

# THE CORNEAL SURFACE

Lucio Buratto, MD; Stephen G. Slade, MD, FACS; Sebastiano Serrao, MD, PhD; and Marco Lombardo, MD, PhD

## Anatomy

**T**he ocular surface is the external aspect of the eye and consists of the cornea, the conjunctiva, and the lacrimal film.

The cornea is transparent, avascular, deformable, and accounts for the anterior portion of the outer layer of the eye. It is surrounded by sclera and is curved more steeply than the rest of the eye as its mean radius of curvature is less than the radius of curvature of the sclera. The cornea is the most powerful refractive element of the eye. The cornea-air interface produces the greatest modification of the refractive index of the eye. The dioptric power of the corneal surface accounts for approximately 80% of the eye's total dioptric power.

The prolate anterior surface of the cornea is in contact with the lacrimal film and the palpebral conjunctiva. Its outline is elliptical with a mean horizontal diameter of 11.7 mm (11 to 12.8 mm), 1 mm more than the vertical diameter, which has a mean value of 10.7 mm (10 to 11.5 mm). Topographically, it is possible to identify an approximately spherical central zone of 4 mm diameter, with a radius of curvature 7 to 7.5 mm and a paracentral, circular, intermediate zone, which is progressively flatter toward the limbus, approximately 2.5-mm wide. The peripheral portion, or corneal limbus, is 1 to 2 mm wide and marks the

transition between the corneal and the sclero-conjunctival tissue.

The corneal epithelium consists of polystratified squamous non-keratinized epithelium, consisting of five to seven rows of cells, with a mean life cycle of 7 days; the thickness varies from 45  $\mu\text{m}$  centrally to 80  $\mu\text{m}$  in the periphery. Three layers can be identified: one superficial, one intermediate, and one basal. The latter rests on a thin basal membrane, Bowman's membrane, approximately 30 to 60  $\mu\text{m}$  thick.

The basal layer consists of a single layer of polyhedral cells oriented with their greatest axis perpendicular to the surface (mean height: 20  $\mu\text{m}$ ; mean width: 10  $\mu\text{m}$ ). Their cytoplasm is rich with organelles, which indirectly indicates a considerable metabolic capacity. Lymphocytes, histiocytes, and Langerhans cells are visible in the basal layer.<sup>6</sup>

The basal cells undergo morphological and biochemical modifications as they transform into polygonal elements along with extensions and ramifications that facilitate their adhesion to each other and to the basal layers below. The intermediate layer consists of two to three rows of cells with a diameter of 25 to 30  $\mu\text{m}$  and the greatest axis parallel to the corneal surface. Their cytoplasm is dense with microtubules and tonofilaments parallel to the greater cell axis. The polygonal elements are transformed into squamous cells, as they migrate toward the surface, and are