At times technical advancements are significant enough to warrant a change or revision in terminology. For example, the classification and proper terminology of laser corneal surgery have been previously addressed so that surgeons and investigators around the world would “make sense in keratospeaking.”1 This is also the case when newer diagnostic instrumentation offers either more or different information than was previously available. It is our belief that we have reached that point with newer methods of imaging the cornea and anterior segment, thereby, revisiting the “keratospeak” regarding the terminology for corneal characterization.2

The era of computerized corneal surface analysis known as “topography” was introduced in the mid-1980s, when algorithms for surface reconstruction of the acquired reflection image from Placido photokeratoscope images were developed. Stephen D. Klyce, PhD, is credited with developing color-coded maps and indices from quantitative analysis of numerous points on the corneal surface.3,4 The term “corneal topography,” however, is a misnomer, in that most of these systems measured slope and produced a derived curvature map. The term is so ingrained that we will continue to use it here to refer to standard reflective Placido-based systems.

Corneal topography represented a true revolution in the diagnosis and management of corneal disease. One of the most important applications of corneal topography was in screening refractive surgical patients, as well as evaluating and improving the results of corneal surgical procedures such as LASIK and photorefractive keratectomy (PRK).4,5 Corneal topography has been found to be sensitive for detecting subtle changes on the anterior corneal surface secondary to ectatic disorders prior to loss of corrected distance visual acuity and the development of typical slit-lamp microscopy findings (i.e., Fleischer corneal epithelial iron ring, Munson sign, Rizzuti sign, or Vogt striae).6,7

In addition to Placido reflection–based corneal topography, other methods, such as the PAR Technology Corneal Topography System (PAR CTS; PAR Technology Corp, New Hartford, New York), which utilizes the technique of raster photogrammetry to define elevation points by analyzing a projected grid on the corneal surface, were also available. The PAR CTS provided highly accurate and reproducible elevation characterization of the corneal surface and was less sensitive to decentration.8 However, corneal measurement by either Placido reflection or raster-photogrammetry was limited exclusively to the front or anterior corneal surface.

Slit-imaging technologies were a further improvement in corneal imaging because of the ability to measure not only the anterior corneal surface but the posterior surface and to define the spatial relationship between the two (thickness map), and subsequently to characterize corneal architecture in three dimension. This reconstruction of the cornea provides significantly more information, therefore, new terminology, such as “tomography,” should be considered, which is more reflective of the three-dimensional characterization of the cornea and should be used to distinguish “tomography” from surface “topography.”

Topography derives from the Greek words “to place” (topo) and “to write” (graphein), which means to describe a place. This is classically related to the study of Earth’s surface shape and features or those of planets, moons, and asteroids. Tomography derives from the Greek words “to cut or section” (tomo) and “to write” (graphein). In medicine, the classic term computed tomography (CT) scanning is used for referring to the...
radiographic technique for imaging a section of an internal solid organ, producing a three-dimensional image. Corneal tomography should be used for the examination of the front and back surfaces of the cornea, along with pachymetric mapping, considering it computes a three-dimensional image of the cornea (Fig). Different technologies, such as horizontal slit scanning, rotational Scheimpflug imaging, arc scanning with very high-frequency ultrasound, and optical coherence tomography, are available in many commercial instruments (Table).

Of course, as for any diagnostic system, repeatability and accuracy issues are critical to ensure the value of the data generated. Limitations of each technology also must be considered. For example, forward protrusion or displacement of the posterior corneal surface, an important landmark of ectasia after LASIK, has been found in many otherwise normal postoperative LASIK eyes using the Orbscan (Bausch & Lomb, Rochester, New York). Although Dupps and Roberts described bulging of the posterior cornea after otherwise uneventful LASIK in normal individuals, its magnitude in stable cases should be extremely limited. Interestingly, in a later study with a mean follow-up of 14 months after LASIK, no patient demonstrated significant forward protrusion of the posterior corneal surface on Pentacam (Oculus Optikgeräte GmbH, Wetzlar, Germany). In addition, another recent study demonstrated Pentacam and Orbscan had no correlation in posterior elevation measurements although good correlations were noted for corneal thickness, anterior elevation, and anterior chamber depth after refractive surgery.20 More data are needed to demonstrate whether corneal tomography enhances the sensitivity for detecting cases at risk for corneal ectasia after LASIK (see our article in this issue21).

Scientific studies for characterizing normalcy and differentiating disease states, as well as demonstrating the sensitivity and specificity of novel tomographic parameters are required. Thickness profile16 and elevation maps17 should be properly interpreted to ensure the clinical benefit of the advanced technology. This is critically necessary in many areas, such as screening for ectasia risk among refractive surgery candidates. The occurrence of ectasia after uneventful LASIK with no recognized risk factors detected by traditional screening criteria, based on clinical parameters (refraction, age, residual stromal bed), along with single-point thickness measurements (pachymetry) and Placido-disk corneal topography, has demonstrated the need for new technologies. More data are needed to demonstrate whether corneal tomography enhances the sensitivity for detecting cases at risk for corneal ec-

<table>
<thead>
<tr>
<th>Method</th>
<th>Instrument (Manufacturer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal slit-scan</td>
<td>Orbscan IIz* (Bausch &amp; Lomb, Rochester, New York)</td>
</tr>
<tr>
<td>Rotating Scheimpflug</td>
<td>Pentacam (Oculus Optikgeräte GmbH, Wetzlar, Germany)</td>
</tr>
<tr>
<td>Rotating optical coherence tomography (OCT)</td>
<td>Visante† (Carl Zeiss Meditec, Jena, Germany)</td>
</tr>
<tr>
<td>Arc scanning with very high-frequency ultrasound</td>
<td>SS-1000 CASIA (Tomey Corp)</td>
</tr>
</tbody>
</table>

*Hybrid systems with a Placido disk topographer.
†Integrated to the ATLAS topographer in the Visante OMNI.
...ies with rigorous statistical analysis are needed for definitively demonstrating the benefit of novel diagnostic tools for detecting ectasia risk, it is important to distinguish three-dimensional reconstruction methods from corneal topography. The terms corneal tomography and corneal topography are useful, because they will distinguish between the two different types of examination, which will likely coexist and be complementary. Topography can evaluate the tear film, which is not examined by slit systems and provides useful information for screening cases at risk for dry eye after refractive surgery. Tomography characterizes the elevation of the front and back surfaces of the cornea and reconstructs pachymetric mapping, which we have found critical to enhance the sensitivity and specificity for detecting ectasia.

REFERENCES


