**

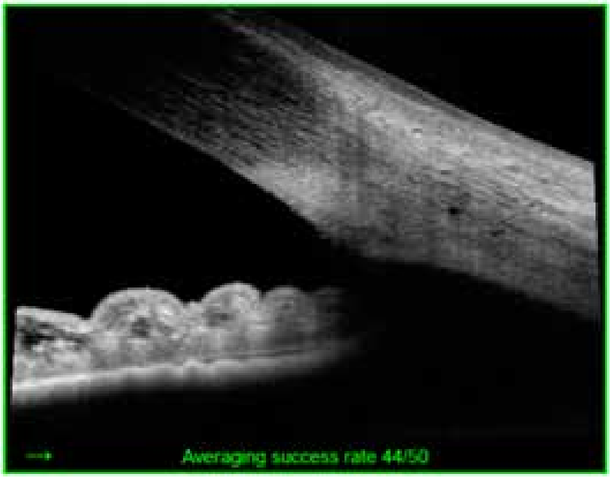

Figure 1 **OCT capture picture of anterior line report of angle assessment (nasal angle)**

Assessment of anterior chamber angle with a slit lamp (Van Herick technique)

A slit lamp was included for anterior chamber angle evaluation with the Van Herick technique which enabled comparison with OCT-ACA.

The Van Herick technique has become the most clinically used qualitative method for estimating anterior chamber angle (ACA). The method is used to quickly assess the risk of the angle closure, or to assess the openness of the angle. The width of the chamber angle can be described by the distance between the corneal light projection and the iris light projection. Van Herick technique was done in a way that the ratio of light and shadow was observed from the temporal side of the limbus, and therefore it was concluded what degree of openness it was.

Assessment of intraocular pressure (IOP) with a noncontact tonometer

IOP is an important measure to screen for primary open-angle glaucoma. For middle-aged men and women, the IOP should range from 9 to 22 mm Hg.

IOP was taken using the handheld Pulsair IntelliPuff tonometer. This method of measuring Intraocular pressure is based on the pressure that the air wave produces on the cornea, i.e., intraocular pressure is measured by an air jet that slightly flattens the cornea and reads the value of intraocular pressure using an optoelectric system (infrared).

This method of IOP measurement is widely used, but it is affected by corneal thickness (the thicker the cornea, the less reliable the results).

Results

Descriptive statistics were performed to determine the mean, range, standard deviation, and variance. T-test and linear regression analysis were used, and significance was determined as 0.05.

Of the total of 118 participants, 92 were female and 26 were males. All were Caucasian subjects and were aged between 19 and 40 years with a mean age of 23,14 (SD ± 5,11) years.

For AS-OCT, the mean results were as follows:

- OCT mean values for ACA were 39,39° (SD ±7,45)
- OCT mean values for corneal curvature were 7,66 mm (SD ± 0,28) for the horizontal meridian, and 7,50 mm (SD ± 0,27) for the vertical meridian of the right eye.
- OCT mean values for central corneal thickness were 539,91 µm (SD ± 31,86).

For autorefractor, the mean results were as follows:

- The mean spherical equivalent was -1,43D (SD ± 2,10). The mean spherical equivalent value ranged from +4,625 to -8,125D.
- With the autorefractor, the mean corneal curvatures were 7,88 mm (SD ± 0,29) in the horizontal meridian and 7,70 mm (SD ± 0,26) in the vertical meridian.

Van Herick assessment gave a mean value of 3,88 (SD ± 0,32), with the majority (n=104, 88%) of participants being determined to have a grade 4 angle, and n=14 (12%), grade 3. Mean IOP was 15,52 mmHg (SD ± 2,67).

Analysis of data by age

There was no even distribution of age, (with 56% of young adults aged between 19 and 21, and 44% were aged from 22 to 40 years old) the median was 21.

Linear regression analysis reveals no significant change across the age range and ACA (y=0.0032x +39.27, R^2=0.00 p>0.05).

Linear regression analysis reveals no significant change across the age range and CCT (y = 0,2181x + 534,86, R^2 = 0,0012 p>0.05).

12 eyes had corneal thickness measurements below 500 µm: one was a participant of 19 years, three of 20 years, three of 21 years, four of 22 years, and one of 25 years old. All these patients had IOP between 12 and 16 mmHg, and were mostly mild to moderate myopes, except one patient that was hyperope.

