Original Research Article

Correlation between Corneal Biomechanics and Lamina Cribrosa Curvature in Primary Open Angle Glaucoma

Abstract

Background: Primary open-angle glaucoma (POAG) is the leading cause of irreversible blindness worldwide. This condition is distinguished by progressive optic neuropathy, excavation of the optic disc, and characteristic visual field abnormalities.Intraocular pressure (IOP) elevation is the primary risk factor. Due to the same collagen makeup of the cornea and sclera, the cornea and lamina cribrosa (LC) may have similar biomechanical qualities. In the present study.This study aimed to establish the association between corneal biomechanical parameters and LC curvature in POAG-affected eyes.

Methods: This prospective comparative cross-sectional investigation was conducted on sixty eyes at the Tanta University ophthalmology department. There were 30 eyes with primary open-angle glaucoma and 30 eyes with normal age, gender, and refraction. The corneal biomechanical parameters applanation 1 length and velocity (A1L, A1V), applanation 2 length and velocity (A2L, A2V), peak distance (PD), the radius of curvature (R), and deformation amplitude (DA) were measured using a non-contact Scheimpflug-based tonometer (corvids ST). LC curvature was determined by measuring the LC curvature index (LCCI) using spectral-domain optical coherence tomography B-scan pictures (OCT). The data were gathered and analyzed using a suitable statistical tool.

Results: Mean A1V was significantly lower (P=0.027)in the POAG group (0.13 ± 0.02 m/sec) than the control groupn(0.14 ± 0.01 m/sec).PD was significantly increased(P=0.05) in the POAG group(4.30± 0.54 mm) than the control

group(3.99± 0.66 mm). R was significantly higher (P=0.004) in the POAG group (7.90± 0.93 mm)thanin the control group(7.14± 1.04 mm). DA was significantly lower (P<0.001) in the POAG group (0.95± 0.06 mm) thanin the control group(1.11± 0.02 mm).LCCIwas significantly higher (P<0.001) in the POAG group(10.69 ±1.77) thanin the control group(6.90 ± 0.93).LCCI showed a positive significant correlation with PD and R and a negative significant correlation with DA.

Conclusions: The corneas of POAG eyes were less deformed than those of normal controls.In POAG patients, corneas with less deformability were related to a more posteriorly bent LC. This result may explain why corneal biomechanics may be utilized to evaluate and predict glaucoma risk and progression. Corvis ST is a novel non-contact tonometer that allows for simple estimation of corneal biomechanics and should be used routinely in patient monitoring.

Keywords: Corneal Biomechanics, Lamina Cribrosa Curvature, Primary Open Angle Glaucoma, Corvis ST

Introduction:

Primary open-angle glaucoma (POAG) is the leading cause of irreversible blindness on a global scale. It is characterized by bilateral chronic progressive optic neuropathy, the gradual degeneration of retinal ganglion cells and their axons, and unique visual field defects. IOP is the primary risk factor for glaucoma development.**(Bertaud,Aragno et al., 2019)**.

POAG is the most common kind of glaucoma in the world (about 70 percent of the cases of glaucoma)**(Beidoe and Mousa, 2012)**. POAG is characterized by gonioscopically open anterior chamber angle, with or without elevated IOP, in the absence of proven systemic or ocular diseases that affect aqueous outflow and/or cause optic nerve injury.**(Grzybowski,Och et al., 2020)**.

Even though glaucoma is curable, the visual loss it causes is irreversible, making early detection vital. Early diagnosis requires examination of the optic disc, retinal nerve fiber layer (RNFL), and visual field.**(Weinreb and Khaw, 2004)**.

Because both the sclera and the cornea have similar content ofcollagen**(Meek and Fullwood, 2001)**, the biomechanical properties of lamina cribrosa (LC) and the cornea may be associated. So, the study of the biomechanical properties of the cornea can indirectly reflex the compression and damage in theLC**(He,Liang et al., 2017, Lee,Kim, et al., 2019)**.

The cornea's biomechanical qualities may dictate its deformation response to applanation, which affects the measurement of intraocular pressure (IOP)**(Liu and Roberts, 2005, Medeiros and Weinreb, 2006)**. In addition, it has been hypothesized that corneal biomechanics may indicate structural abnormalities of the whole eyeball about the onset of glaucoma. Therefore, corneal biomechanics must be understood to improve glaucoma diagnosis and treatment.**(Wells,Garway-Heath, et al., 2008, Congdon,Broman, et al., 2006)**.As a predictor of glaucoma risk, corneal biomechanics may assist in assessing the

effect of corneal thickness on intraocular pressure (IOP). It may also play a crucial role in the diagnosis and treatment of glaucoma**(Liang,Zhang et al., 2019)**.

