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On-Eye Measurement of Optical Performance of Rigid Gas Permeable Contact Lenses Based on Ocular and Corneal Aberrometry

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ABSTRACT: *Purpose.* Our aim was to obtain a complete description of the interactions of rigid gas permeable (RGP) contact lenses with the optics of normal eyes. *Methods.* We measured total and anterior-surface aberrations in four subjects, who were all long-term RGP contact lens wearers. The anterior-surface wave aberration was obtained from videokeratographic elevation maps, and ocular wave aberration was measured with a laser ray-tracing technique. Measurements were performed with and without their own spherical contact lenses. *Results.* With this methodology, we evaluated the optical performance with RGP lenses compared with the natural optics. We estimated the contribution of the anterior surface of the contact lens, the internal ocular optics, flexure, and the tear lens aberrations to the optical performance of eyes wearing RGP contact lenses. We found that in three of four subjects, the contact lens significantly improved the natural optics of the eye. For the subject with higher dominance of corneal aberrations, root mean square (second-order and higher) decreased from 1.36 μm to 0.46 μm. Third- and higher-order aberrations decreased from 0.77 μm to 0.39 μm. The internal optics and lens flexure imposed limits on aberration compensation. Spherical RGP contact lenses did not produce spherical aberration potentially due to a compensatory role of the tear lens. *Conclusions.* Aberration measurements are useful to understand the fitting of contact lenses and the interaction with tear, cornea, and internal optics of the eye. Aberrometry can help to choose the best standard RGP lens parameters to improve the optics of individual eyes. (Optom Vis Sci 2003;80:115–125)

Key Words: contact lens, rigid gas permeable, corneal aberration, corneal topography, videokeratography, ray tracing, aberration correction, spherical aberration, flexure, contact lens fitting, tear lens