Linear regression analysis reveals no significant change across the age range and IOP (y = -0,0228x + 16,045, R^2 = 0,0019 p>0.05)

Pressure larger than 22 mmHg is considered ocular hypertension. In this research, only three participants had larger pressure than 22, two participants of 20 years, and one of 21 years. All three participants were moderate myopes. Only one participant had IOP smaller than 10 mmHg at the age of 20 and was hyperopic. They were all advised to consult with their ophthalmologist.

In measurements of corneal curvature, measurements with an autorefractor gave slightly higher, flat values than measurements with OCT. There is no significant difference in measurements of corneal curvature in age.

Analysis of data by sex

Anterior chamber angle was measured in female average of 39,46° (SD ± 7,53) and in males 39,15° (SD ± 6,97). And there is a very slight difference between these two, but there was no significant difference (p>0,05) in anterior chamber angles between the sexes.

Central corneal thickness was measured in females 536,89 (SD ± 31,13) and in males 550,58 (SD ± 31,51). There was a small difference between males and females, however, this did not quite reach statistical significance (t-test, t=-1.98, p=0.05). Eleven eyes had corneal thickness measurements below 500 µm in females, and one was male.

Intraocular pressure was measured in females 15,70 (SD ± 2,61) and in males 14,88 (SD ±2,85). This did not reach significance (t-test t=1.37, p=0.17).

With OCT measurements of corneal curvature average was 7,63 mm (SD ± 0,28) in horizontal meridian, and in vertical 7,18 mm (SD ± 0,27) in females. In male population it was 7,76 mm (SD ± 0,27) in horizontal and 7,59 mm (SD ± 0,24) in vertical meridian. As far as autorefractor measurements, in the female population the average was 7,85 mm (SD ± 0,29) in horizontal, and in vertical 7,69 mm (SD ± 0,26). In males, we found average curvature in horizontal 7,98 mm (SD ± 0,27), and in vertical 7,77 mm (SD ± 0,27).

Combining horizontal and vertical measurements to yield a single average measure of corneal curvature, a t-test was conducted and revealed significant steeper corneas in females (t-test, t=-2.21, p=0.03).

Analysis of the relation between ACA measurement, IOP and refractive status

Refractive groups were established using mean spherical equivalent refractive error for the right eye as follows: myopia >/=-0.50D, emmetropia <-0.50D and >+0.50D, and hyperopia >+0.50D.

The average ACA for the myopic group was 40,00° (SD ± 7,73), for the emmetropic group was 40,53° (SD ± 5,73), and for the hyperopic group was 34,98° (SD ± 6,06). A one-way analysis of variance was conducted to investigate the relation between the ACA and the mean spherical equivalent refractive error groupings, and revealed a significant difference between groups, with those with hyperopia having a smaller ACA than myopic or emmetropic participants ($F_{(2,113)}$= 3.23, p=0.04). Although there was a very small number of hyperopic participants, it should be further investigated with the higher number of subjects.

The difference of arithmetic means for ACA values measured with OCT and ACA measured with slit lamp was tested, there is no statistically significant difference, but the value p=0.077 which is close to the limit value of 0.05 which indicates a difference that is not statistically confirmed.

Van Herick grading of ACA was either Grade 3 or Grade 4 for the group, and looking at the ACA measurement by OCT, those with Grade 3 classification did on average have a smaller angle (mean 34.8, +/-SD 6.9) than those with Grade 4 (mean 39.9, +/-SD 7.3).

The degree of correlation between IOP and ACA measured with OCT was examined using Pearson's correlation, which yielded an r-value of 0.074. This indicates only a slight degree of correlation, and this was not statistically significant (p>0.05).

The relationship between IOP and SE was examined for all subjects, myopic and hyperopic. Pearson's correla-

