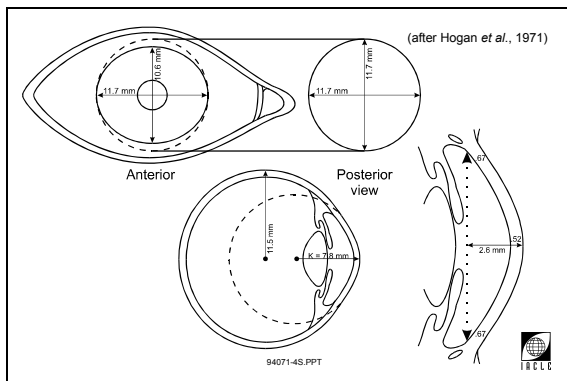


I.A.1 Dimensions

5

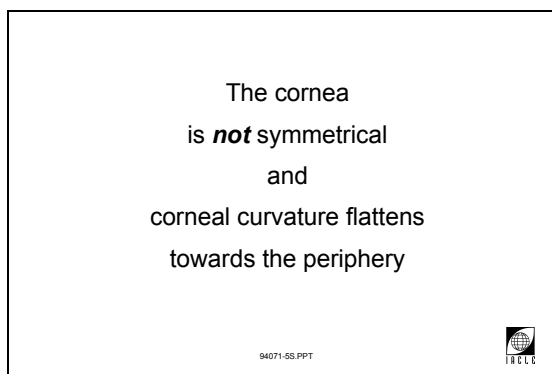


1L194071-4

Dimensions of the Cornea

- Corneal shape is elliptical because of the encroachment of the opaque limbus into the cornea's superior and inferior borders.
- Horizontal visible iris diameter (HVID) is 11.7 mm and vertical visible iris diameter (VVID) is 10.6 mm on average. These may be about 0.1 mm less in females.
- Corneal area is 1.3 cm^2 or $1/14$ of the total area of the globe.
- The globe is bi-spherical with the cornea having the smaller posterior spherical radius of curvature of 6.2 to 6.8 mm (average 6.5 mm).
- According to Maurice (1969), the average corneal thickness is 0.52 mm in the centre and 0.67 mm at the limbus.
- Sagittal depth of the cornea is 2.6 mm with variations largely dependent on the radius of corneal curvature.

6

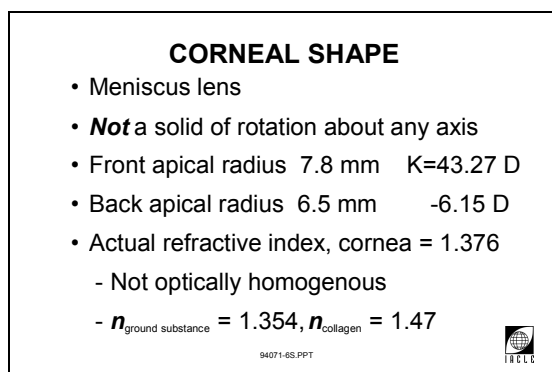


1L194071-5

The cornea is **not** symmetrical and is **not** a solid of rotation about the optic, geometric or any other axis.

- Corneal curvature flattens towards the periphery and the degree of increase in the radii of curvature varies from one meridian to the next. This variation in flattening indicates that the curvature is **not** a solid of rotation about any particular axis.
- Greater corneal toricity is mirrored in an increased difference in the radii of curvature of the principal meridians.
- The outline defining the central spherical area of the cornea is an irregular shape.
- The eye is never still. Constant movement of the eye (saccadic movement) does not allow for a fixed centre of rotation.

7



1L194067-6

Corneal Shape

The cornea is a meniscus lens.

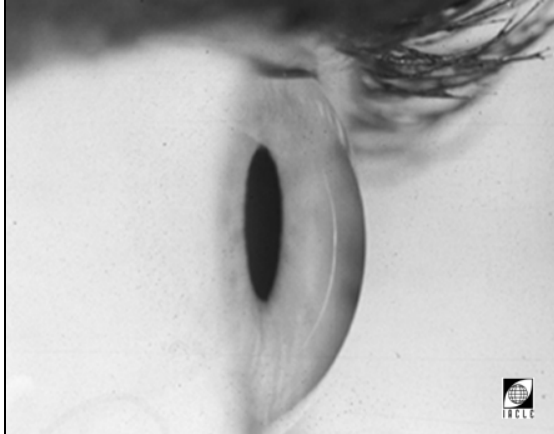
- The average front apical radius is 7.8 mm (corneal power = 43.27 D with an instrument calibrated for a refractive index of 1.3375).
- The average back apical radius of 6.5 mm gives the posterior cornea a power of -6.15 D (assumptions: $n_{\text{aqueous}} = 1.336$ and $n_{\text{post. cornea}} = 1.376$, $r_{\text{post. cornea}} = 6.5 \text{ mm}$).
- The actual refractive index of the cornea (n_{cornea}) is 1.376 (ignoring the tear film).
- The cornea is not optically homogeneous. However the actual refractive indices of the individual layers are not known accurately.
- Most values are for homogenized corneal

material.

