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Poster Abstracts
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Analysis of spherical and chromatic aberration correction in the eye using hybrid (refractive–diffractive) contact lenses

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Purpose: This study aimed to evaluate the simultaneous correction of spherical and chromatic aberrations in hyperopic eyes using hybrid contact lenses that combined refractive and diffractive optical elements.
Method: The Bruce H. Walker eye model was used to simulate a +5.00 diopter (D) hyperopic eye with the Optics Software for Layout and Optimization (OSLO EDU). System optimization was carried out through the generation of error functions based on the ray operators AXIS_EOPD = 0 and AXIS_EDMD = 0, which were designed to minimize spherical and longitudinal chromatic aberrations. The degrees of freedom in the optimization were the conic constant (k) of the anterior lens surface and the diffractive phase coefficients (DF1 and DF2) corresponding to the diffractive optical element located on the same surface. Several combinations of these parameters were evaluated.
Results: The analysis was restricted to on-axis object points. In the first configuration (k = –2.662134, DF1 = –0.001192), the polychromatic point spread function (PSF) value was 0.06177, calculated via fast Fourier transform (FFT). In the second configuration (k = –2.583914, DF2 = –0.000288), the PSF was 0.7256. In the third configuration (k = 0, DF1 = 0.01098, DF2 = –0.002956), the PSF decreased to 0.01291.
Conclusions: The results indicated that simultaneous correction of spherical and chromatic aberrations could be achieved using hybrid refractive–diffractive contact lenses. The most effective configuration involved the conic constant of the anterior lens surface combined with the fourth-order diffractive phase coefficient. The observed PSF deviation of 0.0744 from a diffraction-limited system was attributed to residual chromatic aberration across different pupil heights, as evidenced by the optical path difference (OPD) curves.

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