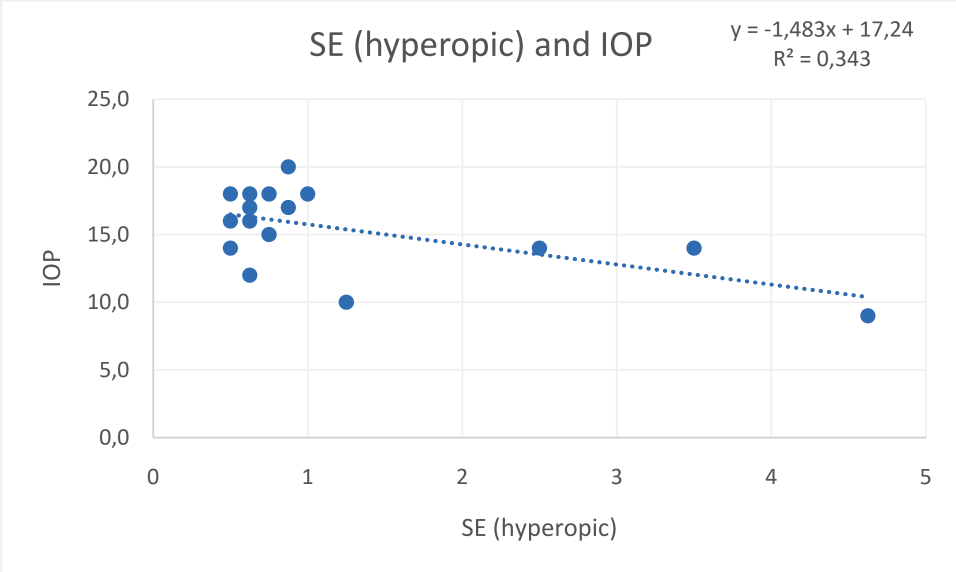

Figure 3. **Linear regression and correlation between IOP and SE for hyperopic patients**

tion yielded an r value of -0.099. This indicates only a slight degree of correlation, and this was not statistically significant ($p>0.05$).

The association between SE and IOP for the myopic group was examined and it was proved that there is no statistically significant association. The Pearson's correlation coefficient is -0.059 and is not statistically significant ($p>0.05$).

The association between IOP and SE in the hyperopic group was examined and the association of the negative direction was observed (Pearson's correlation -0.585) (see scatterplot Figure 3). The relationship was confirmed to be statistically significant ($p<0.05$). This

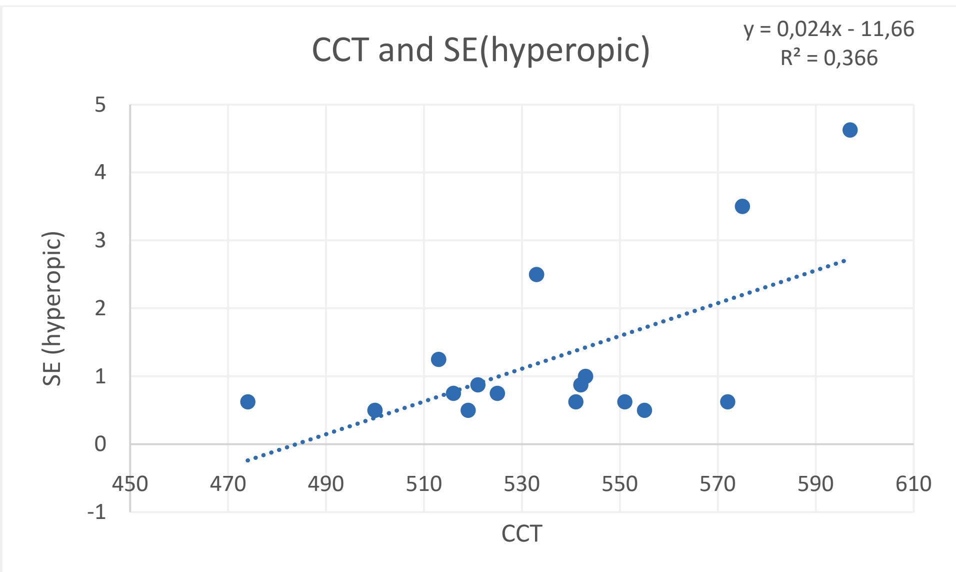

Figure 4. **Linear regression and correlation between CCT and SE for hyperopic patients**

