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*This Article*

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## Spherical Aberration May Slightly Improve Retinal Image Quality In The Presence Of Intraocular Scatter

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### Abstract

**Purpose:** Both spherical aberration and intraocular scatter tends to increase during normal aging. We investigate here if small amounts of spherical aberration (SA), in combination with defocus, could improve the contrast of retinal images in the presence of elevated intraocular scatter.

**Methods:** We measured first the contrast in the images produced by an artificial eye with variable amounts of SA, defocus and scatter. SA was introduced by using aspheric phase plates and scatter with an electro-optical device of polymer dispersed liquid crystal. Contrast was measured for a number of combinations of those three conditions. In a second experiment, we measured in three normal subjects, contrast sensitivity at 6 cycles/degree for two different values of SA (cancelled and that corresponding to an average older subject) and a number of induced scattering levels, by placing the liquid crystal device in front of the eye. The scatter conditions ranged from normal small scatter to a level of scatter approximately similar to that present in older eyes.

**Results:** In the artificial eye, we found some particular combinations of SA and defocus that improved contrast in the image for high levels of scattering. That is to say, we were able to produce images with a higher contrast when some aberrations were induced in comparison to the case of images obtained with lower aberrations. It must be noted that this was a small effect with relative increments in contrast nor larger than 7%. In the case of the real eyes, we also found some increment of the contrast sensitivity in the presence of scatter when SA was induced. However, this situation was not repeated in every tested subject, perhaps due to the combined effect of other aberrations together with SA.

**Conclusions:** We demonstrated that in an artificial eye, in the presence of scatter, some combination of

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defocus and SA may improve the contrast in the image. In some subjects, contrast sensitivity also increased when SA was added. These results may suggest a possible compensatory mechanism to alleviate the degrading effect of an increasing scatter. Although the increase in contrast was small, one could speculate that a larger amount of ocular SA with age could contribute to reduce the degrading effect of a higher intraocular scattering in the aging eye.

**Keywords:** aging: visual performance • optical properties



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