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EC OPHTHALMOLOGY
Editorial

Vision with Higher Order Aberrations

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Received: March 24, 2022; **Published:** March 30, 2022

Optics of human eye is complex. Due to various types of aberrations such as monochromatic aberrations, lower and higher order aberrations, our eyes never make an image of any object exactly same with the object. Even correction of these aberrations is not enough to make an image exactly same with the object because of our pupil which affect the image quality due to diffraction.

Conventional glasses and contact lenses can compensate lower-order aberrations like defocus and astigmatism. Almost all the eyes without any disease or other problems, can have visual acuity of 6/6 with the correction of lower order aberrations that is myopia, hyperopia and astigmatism; because about 85% of the aberrations found in eyes are lower-order aberrations. Studies found that correction of higher order aberrations can improve visual performance including visual acuity and everyday activities [1]. However, majority of these studies are of small sample size and their findings are not consistent about the improvement of vision quality with higher-order aberrations correction. There is another school of thought, correction of higher-order aberrations may deteriorate visual performance with changing the depth of focus. So, more studies are necessary to support any of these hypotheses.

Not only the central visual quality, but peripheral retinal image quality is also important for the overall visual performance as peripheral vision is also important for many activities. It has been believed that peripheral refraction has association with central refractive error development. Studies found that higher-order aberrations affect accommodation both at the central and peripheral retina [2]. So, besides the correction of central aberrations, it is necessary to correct the peripheral aberrations which makes it more complicated to design the optical devices free of aberrations.

Conventional contact lenses are found to increase higher order aberrations; however, wave-front guided speciality contact lenses are able to reduce some amount of higher order aberrations in the central retina [3]. This indicates that it is possible to design spectacles or contact lenses to correct higher-order aberrations. But it is very challenging to make spectacle lenses or contact lenses to correct central and peripheral higher-order aberration without compromising lower-order aberration correction. Because of the contact lens movement and rotation, particularly in toric lenses, it is tricky.

So, it can be concluded that in the near future people can get super visual acuity with higher-order aberrations correction in the central and peripheral field of view. As lower-order aberrations affect more on the retinal image quality, it should not be compromised on the lower-order aberrations when correcting the higher order aberrations.

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Volume 13 Issue 4 April 2022