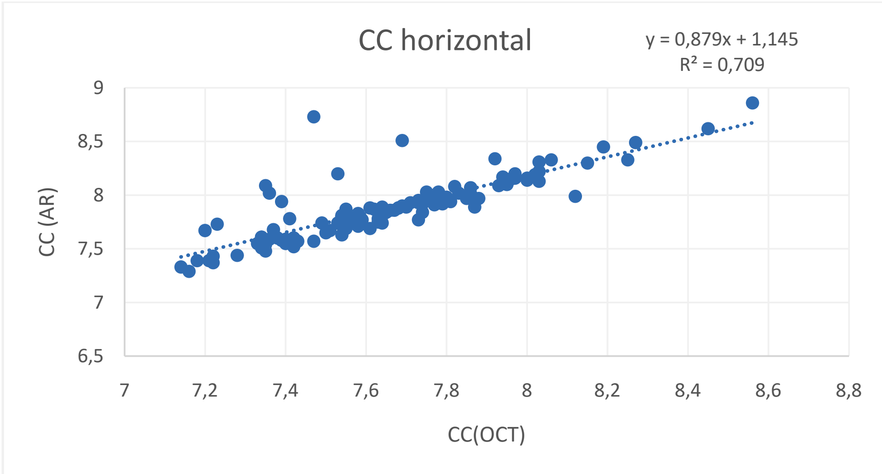

Figure 5. **Linear regression and correlation between OCT and AR for measurements of corneal curvature for horizontal meridian**

negative correlation means that a higher SE hyperopia value yields a lower IOP value and vice versa.

The coefficient of linear correlation between the values of SE and CCT for myopes is -0.052 and is not statistically significant (p>0.05), there is a weak correlation and negative direction.

The association between CCT and SE for the hyperopic group was confirmed, the relationship is positive and at the level of significance (p0.05) and we can consider this result statistically significant. Figure 4 is a scatterplot of SE against CCT for all individual hyperopic participants.

What is the ocular profile of those with narrow ACAs?

To examine the ocular characteristic of those with small ACA, those with an ACA of 30 or less were identified from the data set. There were n=14 subjects with ACA>/=30, and of these, n=3 were classified as Grade 3 ACA with Van Herick's, with the remaining n=11, Grade 4. The mean (+/-SD) IOP of the subgroup was 14.6 +/-3.1. Mean central corneal thickness was 540.4 +/- 40.5 and mean SE was -0.53D +/-1.73 (range -3.375 to +3.50). These data are similar to the overall mean values for these variables.

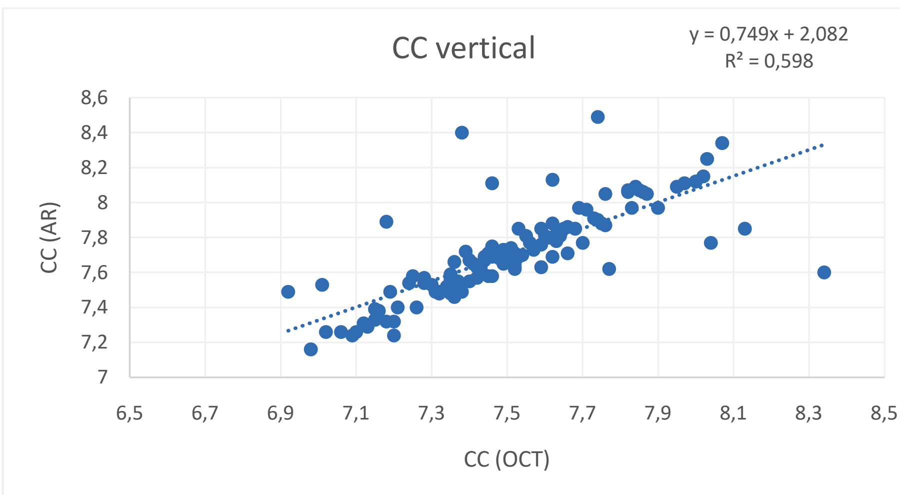

Figure 6. **Linear regression and correlation between OCT and AR for measurements of corneal curvature for vertical meridian**

What is the comparability of corneal curvature measures between the AR and the OCT instruments?

Figure 5 is a scatterplot of CC measured with AR against CC measured with OCT in horizontal meridian. The coefficient of linear correlation is 0.842 and says that the relationship between the examined variables of horizontal corneal curvature measured with OCT and AR is extremely strong and positive, and statistically significant ($p<0.01$).

According to the regression equation in the graph the interpretation of CC (AR) with CC values (OCT) is 70.90%. A higher CC (OCT) value per unit affects a higher CC (AR) value by 0.8794 units.

In 118 pairs of values measured with OCT and AR for corneal curvature, a correlation coefficient of 0.773 was obtained which explains that the connection between OCT and AR for the vertical meridian is strong and positive. The coefficient is statistically significant with a 0.01 level of significance.

