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EXAMINATION OF THE CORNEA AND LIMBUS*

1. THE NORMAL CORNEA AND LIMBUS

A) THE NORMAL CORNEA IN FOCAL (DIFFUSE) LIGHT

OBSERVATION OF THE REFLECTING ZONES

Fig. 1a. Schematic illustration showing the passage of the luminous bundle of light through the normal cornea (compare page 9).

*a* = anterior surface of the cornea (surface of entry); *bd* = anterior edge, especially distinct after the instillation of fluorescein; *bfdh* = the cut surface, especially important for the purpose of localization (shown by hatched lines). *eg* as a rule is only visible in pathologic cases, and at times in normal corneal zones at the periphery** (senile and presenile phenomenon); *efgh* = posterior surface of cornea (surface of exit). On this surface precipitates are found, they are not visible in the area *acgq*.

Proceeding from *fh* toward *eg* they become less and less distinct (compare Fig. 20), on account of the interposition of more dense luminous areas. For the purpose of determining the depth of a certain area, we allow the latter to enter into the cut section *bfdh*. The latter need not be visible. It is only necessary to locate *bd* and *fh*. The plane between these two edges will then represent the cut section *bd fh*. With the light from the temporal side we place the surface *bf dh* (and with it the whole of the bundle of light) temporalward to the area in question. Now carefully approach the latter toward the surface *bf dh* until it is *just about to enter* this plane. This localizes it in this surface and consequently also in the cornea (compare text on page 9). In a similar manner one may localize areas in the lens. To obtain a sharp picture of edge *bd* and *fh* the bundle of light and microscope must individually be in correct focus. For the purpose of determining depth we usually select *Oc. 2* and *Obj. a2*—giving a 24 time magnification. The slit should be quite narrow.

*Fig. 1b.* Cylindrical bundle. (See page 10.)

*Fig. 1c.* The visibility of the endothelial reflecting zone. (See page 19.)

*Fig. 2.* Images of the normal cornea (compare page 18).

To the left the sharply focussed anterior image. To the right the yellow (olive-green) correspondingly smaller image of the posterior cornea of a normal eye.

The image of the anterior cornea shows a slight chromatic aberration at its borders (*Oc. 2, Obj. a2*).—(By focussing the nitrogen fibre on the diaphragm of the illuminating lens one may see an image of it in the picture.)

Note the sharp, regular borders of these pictures. Only coarse irregularities are here manifested, in contrast to the reflecting zones (*Fig. 3*), wherein the most minute surface variations may be easily observed.

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* In the illustrations, the direction of the light is, if necessary, indicated by an arrow.

** By narrowing the bundle of light this edge may be made visible in normal tissue.
**THE NORMAL CORNEA**

Fig. 3. Normal corneal tissue. A girl, 18 years of age. Normal anterior (Sp) and posterior (Sp') reflecting zones of the cornea (compare page 18).

Both zones are within the region of diffuse reflection (D, D'), the anterior within \( abed \), the posterior within \( efgh \) (Fig. 1a). Oc. 4, Obj. a3.

After the reflected images (Fig. 2) have appeared in the field of vision, in order to observe the anterior reflecting zone, we focus the anterior corneal surface in the direction of the anterior reflecting image. \( Sp \) then appears within the stripe \( D \), its borders are curved, not distinctly defined, and the corners are rounded. On the superficial corneal surface movable black dots and ringlets are seen. They are corpuscular elements in the lachrymal fluid. They give origin to colours of dispersion (interference colours), especially after rubbing the eyelids, and after the instillation of ointments, which increase secretion (Fig. 3). In addition one may observe small white mosaic-like areas not of the epithelium, movable with the surface fluid (compare page 18).

Let us now focus somewhat more deeply onto the posterior reflecting zone (Sp').

We may now see the living endothelium, as we have recently observed it for the first time. The mosaic is composed of small, usually hexagonal fields (compare page 18\(^{13}\)\(^{15}\)). The colour of this zone is olive-yellow. Its borders are less distinct compared to those of the anterior area. Especially in the periphery one may note a flat grooved, wavy irregularity. This condition is found in all corneas and is increased in age and in pathologic eyes. The letters \( a \) to \( h \) refer to the borders of the diffusely illuminated corneal area (compare Fig. 1a). This area shows normal corneal tissue in focal light. We may easily recognize a delicate wart-like designing, in which (in the chosen angle of illumination) are situated long, horizontal, indistinct, lighter spots of varied sizes, on a uniformly dark bluish-gray background. There is therefore no area in the normal cornea which is "optically empty". All tissue elements reflect the light in varied degrees. This may easily be comprehended, if we consider that the corneal substance is saturated by a fluid, which has a different index of refraction (if we alter this index of refraction by injecting normal salt solution, water or even air into the corneal tissues, we may instantly cause the latter to become opaque). On the other hand, the solid elements which constitute the corneal tissue, the epithelium, corneal lamellae and corpuscles are of a different physical nature and therefore present varied indices of refraction. The lighter spots are due to the fixed corneal corpuscles, while a layer formation, which may be due to the lamellae, is not discernable. This latter however we have observed when demonstrating the Bowman's Canaliculi.

Within the corneal substance, always medially and superficially, never in the deep areas, we may observe the corneal nerve fibres (compare Fig. 7). Apparently in connection we these we find circumscribed grayish-white, usually round opacities, measuring 0.03 to 0.07 mm in diameter (compare under keratoconus, in which cases these opacities are seen with great frequency). With a little practice it will not be necessary to especially focus for the reflecting images.

Fig. 4. Amorphous endothelium, Mrs. E. age 49.

Presenile grayish hair. (Complains of asthenopia.) Vision normal, emmetropia, no distinct arcus senilis, tension normal. Note the disseminated light spots which give the impression of rough knob-like prominences.