LC is a dense network of connective tissue that surrounds the optic nerve head (ONH) and transports RGC axons to the optic nerve. The LC shields RGC axons mechanically from the translaminar pressure differential between intraocular and extraocular space and the intraocular pressure-induced hoop strains of the surrounding sclera (IOP) **(Ling,Shi, et al., 2019)**.

The LC has been regarded as the primary site of glaucoma pathogenesis. An experiment in an early glaucoma model demonstrated that morphologic abnormalities in the LC preceded RNFL degradation**(Bellezza,Rintalan, et al., 2003)**.

In glaucoma, the LC has a more posterior insertion into the sclera, greater cupping or depth, and the development of localized abnormalities. These anomalies may be detected by optical coherence tomography and other clinical imaging methods. **(Downs and Girkin, 2017)**.

The objective of this research was to determine the link between corneal biomechanical parameters and LC curvature in POAG-affected eyes.

Patients and Methods:

This Prospective comparative cross-sectional research washeld on 60 eyes of 60 subjects at the ophthalmology department, Tanta University. Patients were classified into30 eyes with adult primary open-angle glaucoma and 30 healthy control eyes matched for age, sex, and refraction.

Patients with POAG had bilateral adult-onset illness, glaucomatous optic nerve degeneration, an open anterior chamber angle, and VF loss. Spherical correction between (- 6 Diopters & + 3 Diopters) and cylindrical correction within ± 3 Diopters. Normal participants in the control group should have bilateral normal optic disc appearance, bilateral normal Standard automated perimetry (SAP), IOP < 21 mmHg with no family history of glaucoma.

A patient's or a patient's family member's written informed permission was acquired. Tanta University Hospitals Ethical Committee permission was obtained before the study was conducted.

Exclusion criteria: Included angle closure glaucoma and other types of secondary glaucoma, unreliable visual fields (defined as false-negative >20 percent, false positive >20 percent, and fixation loss >15 percent), possible neurological field loss, previous intraocular surgeries, laser therapy or trauma, opaque media or poor-quality OCT images (e.g., dense cataract or vitreous hemorrhage), and congenital anomalies of the optic nerve (e.g., optic).

All patients were submitted to the following: medical and family history, complete personal history taking including age, sex, and history of intraocular surgery, neurologic, metabolic, or systemic disease.

Ophthalmic examination:

Refraction, UCVA, and BCVA are measured with a slit-lamp biomicroscope, IOPis measured with a Goldmann applanation tonometer, gonioscopy is performed with a Goldmann indirect gonioscopy lens, a fundus examination is performed with a Volk 90D lens following pupillary dilation with 1% tropicamide, and axial length is measured with a NIDEK AL-SCAN optical bio (Type 72100, Oculus Optikgerate GmbH, Wetzlar, Germany).

Assessment of corneal biomechanics:

The Corvis-ST non-contact tonometer uses a high-speed Scheimpflug camera (4330 frames per second) to take 140 images of corneal deformation in response to an air puff. The patient's head was supported by the chin rest, and the air puff nozzle was positioned directly over the affected eye.The device can automatically produce a focused air puff with a pressure of 60 mm Hg from a nozzle with a diameter of 3.05 mm which is 11 mm from the cornea. The corneal deformation caused by the air puff is captured on video by a 45° angled Schiempflug camera, which shows the cornea's initial inward applanation, maximum

concavity, and subsequent outward applanation or flattening as it returns to its normal shape.Corvis ST provides many corneal biomechanical properties based on the deformation response.The air puff first pulls the cornea inward and flattens it. Measurements of the length and speed of the corneal apex are taken during the first phase of applanation (A1). The cornea gradually becomes more concave in shape as it moves inward. There are three biomechanical factors that we evaluate here. The amount of deformation, measured in millimeters, is the distance traveled by the corneal apex from the beginning of the deformation to the point of maximum concavity.PDis the millimeter distance between the two bending points of the cornea. R represents the cornea's center concave curvature. In the second applanation phase (A2), the cornea is flattened again and the length and velocity of the corneal apex are measured as the cornea returns to its normal, convex shape.

