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Central corneal thickness

Ocular correlations in normal eyes and those with primary angle-closure glaucoma

RONALD F. LOWE

From the Glaucoma Unit, The Royal Victorian Eye and Ear Hospital, and the Ophthalmic Research Institute of Australia

In recent papers (Lowe, 1968, 1969a) it was shown that in normal eyes, lens position and thickness were coordinated with axial length and radius of corneal curvature, whereas in eyes with primary angle-closure glaucoma these correlations were lacking. Throughout adult life, lenses increase in thickness at the same rate in normal eyes and those with angle-closure glaucoma, but no change could be shown in axial length or mean radius of corneal curvature.

The present paper describes investigations to determine whether central corneal thickness is correlated with axial length and radius of corneal curvature, whether central corneal thickness changes with age, and whether corneal thickness has any special effect in producing the shallow anterior chamber which is the distinguishing feature of eyes with primary angle-closure glaucoma.

Patients and techniques

The subjects were 80 persons with normal eyes (157 eyes) and 61 patients with primary angle-closure glaucoma (118 involved or second eyes). Details have been given in a previous publication (Lowe, 1969a).

Radii of corneal curvature were measured in the two principal meridia using a Javal-Schiötz (Haag-Streit) keratometer. The mean of the two measurements was used in the calculations.

Central corneal thickness was determined by a Haag-Streit 900 slit-lamp pachometer (Lowe, 1966). Corrections for corneal curvature were included. Three readings were taken each time and the means were used in the calculations.

Axial lengths were determined by 15 megacycle/sec. time-amplitude ultrasonography using a stand-off technique (Lowe, 1967). The accuracy of this method has been assessed and considered appropriate (Lowe, 1968).

Results

COMPARISONS OF CENTRAL CORNEAL THICKNESS

The means of central corneal thickness for normal eyes and those with angle-closure glaucoma are compared in Table I. The figure for normal eyes ($0{\cdot}517 \pm 0{\cdot}034$ mm.) is almost identical with that given by Mishima and Hedbys (1968) using the same method ($0{\cdot}518 \pm 0{\cdot}02$ mm.). Figures from other investigators which show more variation were tabulated by Donaldson (1966).

The mean central corneal thickness of the eyes with angle-closure galucoma was $0{\cdot}533 \pm 0{\cdot}034$, but a "*t*" test on the means of the two series showed no significant difference.

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Address for reprints: 82 Collins St., Melbourne, 3000, Australia

Table I *Comparison of corneal thickness*

Series of eyes	*Normal*	*Angle-closure glaucoma*
No. of eyes	157	118
Mean thickness (mm.)	0·517	0·533
Standard deviation	±0·034	±0·034
S.E. of mean	±0·0027	±0·0031
Range (mm.)	0·41–0·60	0·44–0·63
"t" test on means	"t"=0·0395; degrees of freedom=273	
Significance	Not significant	

AXIAL LENGTHS AND CORNEAL THICKNESS

Axial length was compared with corneal thickness in each eye (Table II). No correlation between axial length and central corneal thickness could be shown for either series.

Table II *Statistics of axial length* (X) v. *central corneal thickness* (Y)

Series of eyes	*Normal*	*Angle-closure glaucoma*
No. of eyes	157	118
Regression line	Y=0·534–0·00072X	Y = 0·573–0·0018X
S.E. of regression variance	0·00334	0·00296
Due to regression variance	0·0000542	0·000418
About regression variance	0·001164	0·00115
F—ratio	0·04657	0·3643
Significance	Not significant	Not significant
Correlation coefficient	—0·0173	—0·0560
Significance	Not significant	Not significant

CORNEAL RADIUS AND CORNEAL THICKNESS.

Mean radius of corneal curvature was compared with central corneal thickness in each eye (Table III). No correlation between mean radius of corneal curvature and central corneal thickness could be shown for either series.

Table III *Statistics of mean radius of corneal curvature* (X) v. *central corneal thickness* (Y)

Series of eyes	*Normal*	*Angle-closure glaucoma*
No. of eyes	157	117
Regression line	Y = 0·556–0·0050X	Y = 0·609–0·0099X
S.E. of regression variance	0·0113	0·01067
Due to regression variance	0·000229	0·0009953
About regression variance	0·00116	0·001151
F—ratio	0·1967	0·8647
Significance	Not significant	Not significant
Correlation coefficient	—0·0356	—0·0864
Significance	Not significant	Not significant

CORNEAL THICKNESS AND AGE

Statistics of corneal thickness with age are compared for normal eyes and those with angle-

closure glaucoma in Table IV. No significant change in corneal thickness was found for normal eyes.

Table IV *Statistics of age (X) v. central corneal thickness (Y)*

Series of eyes	*Normal*	*Angle-closure glaucoma*
No. of eyes	157	118
Regression line	Y = 0·504 + 0·00022X	Y = 0·570–0·00056X
S.E. of regression variance	0·000202	0·000273
Due to regression variance	0·001356	0·004703
About regression variance	0·001155	0·001109
F—ratio	1·174	4·238
Significance	Not significant	0·05 > P > 0·025
Correlation coefficient	+0·0867	—0·1877
Significance	Not significant	0·05 > P ⩾ 0·01

For those with angle-closure glaucoma, the regression line showed a significant reduction in corneal thickness with age. By calculation, the magnitude of this thinning was found to be minute — only — 0·028 ± 0·014 mm. in 50 years.

Conclusions and summary

No statistical difference could be found between the mean central corneal thickness of normal eyes and those with primary angle-closure glaucoma.

For normal eyes no correlations could be found for central corneal thickness against axial length, mean radius of corneal curvature, or age.

For eyes with primary angle-closure glaucoma, no correlations could be found for central corneal thickness against axial length or mean radius of corneal curvature, but a minute significant central corneal thinning was found with increasing age.

The investigations described previously (Lowe, 1969b) and in this paper show the curvature and thickness of the cornea have no special effect in producing the shallow anterior chamber typical of eyes with primary angle-closure glaucoma.

Corneal thickness assumes importance only during severe attacks of acute angle-closure glaucoma when the thickened oedematous cornea can encourage iridocorneal contact and peripheral anterior synechiae.

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