Chapter 5

Placido Disk-Based Topographic Systems

ATLAS 9000 Corneal Topographer

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The ATLAS 9000 Model (Carl Zeiss Meditec, Jena, Germany) corneal topographer (CT) is a large cone Placido disk system designed to measure corneal curvature and produce color-coded maps for the detection of corneal conditions and pathologies. This system also aids in the screening and postoperative management of refractive procedures such as laser-assisted in situ keratomileusis (LASIK), photorefractive keratectomy (PRK), and multifocal and toric intraocular lenses (IOLs) and in the selection and fitting of rigid gas-permeable (RGP) contact lenses. The field of view of the camera system is large enough to capture the limbus boundaries of the eye, thus allowing white-to-white (limbus-to-limbus) measurements, as well as the determination of the geometric center of the eye for better contact lens fitting and eye registration.

The ATLAS 9000 Placido disk-based system projects a series of 22 concentric infrared (950 nm) light rings onto the cornea of the eye. An image of the reflected rings is captured with a digital camera. The ATLAS system analyzes thousands of data points in the image to measure the distances between rings and their relationships with each other in order to reconstruct the corneal surface into a color-coded topography map. The ATLAS system can display the image of the cornea in a variety of ways, including curvature, elevation, and aberrations. The ATLAS system also has the ability to capture both scotopic (without light) and photopic (with light) pupil images. With the exception of the keyboard and printer, the ATLAS system integrates all hardware components in a single unit, including the image acquisition optics, the system computer, and a flat panel display screen.

Image Acquisition

The patented Cone-of-Focus technology used by the ATLAS system is the most critical part of the system's alignment and focusing mechanism.[1] The 22 rings of the large cone are separated by a smaller Cone-of-Focus at the location of the 9th ring. This smaller cone protrudes outward and reflects on the eye at a fixed, known distance from the camera. This reflection appears on the live video image as a larger separation between the rings surrounding the small cone. As the cone is brought closer to the cornea, the cone ring moves closer to the inner ring. As the cone is brought further from the cornea, the cone ring moves closer to the outer ring. The properly focused image results in even separation between the rings surrounding the cone. ATLAS' Cone-of-Focus uses a triangulation method to find the exact location and distance of the rings. A "triangle" is formed between the cone, the corneal surface, and the Placido rings.

Wang M. *Corneal Topography: A Guide for Clinical Application in the Wavefront Era, Second Edition (pp. 43-102)*