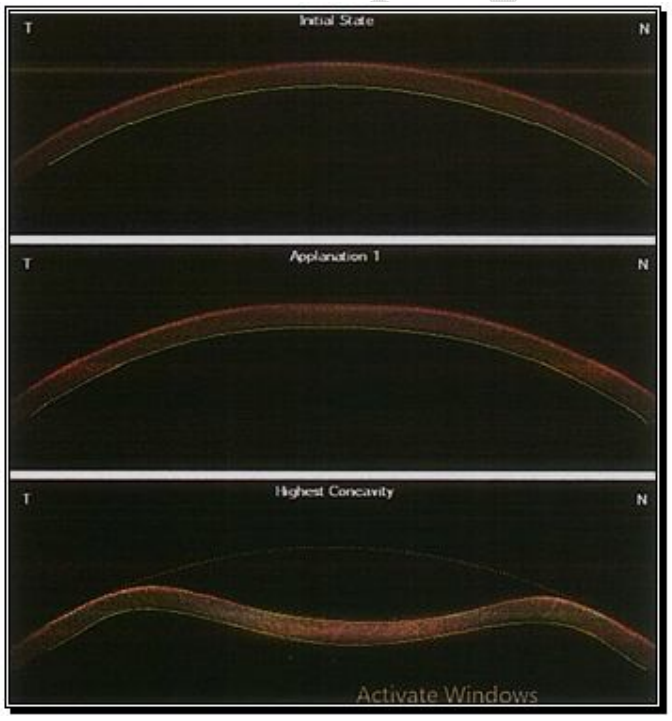

Fig 1: Stages of corneal applanation by Corvis- ST.

Enhanced Depth Imaging SD-OCT of the optic disc:

The ONH of each eye was scanned utilizing the EDI method and OCT (Heidelberg Engineering).The same imaging equipment was used by an experienced investigator who was blinded to the patient's clinical information. EDIscans were acquired with 6 radial line B-scans (each at a 30° angle) focused on the optic disc (vertical, horizontal, and 4 obliques in between).A scan with 50 percent LC vision lost because of prelaminar neural tissue or overlaying arteries was deemed to be of low image quality. We obtained pictures with a quality score of >15 (about 65–70 parts per eye).These B-scan values were utilized to establish the average LCCI of the eye. Using OCT imaging measuring calibrators, the parameters were measured.

Measurement ofLC curvature index LCCI

As LC deformation manifests as a pattern of posterior bending, the LC strain may be determined by analyzing the LC curve.To measure the posterior bending of the LC, the LCCI was established as the inflection of a curve displaying a portion of the LC. To calculate the LCCI, Connecting the two sites on the anterior LC surface where the lines generated from each Bruch's membrane termination point crossed the BMO reference line produced a new reference line.This reference line's length is determined by its width (W). The greatest distance between the reference line and the anterior LC surface was then utilized to calculate the depth of the LC curve (LCCD).The LCCI was then determined by multiplying (LCCD/W) by 100.

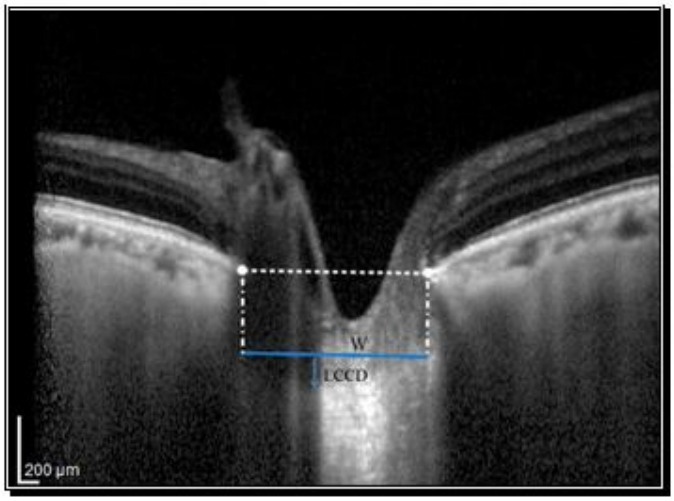

Fig 2: Measurement of LCCI

Statistical analysis:

Statistical analysis was performed using SPSS version v26 (IBM Inc., Armonk, NY, USA). To do a direct comparison between the two groups, we provided mean and standard deviation data and used an unpaired Student's t-test (SD). If appropriate, qualitative variables were presented as frequency and percentage and were analyzed using the Chi-square test. A two-tailed P value of 0.05 or less was considered statistically significant.

