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# Predicted Optical Performance of Pseudophakic Eyes Corrected for Spherical and Chromatic Aberrations Through an Intraocular Lens

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## Abstract

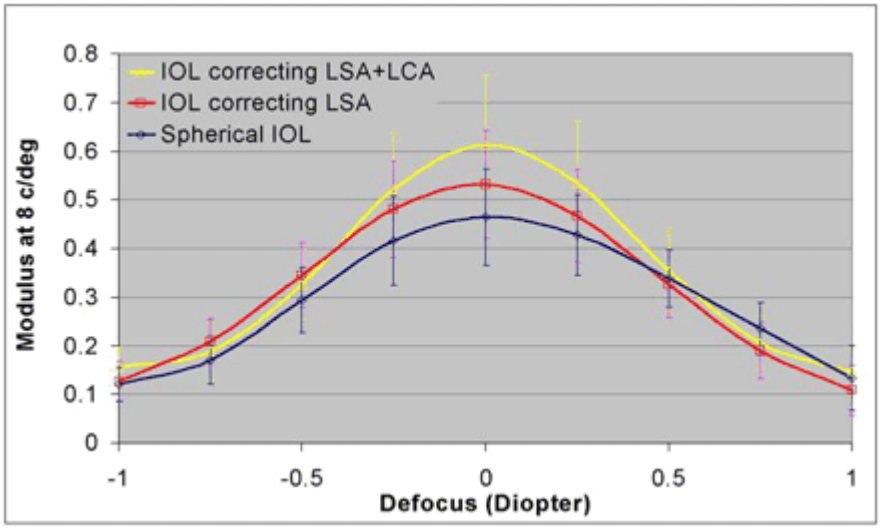
**Purpose:**To use clinically verified eye models to explore depth of focus (DOF), sensitivity to intraocular lens (IOL) tilt and decentration in pseudophakic eyes corrected for spherical and chromatic aberrations.

**Methods:**White light pseudophakic eye models were constructed from the measurements of 46 cataract patients. Models were verified using the average measured contrast sensitivity function (CSF) and wavefront aberration of pseudophakic patients implanted with two types of IOL. Separately, longitudinal spherical aberration (LSA)- and longitudinal chromatic aberration (LCA)- correcting IOLs of different powers were optimized in an eye model with the LSA and LCA of the average aphakic eye. The IOLs, which had aspheric anterior surfaces and diffractive posterior surfaces, were fitted in the 46 eye models. DOF, and sensitivity to IOL decentration and IOL tilt were evaluated based on modulation transfer function (MTF). The results were compared with standard spherical and aspherical IOL results.

**Results:**When comparing spherical and aspherical lenses, the improvement in the physiological eye models correlated well with the improvement in clinical outcomes.When only LSA was corrected (aspheric IOLs) the improvement was ~20% over pseudophakic eyes without correction (spherical IOLs). When both LSA and LCA were corrected, improvement over pseudophakic eyes with no correction was ~50%. The DOF of IOLs that corrected for LSA and LCA was similar to the DOF of spherical and aspherical IOLs (Figure). Lenses that corrected for LSA and LCA could be, on average, decentered by as much as 0.8 mm before their polychromatic MTF at 8 cpd was less than that of the aspheric or spherical

control lenses. The lenses are relatively insensitive to lens tilt.

**Conclusions:**Realistic eye models that include higher order aberrations and chromatic aberration are important in determining the impact of new IOL designs. The results of this study indicate that the improvement obtained with IOLs that aim for the complete correction of LSA and LCA is clinically significant without sacrificing DOF.

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