# OPD-Scan III: Powerful Informatics Helps Guide Preoperative Planning

Analysis of each component of the optical system provides an opportunity to design a surgical plan with a greater chance of achieving a successful outcome.

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Preoperative planning is fundamental to ensuring accurate outcomes after cataract or refractive surgery. The technology used by the evaluating surgeon plays a vital role in patient selection, as well as for choosing the appropriate lens option for cataract surgery or designing the optimal refractive pattern. Minimizing the potential for a postoperative refractive surprise has become increasingly important with the growing popularity of refractive lens exchange (RLE) with implantation of toric and premium multifocal implants.

The OPD-Scan III (NIDEK) is an advanced diagnostic device that is well suited to the laser and cataract refractive surgeon. The device combines autorefraction, corneal topography, ocular aberrometry, pupillography, and white-to-white measurements in a single platform. The incorporation of all these features allows evaluation of internal aberrations, potential visual acuity, and modulation transfer function (MTF), each of which may be useful for analyzing the individual optical components of the eye. Armed with this information, the evaluating surgeon can customize the approach to surgery and thereby reduce the potential of missing the refractive target.

## THE DAYA SUMMARY

I have worked with NIDEK to develop an overview report, the RLE Cataract Summary, that combines a number of parameters for surgical planning and postoperative evaluation that are useful for lens and refractive surgeries.

The cogent summary is divided into three columns. The overall aberrometry, refraction, and quantitative aberrometry are in the central column. The corneal contribution derived from Placido topography is represented in the left-hand column and the internal contribution derived by subtracting the corneal component from the overall aberrometry occupies the right-hand column. The bottom half of the report follows the same columnar format and shows aberrometry-derived astigmatism (axis and magnitude) above and overall higher-order aberrations below. This cleverly shows the overall contribution by each optical component—corneal versus internal (Figure 1). Presentation of the data in this manner provides the surgeon a simplified overview of the influence of corneal aberrations and internal aberrations to overall ocular aberrations. Data on refraction, keratometry, visually significant higher-order aberrations (eg, coma and spherical aberration), and pupillometry can then be evaluated in greater detail.

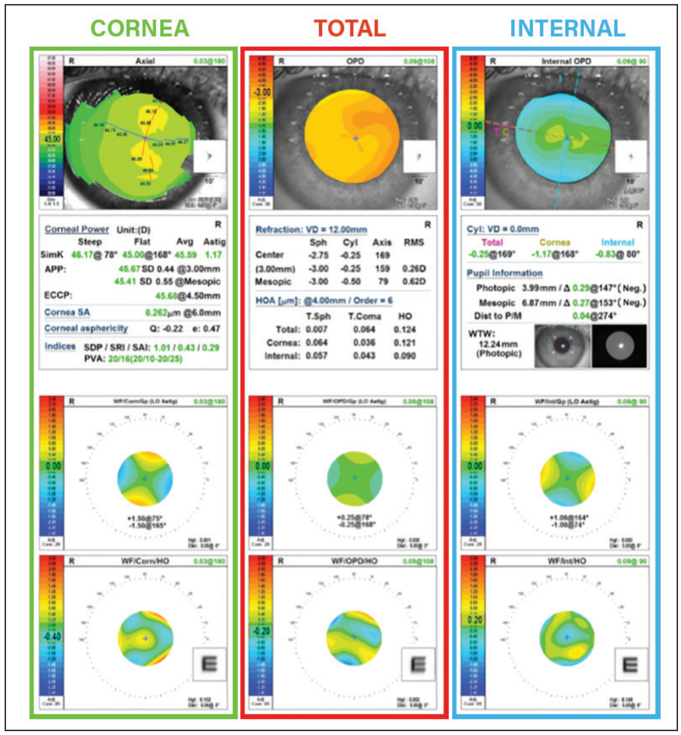


Figure 1. The three-column format of the RLE Cataract Summary provides a quick summary of relevant information for planning lens and refractive surgeries.

The role of internal optical features in contributing to total aberrations is currently underappreciated. The influence of internal optical features can be demonstrated in a sample image from a patient who has myopic astigmatism (Figure 2). At this stage of the patient's life, the corneal spherical aberration is compensating for the internal optical aberrations to ensure the retinal image is optimized. However, natural changes in the crystalline lens during the aging process, along with enlargement of the anterior-posterior diameter and increase in stiffness of the lens, will affect the internal portion, which can negatively impact image quality, increase total positive spherical aberration, and ultimately lead to loss of visual quality. Another example is seen in Figure 3, where reduction of internal negative aberration results in a higher level of overall spherical aberration. This eye may well benefit from an aspheric IOL to improve visual quality.