The correlation between two quantitative factors within the same group was calculated using the linear correlation coefficient (r).

Results:

Age and sex were insignificantly different between the two groups.The spherical equivalent ranged from -2 - +3 D with a mean of 0.5 ± 1.13 D in the control group and from -4 - +1 D with a mean of -0.18 ± 1.56 D in the primary open-angle glaucoma group. The spherical equivalent was insignificantly different between the two groups.Axial length ranged from 22.55 - 24.97 mm with a mean of 23.79 ± 0.89 mm in the control group and from 23.60 -

25.83 mm with a mean of 24.21 ± 0.83 mm in the primary open-angle glaucoma group. Axial length was insignificantly different between the two groups.

Central corneal thickness ranged from 504 - 614 mm with a mean of 558 ± 34.53 mm in the control group and from 485 - 594 mm with a mean of 545.6 ± 33.99 mm in the primary open-angle glaucoma group. Central corneal thickness was insignificantly different between the two groups.

IOPranged from 11 - 17 with a mean of 13.02 ± 1.68 in the control group and from 16 - 26 with a mean of 20.53 ± 2.70 in the POAG group. IOPwas significantly higher in the POAG group thanin the control group (P=0.001).**Table 1**

Table (1): Baseline characteristics of the studied group:

		Control group (n=30)	Primary open-angle glaucoma (n=30)	P value
Age (years)	Mean± SD	51.63± 7.22	56.80 ± 9.86	0.614
	Range	40 – 65	42 - 71	
Sex	Male	14 (46.7%)	12 (40.0%)	0.794
	Female	16 (53.3%)	18 (60.0%)	
Spherical equivalent (D)	Mean± SD	0.5 ± 1.13	-0.18 ± 1.56	0.057
	Range	-2 - +3	-4 - +1	
Axial length (mm)	Mean± SD	23.79 ± 0.89	24.21 ± 0.83	0.067
	Range	22.55 - 24.97	23.60 - 25.83	
Central corneal thickness	Mean± SD	558 ± 34.53	545.6 ± 33.99	0.166
	Range	504 – 614	485 – 594	
Intraocular pressure	Mean± SD	13.02 ± 1.68	20.53 ± 2.70	**0.001***
	Range	11 – 17	16 – 26	

Applanation 1 length ranged from 1.13 - 2.82 mm with a mean of 1.89 ± 0.38 mm in the control group and 1.73 - 2.58 mm with a mean of 1.9 ± 0.19 mm in the POAG group. Applanation 1 length was insignificantly different between the two groups.

Applanation 1 velocity ranged from 0.12 - 0.17 m/sec with a mean of 0.14 ± 0.01 m/sec in the control group and from 0.11 - 0.18 m/sec with a mean of 0.13 ± 0.02 m/sec in POAG group. Applanation 1 velocity was significantly lower in the POAG group thanin the control group (P=0.027). Applanation 2 length ranged from 1.6 - 2.06 mm with a mean of 1.84 ± 0.14 mm

in the control group and from 1.46 - 2.39 mm with a mean of 1.80± 0.19 mm in the POAG group. Applanation 2 length was insignificantly different between the two groups. Applanation 2 velocity ranged from -0.36 - (-0.26) m/sec with a mean of -0.33 ± 0.03 m/sec in the control group and from -0.37 - **(**-0.25**)** m/sec with a mean of -0.33 ± 0.03 m/sec in POAG group. Applanation 2 velocity was insignificantly different between the two groups.**Table 2**

Table (2): Applanation 1 and 2 length and applanation 1 and 2velocities in the studied groups:

		Control group (n=30)	**Primary open-angle glaucoma (n=30)**	**P value**
Applanation 1 length(mm)	Mean± SD	1.89 ± 0.38	1.9 ± 0.19	0.928
	Range	1.13 - 2.82	1.73 - 2.58	
Applanation 1 velocity (m/sec)	Mean± SD	0.14 ± 0.01	0.13 ± 0.02	**0.027***
	Range	0.12 - 0.17	0.11 - 0.18	
Applanation 2 length(mm)	Mean± SD	1.84 ± 0.14	1.80 ± 0.19	0.374
	Range	1.6 - 2.06	1.46 - 2.39	
Applanation 2 velocity (m/sec)	Mean± SD	-0.33 ± 0.03	-0.33 ± 0.03	0.528
	Range	-0.36 - (-0.26)	-0.37- (-0.25)	

