IOP range). When the cornea is in a dehydrated state, stress is distributed mainly to the posterior layers or uniformly over the entire cornea. When the cornea is edematous, the anterior lamellae take up most of the strain. Most keratorefractive procedures alter corneal biomechanical properties either directly (e.g., RK weakening the cornea to induce refractive change) or indirectly (e.g., excimer laser surgery weakening the cornea by means of tissue removal). The lack of uniformity of biomechanical load throughout the cornea explains the variation in corneal biomechanical response to different keratorefractive procedures. LASIK has a greater overall effect on corneal biomechanics than does photorefractive keratectomy (PRK) and small-incision lenticule extraction (SMILE), not only because a lamellar flap is created but also because the laser ablation occurs in the deeper, weaker corneal stroma, modifying a greater amount of corneal tissue.

**Corneal Imaging for Keratorefractive Surgery**

Corneal shape, curvature, and thickness profiles can be generated from a variety of technologies such as Placido disk–based systems and elevation-based systems (including scanning-slit systems and Scheimpflug imaging). Each technology conveys different information about corneal curvature, anatomy, and biomechanical function. Also, computerized topographic and tomographic systems may display other data: pupil size and location, indices estimating regular and irregular astigmatism, estimates of the probability of having keratoconus, simulated keratometry, and corneal asphericity. Other topography systems may integrate wavefront aberrometry data with topographic data. Although this additional information can be useful in preoperative surgical evaluations, no automated screening system can supplant clinical experience in evaluating corneal imaging.

The degree of asphericity of the cornea can be quantified by determining the $Q$ value, with $Q = 0$ for spherical corneas, $Q < 0$ for prolate corneas (relatively flatter periphery), and $Q > 0$ for oblate corneas (relatively steeper periphery). A normal cornea is prolate, with an asphericity $Q$ value of $-0.26$. Prolate corneas minimize spherical aberrations by virtue of their relatively flat peripheral curve. Conversely, oblate corneal contours, in which the peripheral cornea is steeper than the center, increase the probability of having induced positive spherical aberrations. After conventional refractive surgery for myopia, with the resulting flattening of the corneal center, corneal asphericity increases in the oblate direction, which may cause degradation of the optics of the eye.

**Corneal Topography**

Corneal topography provides highly detailed information about corneal curvature. Topography is evaluated using keratoscopic images, which are captured from Placido disk patterns that are reflected from the tear film overlying the corneal surface and then converted to computerized color scales (Fig 1-7). Because the image is generated from the anterior surface of the tear film, irregularities in tear composition or volume can have a major impact on the quality and results of a Placido disk–based system. Because of this effect, reviewing the Placido image (image of the mires) prior to interpreting the maps
Figure 1-7 Placido imaging of the cornea. **A**, The ring reflections of the Placido imaging device can be seen on this patient’s cornea. This image is then captured and analyzed. *(Courtesy of M. Bowes Hamill, MD).* **B**, The printout of the captured Placido image is seen in the lower right hand corner of this image with the different calculated color maps displayed in the other corners. *(Courtesy of M. Bowes Hamill, MD.)*

and subsequent numerical data is extremely important. In addition, Placido disk–based systems are referenced from the line that the instrument makes to the corneal surface (termed the vertex normal). This line may not necessarily be the patient’s line of sight or the visual axis, which may lead to confusion in interpreting topographic maps. For a more