The OPD-Scan III significantly improves the ability to measure each relevant portion of corneal, internal, and total aberrations by combining Placido disk corneal topography (plotted using

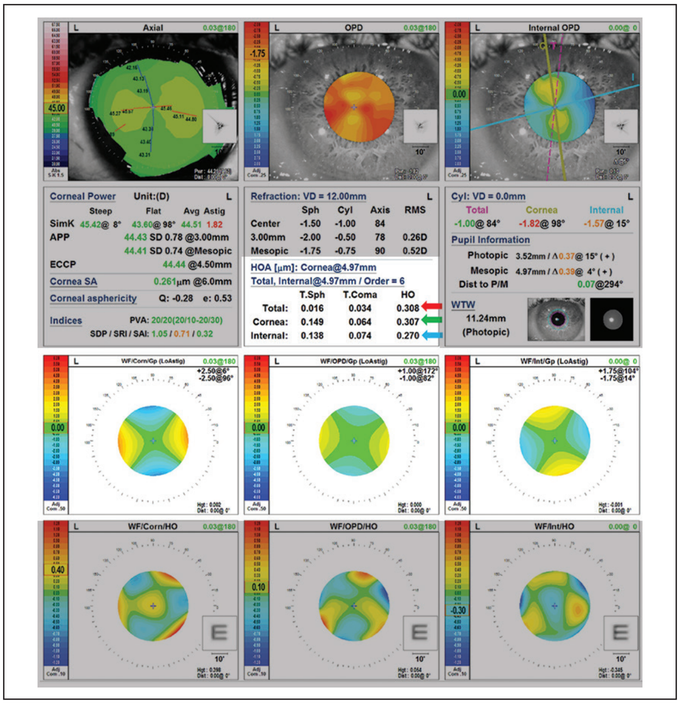

Figure 2. Sample RLE Cataract Summary from a patient with myopic astigmatism.

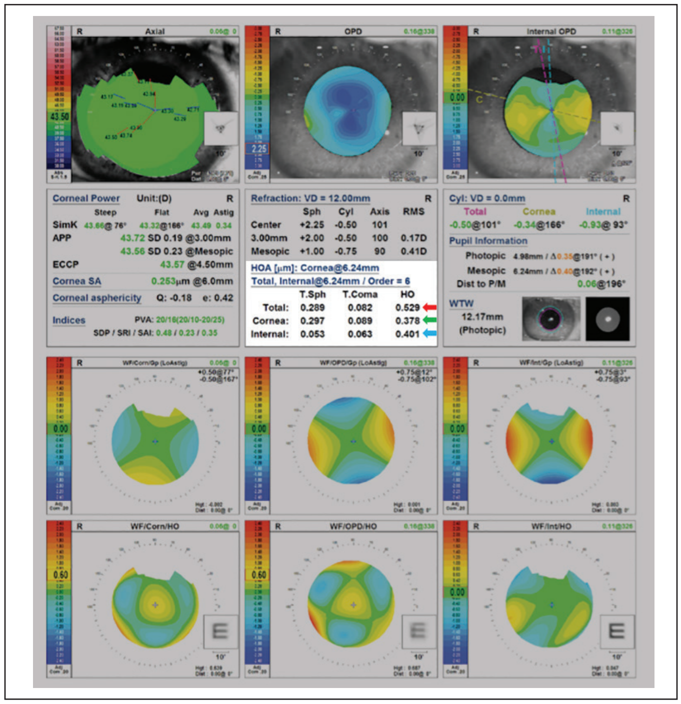

Figure 3. Findings on this patient's report suggest that an aspheric IOL will help to improve visual quality postoperatively.

11,880 data points over 39 concentric Placido rings) and ocular aberrometry (plotted using 2,520 data points over 9.5 mm to the 8th Zernike order). Corneal aberrations are subtracted from the overall aberrometry to derive the internal contributions. The resulting maps and data can be used to assess corneal integrity and determine the source of clinically significant aberrations, each of which can aid in developing a surgical plan. These maps are also important for postoperative follow-up. For example, internal aberrometry can be used to evaluate toric lens alignment postoperatively, conveniently without the need for dilation.

## ASTIGMATISM CORRECTION

Astigmatism is a general term describing deviation from spherical corneal curvature, and it is further classified as regular or irregular. In an eye with a cataract and regular, stable, and symmetrical astigmatism, toric IOLs are typically an option. Yet, understanding the magnitude of corneal cylinder and its axis is critical for accurate placement of a toric lens. This can be easily accomplished by assessing wavefront-derived astigmatism with the OPD-Scan III using the corneal wavefront axis. Where this method is very useful is in those patients who, for instance, have forme fruste or frank keratoconus. Topographic astigmatism is asymmetric and nonorthogonal. It is thus difficult to establish the correct axis for toric alignment. Again, wavefront aberrometry averages out overall astigmatism in terms of magnitude and axis. Similarly, for patients who wish to receive a high-performance premium lens where the magnitude of astigmatism is low, placement of limbal relaxing incisions can be determined using similar methodology.

Irregular astigmatism has historically been difficult to manage in the patient undergoing cataract surgery or RLE. This is because irregularities may derive from the tear film, the epithelial layer, the subepithelial layer, or the stroma. The surface regularity index (SRI) on the report is a good reflection of either the quality of the image taken or surface irregularity from rapid tear film evaporation, an irregular tear film, or epithelial basement membrane dystrophy. These can result in an erroneous IOL calculation from inaccurate keratometry readings. It is best that the cause of the low SRI be determined and treated if at all possible. A persistently poor SRI may well be a contraindication for implantation of a premium IOL.

## CONCLUSION

The Daya Summary provides a powerful set of data for surgical planning, patient counseling, and postoperative evaluation. Other features available on the OPD-Scan III may help plan the surgical approach, including information on pupillary diameter, the pupil's shape, and the deviation of the visual axis from the pupillary center as well as the point spread function, which is a simulation of retinal image quality, presented for the overall optical system, and for the cornea and internal aspects separately. Thorough analysis of the optical components of the eye, overall and separately, helps minimize the potential for missing the target during cataract surgery, RLE, or refractive surgery, which in turn increases the chances of a satisfactory outcome for the surgeon and the patient. ■

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