The graph gives a regression equation that describes the correlation of the examined vertical meridian. The interpretation of the AR value is 59.8%, based on the OCT value for the vertical meridian.

Discussion and Conclusions

OCT is generally accepted in clinical trials of various diseases and especially in the detection of glaucoma. In today's modern age when technology is advancing more and more, it is also increasingly relying on more precise devices, such as OCT.

Assessing the anterior chamber angle is an important part of the investigation of individuals at risk of glaucoma and ocular hypertension.

For patients with narrow angles, it is important in the treatment of their glaucoma early classification. The use of technology for imaging ACA has brought to the definition of a series of quantitative parameters for describing anatomical features of the anterior segment of the eye. OCT imaging methods can offer objective assessment and documentation of the angle, as well as quantitative information describing the anatomical features of the anterior segment.

Both Van Herick and OCT assessments of the ACA involve subjective judgement. The Van Herick test affords several advantages over OCT imaging, but with continuing advances in OCT imaging, supported by advanced analytical tools, it is anticipated that this technology will play a more significant role over time.

From this research, we have found that anterior chamber angle measurements with OCT gave the average value of the angle 39,39° (SD ± 7,45) in young Caucasian adults in comparation with the research paper by Lam et al. (2012), where ACA assessment was conducted with fifty young (mean age 21 years) and fifty middle-aged (main age 46 years) Chinese patients. The mean ACA in the young group was 42.74° (SD ± 4.34) on the temporal side, and on the nasal 43.00° (SD ± 6.10). And in the middle-aged group, the mean ACA was 38.14° (SD ± 5.24) on the temporal side, and on the nasal 36.92° (SD ± 5.68).

Based on the study of Leung et al (2008), the mean anterior chamber angle of healthy normal eyes was 35.9 ± 5.7° and in comparison to our research we get a little higher value of 39,39° (SD ± 7,45). In the study by Vossmerbaeumer U. et al (2013) conducted on 668 eyes, in a German working population, the mean width of the chamber angle in the myopic group was determined as 40.8°, in the hyperopic group was 31.8° and in the emmetropic group 36.3°. In comparison with this research, we get the average value of 40.00° in myopic participants, for the hyperopic group it was 34.98°, and for the emmetropic group it was 40.53°. There were n=14 subjects with ACA>/=30, and of these, n=3 were classified as Grade 3 ACA with Van Herick's, with the remaining n=11, Grade 4. Despite a narrower ACA on OCT measures, there wasn't any evident predisposition to higher IOP which does not mean that it will not appear in old age.

Rashdan et al. (2019) concluded that thinner corneas are more frequent in females. Galgauskas et al (2014) reported on central corneal thickness in 1,650 Caucasians, classification of central corneal thickness in their study was from 524–564 µm as the average. Mild thinning was 510–524 µm, moderate thinning was 489–510 µm, and extreme thinning was less than 489 µm.

Galgauskas et al (2014) also reported 545.0 µm (SD ± 25.6) in men and 544.4 µm (SD ± 33.5) in women. The mean CCT was 550.8±35.7 µm in subjects aged 18–29 years, and 557.5±27.6 µm in those aged 30–39 years. There was a significant difference in subjects aged 18–

29 years; men had higher CCT than women, which we have also found. Hoffmann E.M. et al also came to the conclusion that men have slightly thicker corneas than women.

In this research central corneal thickness measured in females was 536,89 (SD ± 31,13) and in males 550,58 (SD ± 31,51), also eleven female eyes and one male eye had corneal thickness smaller than 500 µm. Even though it seems to be that females have slightly thinner corneas as well in this research it did not quite reach statistical significance (t-test, t=-1.98, p=0.05).

Measurements with Van Herick gave the average value of 3,88 (SD ± 0,32). Both methods gave information that young Caucasian adults aged from 19 to 40 without any ocular disease have wide-open angles.

Average values of corneal curvature with AR were 7,88 mm (SD ± 0,29) in horizontal, and in vertical 7,70 mm (SD ± 0,26), and with OCT it was 7,66 mm (SD ± 0,28) in the horizontal meridian, and in the vertical 7,50 mm (SD ± 0,27). Measurements of corneal curvature against the age of participants reveal no significant change across the age range (p>0.05), but in analyzing the result according to sex, it has been found that there were significantly steeper corneas in females (t-test, t=-2.21, p=0.03).