- Little light is reflected from internal layer interfaces, suggesting minimal refractive index differences. However:

$n_{\text{ground substance}} = 1.354$ and $n_{\text{collagen}} = 1.47$. Since ground substance constitutes about 1% of the cornea and collagen about 15%, this observation is perhaps a little surprising given the significant refractive index difference.

8



1L10116-92

Corneal Profile

The cornea is:

- Transparent.
- The principal optical surface of the eye, accounting for approximately two-thirds of the eye's refractive power.

9

CORNEA

- 78% water
- 15% collagen
- 5% other parts
- 1% GAGs
- Epithelium \approx 10% of cornea's wet weight

94071-7S.PPT



1L194071-7

Corneal Composition

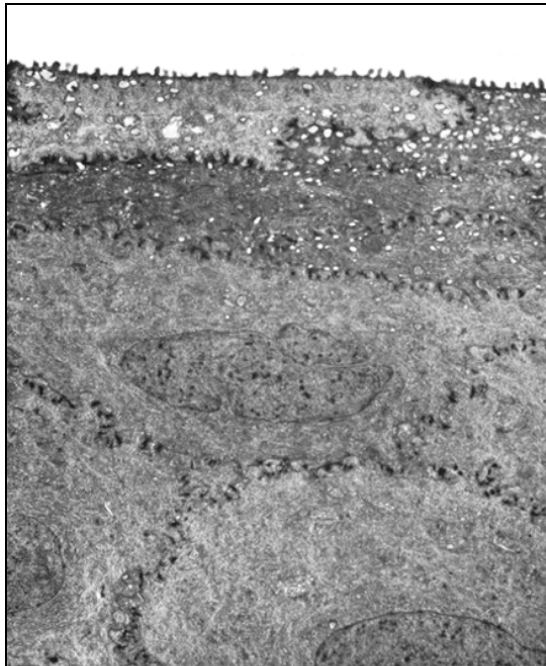
The cornea is composed of:

- 78% water.
- 15% collagen.
- 5% other proteins.
- 1% glycosaminoglycans (GAGs).
- 1% salts.

These are wet weight figures.

The epithelium accounts for approximately 10% of cornea's wet weight.

13



Hogan *et al.*, 1971
Histology of the Human Eye
Fig. 3.12
WB Saunders Company



1L10613-95

Electron Micrograph of the Epithelium (Hogan *et al.*, 1971)

- Microplicae and microvilli are seen on the surface. They are thought to play a role in tear film stability by anchoring the mucus layer.
- This transverse section shows both the squamous (surface) and wing cells.

14

EPITHELIUM

- 50 microns thick
- 5-layered structure
 - squamous cells (surface)
 - wing cells
 - columnar cells (basal)
- Cell turnover (basal to surface)
≈ 7 days

94071-9S.PPT



1L194071-9

Epithelium

- The epithelium is 50 microns thick.
- It is a five-layered structure:
 - outer surface cells: two layers of flattened squamous cells
 - middle wing cells: two to three layers of polygonal cells
 - inner basal cells: one layer of columnar cells.
- Cellular turnover, i.e. the time required for basal cells to migrate anteriorly to become surface cells, is approximately seven days.

15

EPITHELIUM CELLS SURFACE CELLS (2 Layers)

- Thin
- Squamous
- Overlapping polygonal cells

WING CELLS (2 Layers)

- Overlays Basal layer
- 'Wings' protruding into space between domes of basal cells

BASAL CELLS

- Deepest
- Columnar
- Hemispherical anterior surface

94071-10S.PPT



1L194071-10

Epithelial Cells (Hogan *et al.*, 1971)

- Surface cells (two layers):
 - thin
 - squamous
 - overlapping polygonal (see *a* in slide 16).
- Wing cells (two layers):
 - overlay the basal layer
 - 'wings' protruding into the space between domes of basal cells (see *b* in slide 16).
- Basal cells (one layer):
 - deepest
 - columnar