

# Letter to the editor

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## Dear editor

We read with interest the article entitled ‘Population spherical aberration: associations with ametropia, age, corneal curvature, and image quality’ by Kingston and Cox.<sup>1</sup> The authors provided higher order aberrations data for a sample of 1,124 eyes and performed correlation analyses to compare higher order aberrations with refraction and biometry data, such as spherical equivalent power and corneal curvature. Special attention was drawn to spherical aberration.

We agree with the authors’ statement that large scale studies are important. It is essential for future authors to have benchmark data to allow for comparisons.

Kingston and Cox based their analysis on two citations that found the spherical aberration coefficient to be the only higher order aberration coefficient that is significantly different from zero. They found that spherical aberration coefficient was correlated significantly with age, but not with refraction.

We would like to draw the attention of the authors to our paper,<sup>2</sup> which provided higher order aberration data of 24,604 subjects (49,208 eyes). We found that all third and fourth order aberration coefficients were significantly different from zero, that most of them were significantly different between myopes and hyperopes, and that correlations of most of the coefficients with refraction were significant, although nearly all were weak ( $R^2 < 0.02$ ). Spherical aberration coefficient showed the highest correlation with refraction. In a multivariate correlation, refraction explained 8% of the variation of spherical aberration coefficient, with the coefficient becoming more positive/less negative as refraction became more positive/less negative.

Similar to Kingston and Cox, we found spherical aberration to increase significantly with age, although we had to use near addition as a proxy for age.

## References

1. Kingston AC, Cox IG. Population spherical aberration: associations with ametropia, age, corneal curvature, and image quality. *Clin Ophthalmol*. 2013;7:933–938.
2. Hartwig A, Atchison DA. Analysis of higher-order aberrations in a large clinical population. *Invest Ophthalmol Vis Sci*. 2012;53(12):7862–7870.

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## Author's reply

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## Dear editor

We would like to thank Atchison and Hartwig for guiding us to their recently published study reporting the higher order aberrations in a large clinical population. We apologize for the oversight of not including this large population study as a reference when stating that only a few studies have currently been conducted on a large scale, and few under a single protocol. Their study is comprehensive and with an analyzed sample size of over 24,000 eyes, and a total population of over 40,000 eyes, it most definitely is the largest study reported in the literature.

The purpose of our study was to focus on the impact and relationships associated with spherical aberration, for two reasons: firstly, that it is the largest magnitude wavefront aberration term seen in our data across our population sample following defocus and astigmatism, and secondly, and just as importantly, as a rotationally symmetrical aberration it is

the most probable higher order wavefront aberration to be corrected using commercially available soft contact lenses and intraocular lenses.

Atchison and Hartwig point out that they found all third and fourth order wavefront aberration terms to be statistically significantly different from zero, something that we also found in our population. However, since this statistical difference of the population mean from zero was driven in part by the large sample sizes in both studies, and since the reported level of clinically meaningful differences for coma and trefoil were larger than those found in our population study,<sup>1</sup> we chose to investigate the impact and relationships with spherical aberration only. In regard to the reported differences in the relationship between spherical aberration and the population, again, it would seem that the statistical significance is driven by sample size and age of the overall populations reported. To that end, while Atchison and Hartwig did indeed find a statistically significant relationship between spherical aberration and refraction, they admit that the relationship is weak and only accounts for 8% of the spherical aberration, demonstrating the often conflicting results between statistically and clinically relevant significance that large sample data sets such as theirs and ours can generate.

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## Reference

1. Atchison DA, Guo H. Subjective blur limits for higher order aberrations. *Optom Vis Sci.* 2010;87(11):E890–E898.

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