PDranged from 2.84 - 5.14 mm with a mean of 3.99± 0.66 mm in the control group and from 3.64 - 5.41mm with a mean of 4.30 ± 0.54 mm in the POAG group. PDwas significantly higher in the POAG group thanin the control group (P=0.05).R ranged from 6.03 - 9.51 mm with a mean of 7.14 ± 1.04 mm in the control group and from 6.65 - 9.97 mm with a mean of 7.90 ± 0.93 mm in the POAG group. R was significantly higher in the POAG group thanin the control group (P=0.004). Deformation amplituderanged from 1.04 - 1.15 mm with a mean

of 1.11 ± 0.02 mm in the control group and from 0.92 - 1.17 mm with a mean of 0.95 ± 0.06 mm in the POAG group. Deformation amplitudewas significantly lower in the POAG group thanin the control group (P<0.001).LCCI ranged from 5.40 - 8.30 with a mean of 6.90 ± 0.93 in the control group and from 7.60 - 13.30 with a mean of 10.69 ±1.77 in the POAG group. LCCI was significantly higher in the POAG group thanin the control group (P<0.001).

RNFL ranged from 92 - 113 um with a mean of 105.0 ± 5.66 um in the control group and from 55 - 90 um with a mean of 73 ± 10.68 um in the POAG group. RNFL was significantly lower in the POAG group thanin the control group (P<0.001). **Table 3**

Table (3): PD**, Radius of curvature, Deformation amplitude,LCCI, and** RNFL**thicknessof the cornea in the studied groups:**

		Control group (n=30)	**Primary open-angle glaucoma (n=30)**	**P value**
Peak distance (mm)	Mean± SD	3.99 ± 0.66	4.30 ± 0.54	**0.05***
	Range	2.84 - 5.14	3.64 - 5.41	
The radius of curvature (mm)	Mean± SD	7.14 ± 1.04	7.90 ± 0.93	**0.004***
	Range	6.03 - 9.51	6.65 - 9.97	
Deformation amplitude (mm)	Mean± SD	1.11 ± 0.02	0.95 ± 0.06	**<0.001***
	Range	1.04 - 1.15	0.92 - 1.17	
Lamina cribrosa curvature index	Mean ± SD	6.90 ± 0.93	10.69 ±1.77	**<0.001***
	Range	5.40 - 8.30	7.60 - 13.30	
RNFL thickness (um)	Mean ± SD	105.0 ± 5.66	73 ± 10.68	**<0.001***
	Range	92 – 113	55 – 90	

IOP showed a positive significant correlation withA1L,A1V,A2L, PD, R, andLCCI and a negative significant correlation with DA andRNFL, and IOP showed an insignificant correlation with A2V.**Table 4**

Table (4): Correlation between IOP and different parameters:

	IOP	
	R	**P**
A1L	**0.403**	**0.001***
A1V	**0.297**	**0.021***
A2L	**0.363**	**0.004***
A2V	0.241	0.064
PD	**0.667**	**<0.001***
R	**0.811**	**<0.001***
DA	**-0.443**	**<0.001***
LCCI	**0.536**	**<0.001***
RNFLT	**-0.555**	**<0.001***

IOP: Intraocular pressure, A1L: Applanation 1 length, A1V: Applanation 1 velocity, A2L: Applanation 2 length, A2V: Applanation 2 velocity, PD: Peak distance, R: Radius of curvature, DA: Deformation amplitude, LCCI: Lamina cribrosa curvature index, RNFLT: Retinal nerve fiber layer thickness, r: Pearson coefficient

LCCI showed an insignificant correlation with A1L, A1V, A2L, and A2V and a negative significant correlation with DA and RNFL, and a positive significant correlation with PD and R.**Table 5**

Table (5): Correlation between LCCI and different parameters:

	LCCI	
	R	**p**
A1L	0.129	0.325
A1V	-0.094	0.473
A2L	0.066	0.617
A2V	0.055	0.678
PD	**0.407**	**0.001***
R	**0.499**	**<0.001***

DA	**-0.685**	**<0.001***

A1L: Applanation 1 length, A1V: Applanation 1 velocity, A2L: Applanation 2 length, A2V: Applanation 2 velocity, PD: Peak distance, R: Radius of curvature, DA: Deformation amplitude, LCCI: Lamina cribrosa curvature index,r: Pearson coefficient.