The degree of correlation between IOP and ACA measured with OCT gave a slight degree of correlation, a non-existent relationship between the observed characteristics that is not statistically significant (p> 0.05).

Changes in ACA and the assumption of the possibility of glaucoma according to this research would certainly be visible above 40 years of age. Of course, consider a few myopic patients described whose intraocular pressure was above 22 mmHg, especially since myopia ultimately carries its consequences and complications such as myopic maculopathy, retinal detachment, cataracts, choroidal neovascularization (CNV) and glaucoma is also something to think about. In this research, the association between SE and IOP for the myopic group was examined and it was proved that there is no statistically significant association (p> 0,05). While in the case of hyperopia and IOP, the association was of the negative direction and was confirmed to be statistically significant (p <0.05). Hyperopic refraction has been described in many pieces of literature as a risk factor for angle-closure glaucoma, but in this case, there has been no big difference in angles between myopes and hyperopes, but hyperopes had slightly narrower angles.

In this research, there was very little association between ACA, IOP, SE, CC, and CCT due to very young patients and no ocular diseases which we expected to be none.

This study reports_mean values for ACA were 39,39°, which gives a value of the open anterior chamber angle in young Caucasian adults. There was no significant relation between IOP, ACA or SE in the sample of young adults. However, a higher level of hyperopic SE has a significant decrease in IOP and should be further investigated due to the small sample of hyperopic subjects. The paper provides relevant guidelines that indicate that a larger number of respondents could determine with certainty that they are healthy young people and have no connection with glaucoma, especially the closed type that would be associated with trauma and diseases of the anterior segment of the eye, such as iridocyclitis.

This project was made in 2021 as part of the MSc Advanced Clinical Optometry research project "What is the relation between anterior chamber angle, IOP, corneal curvature and refractive status in young Caucasian adults?" at the Ulster University.

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Odnos između kuta prednje očne komore, intraokularnog tlaka, zakrivljenosti rožnice i refrakcijskog statusa u populaciji mladih bijelaca

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Sažetak

Cilj: Istražiti odnos između kuta prednje očne komore, intraokularnog tlaka i refrakcijskog statusa oka u mladoj odrasloj populaciji s dobrim očnim zdravljem.

Metode: Upotrebom autorefraktometra prikupljeni su podaci o zakrivljenosti rožnice i refrakcijskim pogreškama kod sudionika i time je omogućena usporedba između refrakcijskog statusa, spola i dobi. Refrakcijske greške izražene su u dioptrijama kao sferni ekvivalent. Intraokularni tlak izmjeren je beskontaktnim tonometrom Pulsair. Svi pacijenti podvrgnuti su istim optometrijskim pregledima zakrivljenosti rožnice prednje očne komore, kuta prednje očne komore i debljine rožnice koji su izmjereni optičkom koherentnom tomografijom Topcon Maestro. Za Van Herickovu metodu primijenjena je procjepna svjetiljka.

Rezultati: Mjerenja su izvršena na 118 očiju (desno oko) kod 26 muškaraca i 92 žene, u dobi od 19 do 40 godina i bez očnih bolesti. Nije bilo značajnih promjena u okularnom profilu kod ispitanika različite dobi ili spola, osim nešto strmije rožnice kod žena (p = 0,03).

Nije bilo značajne korelacije između intraokularnog tlaka i kuta prednje očne komore (p > 0,05) ni intraokularnog tlaka i sfernog ekvivalenta (p > 0,05); međutim, kada su osobe s hipermetropnim sfernim ekvivalentom pregledane zasebno, došlo je do značajnog smanjenja intraokularnog tlaka kod većega hipermetropnog sfernog ekvivalenta (p < 0,05).

Zaključak: Istraživanjem je dobivena prosječna vrijednost za kut prednje očne komore od 39,39°, što je vrijednost za populaciju mladih bijelaca. Nije utvrđena značajna veza između intraokularnog tlaka, kuta prednje očne komore ili sfernog ekvivalenta kod ispitanika. Međutim, viši hipermetropni sferni ekvivalent ima značajno smanjenje intraokularnog tlaka i treba ga dodatno istražiti zbog malog uzorka hipermetropnih ispitanika.

Ključne riječi: kut prednje očne komore, parametri prednjeg segmenta, središnja debljina rožnice, zakrivljenost rožnice, refrakcijska greška, sferni ekvivalent, intraokularni tlak