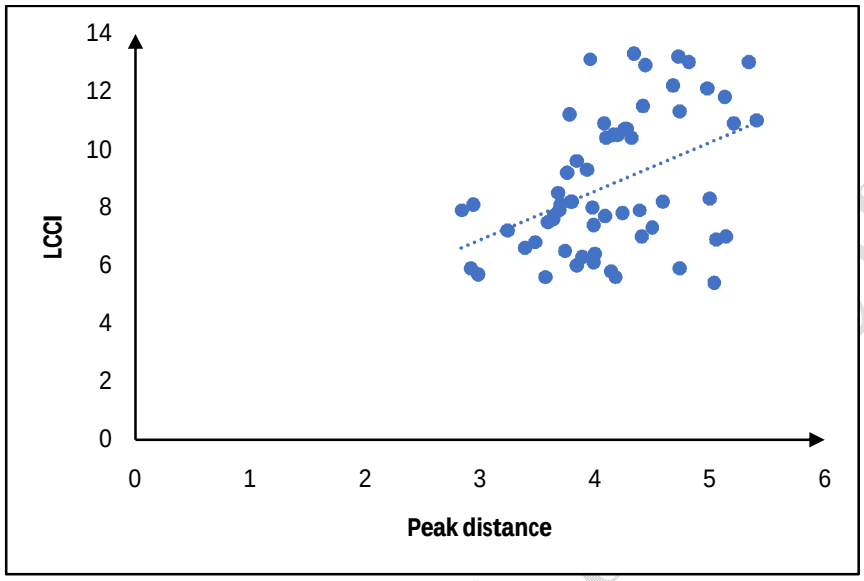

Fig 3: Correlation between LCCI and peak distance.

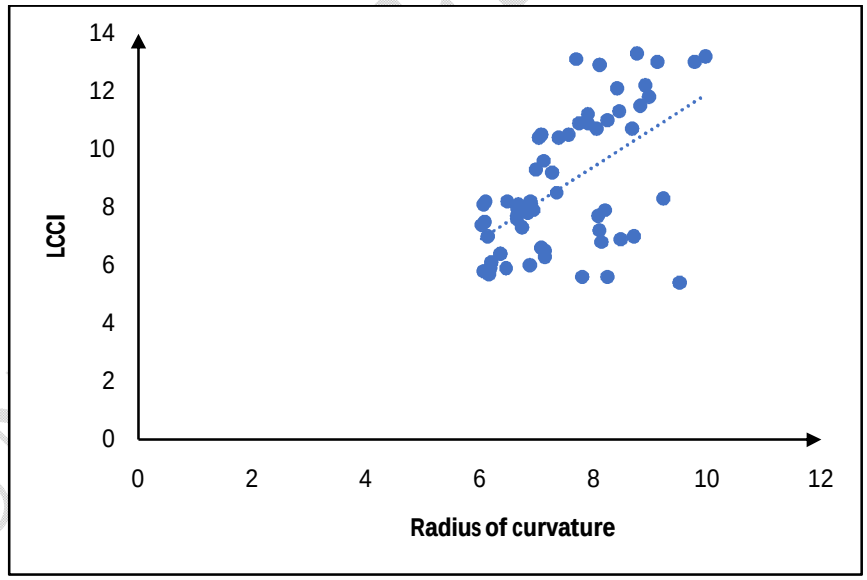

Fig 4: Correlation between LCCI and R.

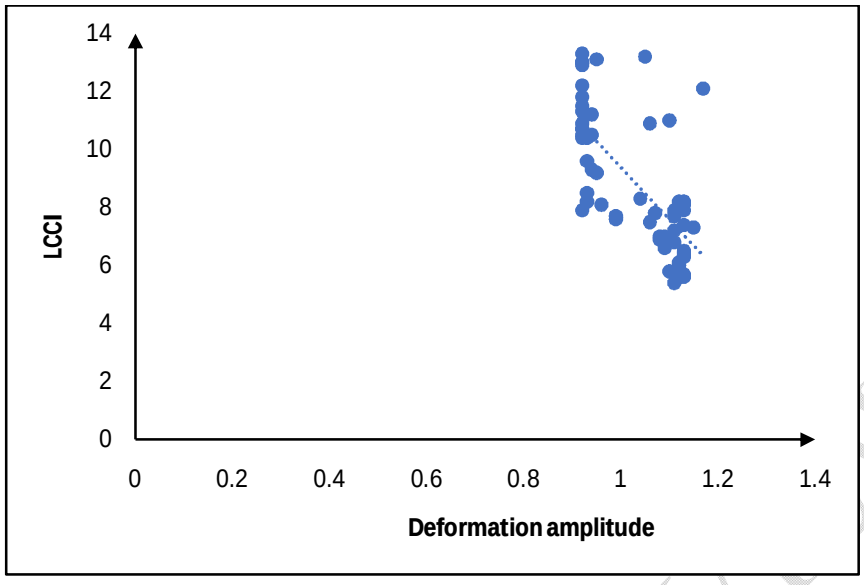

Fig 5: Correlation between LCCI and deformation amplitude

Discussion

Atrophy of the optic nerve and the death of retinal ganglion cells and their axons characterize the progressive, chronic optic neuropathy known as POAG, which affects adults. During gonioscopy, an open anterior chamber angle is associated with this condition.

The purpose of this study was to investigate the relationship between corneal biomechanical characteristics and lamina cribrosa curvature in eyes affected by POAG.

In the present study, it was found that applanation 1 velocity (A1 V) was significantly lower in the POAG group with a mean of 0.13 ± 0.02 m/sec thanthe control group 0.14 ± 0.01 m/sec, (P= 0.027).

Similarly to our findings, **Pradhan et al., (2020)(Pradhan,Deshmukh, et al., 2020)** conducted a prospective, cross-sectional study that included 42 eyes with POAG and 46 healthy controls. The results showed that A1 V was significantly lower in the POGA group thanin the control group (P= 0.03). They hypothesized that the corneas of glaucomatous eyes were less flexible.

In contrast with **Leung et al., (2013)(Leung,Ye et al., 2013)**conducted a prospective study that included 140 glaucomas suspect/glaucomatous and 40 normal eyes for repeated measurements of corneal deformation responses by Corvis-ST.The results showed no significant difference in A1 V between POAG and control groups (P = 0.174). We think this difference may be because the glaucoma group included suspect glaucoma patients.

In the present study, it was found that PD was significantly higher in the POAG group with a mean 4.30± 0.54 mm than control group 3.99± 0.66 mm (P =0.05).

In line with our study, **Wang et al., (2015)(Wang,Du et al., 2015)** conducted a case-control study including about 37 cases with POAG and 36 healthy controls.In comparison with the corneal deformation response of people with POAG to that of healthy individuals.The study found that PD was significantly higher in POAG than control group (P= 0.014). They indicated that a cornea with reduced deformability is believed to reach A1 more slowly and exhibit a smaller concavity at greater PD.

Contrary to these results, **Jung et al., (2020)(Jung,Park et al., 2020)**results showed no significant difference in PD in POAG group and than control group. (p =0.214).

In the present study, it was found that radius of curvature (R) was significantly higher in POAG group with mean 7.90± 0.93 mm than control group 7.14± 1.04 mm (P = 0.004).

Parallel to our results, **Jung et al., (2020)(Jung,Park et al., 2020)**highlighted that that R was significantly higher in POAG group than control group (P= 0.032).

In contrast to **Pradhan et al., (2020)(Pradhan,Deshmukh et al., 2020)**which stated that there was no significant difference in R between POAG and control groups (P= 0.86).

In our study, deformation amplitude(DA)was significantly lower in POAG group with mean 0.95± 0.06 mm than control group 1.11± 0.02 mm (P<0.001).

In line with our results, **Wang et al., (2015) (Wang,Du et al., 2015)** found that DAwas significantly lower in POAG group than control group (P =0.045). They demonstrated that a

cornea with less deformability reaches A1 more slowly (with a longer A1L and a smaller A1V), has less concavity (with a lower DA and a higher PD), and reaches A2 faster (with longer A2L, and higher A2V).

Parallel to our findings, **Pradhan et al., (2020)(Pradhan,Deshmukh et al., 2020)**highlighted that DA was significantly deacreased in POAG group than control group (P= 0.002). They implied that POAG patients had stiffer corneas than controls.

In line with our results, **Tian et al., (2016)(Tian,Wang et al., 2016)**showed that POAG group DA was much decreased than the control group. (P<0.001).

In consistent with our results, **Jung et al., (2020) (Jung,Park et al., 2020)** highlighted that DAwas significantly decreased in glaucoma patients than control group (P= 0.010).

On the contrary, **Leung et al., (2013) (Leung,Ye et al., 2013)**found that There was no statistically significant difference in DA between the POAG and control groups (P= 0.072). Including suspected glaucoma patients in their research as opposed to verified glaucoma diagnoses in ours might provide a plausible explanation for this discrepancy in outcomes.

In the present study,it was found that the lamina cribrosa curvature index (LCCI) was significantly higher in the POAG group with a mean of 10.69 ±1.77 thanin the control group with a mean of 6.90 ± 0.93 (P <0.001)**.**

In line with our findings, **Wu et al., (2021)(Wu,Du et al., 2021),** found thatApproximately 91 eyes with IOP 30 mmHg (group A), 21 mmHg IOP 30 mmHg (group B), and normal IOP (group C) were studied by swept-source OCT in a retrospective investigation (control, group C).The results showed that LCCI was significantly increased in POGA group than control group (P < 0.001)**.**

Parallel to our results, **Tan et al., (2019)(Tan,Tham et al., 2019)**142 people with POAG and 88 healthy controls were studied to learn more about the morphological changes in the

anterior lamina cribrosa. The results showed that the POGA group's LCCI was significantly higher than the control group's (P = 0.030).

In line with our results, **Lee et al., (2017)(Lee,Kim et al., 2017),**we performed a prospective research on 77 POAG patients and 77 healthy participants. They noted that LCCI was considerably elevated in the POGA group than the control group (P 0.001).

In consistent with our results, **Kim et al., (2016)(Kim,Jeoung et al., 2016b)**prospectively studied 123 eyes with POAG and 92 eyes of healthy individuals of a similar age. Their study results demonstrated that that LCCI was significantly higher POAG group than control group (P < 0.001).

Also, **Kim et al., (2016) (Kim,Jeoung et al., 2016a)**performed a study Swept-OCT was used to compare the LC structures of 108 eyes affected by POAG to 61 healthy eyes, assessing the correlation between LC structure variation and baseline IOP.They found that LCCI levels were considerably greater in the POAG group than in the control group. (P < 0.001).

In the present study, it was found that IOP showed a negative significant correlation with DA (P <0.001) and RNFL (P <0.001) and a positive significant correlation with LCCI (P <0.001).

In line with our results, **Wu et al., (2021)(Wu,Du et al., 2021)**stated that IOP had a negative significant correlation with average RNFL thickness (P < 0.001).

In line with our results, **Jung et al., (2020)(Jung,Park et al., 2020)**stated that IOP had a negative significant correlation significant correlation with DA (P<0.001).

Additionally, a significant positive correlation between IOP and LCCI was reported by **Lee et al., (2019)(Lee,Kim et al., 2019)**represented in the larger LCCI was associated with larger IOP (P < 0.001).

In consistent with our findings, **Lee et al., (2016)(Lee,Yu et al., 2016)**investigated 39 eyes of 39 patients with POAG. The LCCI was assessed before and after trabeculectomy using EDI-

OCT. The results demonstrated that the LC curvature was reduced after lowering IOP ($P < 0.001$).

In the current research, it was shown that LCCI has a substantial negative association with DA (P0.001) and a strong positive correlation with PD ($P= 0.001$) and R ($P<0.001$).

Notably, to the best of our knowledge, this is the first research to examine the relationship between LCCI and corneal biomechanics using Corvis-ST.Based on previous research demonstrating weak to moderate associations between Corvis-ST and ORA parameters evaluating distinct biomechanical aspects,[135] and that Corvis-ST may be more useful in assessing true biomechanical properties than ORA [136], It was hypothesised that the correlation we found between corneal biomechanics and LCCI might follow a certain pattern similar to that performed by**Lee et al., (2019) (Lee,Kim et al., 2019)**between corneal hysteresis and LC.

Our study had several limitations, Initially, this was a cross-sectional observational research. The predictive significance of corneal biomechanics and LCCI could not be determined. This study's sample size was quite small; consequently, the results should be regarded with caution. Due to the exclusion of eyes with slanted discs and eyes with prior surgery, our findings cannot be extended to such eyes.In our analysis, we were unable to account for the potential influence of antiglaucoma treatment. It has been shown that topical prostaglandin analogs alter corneal biomechanical characteristics in glaucoma patients. Corvis-ST measurements may also exhibit diurnal fluctuations.

Conclusions:

The corneas of POAG eyes were less deformable than those of normal controls. In POAG patients, corneas with less deformability were related to a more posteriorly bent LC.This result may explain why corneal biomechanics may be utilised to assess and predict glaucoma

risk and progression. Corvis ST is a novel non-contact tonometer that allows for simple estimation of corneal biomechanics and should be used routinely in patient monitoring.

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