Comparison of Accuracy and Reproducibility of Ophthonix, Alcon, and VISX Wavefront Aberrometers as Measured in Model Eyes

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Abstract

Purpose: To assess and compare the accuracy and reproducibility of a new diffractive grating based wavefront aberrometer against two commercial Hartmann–Shack type wavefront aberrometers.

Methods: A binocular wavefront aberrometer (Z–View™, Ophthonix, Inc., San Diego, CA) has recently been developed for use in the dispensing of wavefront guided eyeglasses and contact lenses. The instrument utilizes a novel low–cost wavefront sensor based on a self imaging diffractive element. The performance of this new diagnostic aberrometer was compared to two Hartmann–Shack type wavefront aberrometers that have been developed for wavefront guided LASIK applications (LADARVision®, Alcon, Ft. Worth, TX; WaveScan™, VISX, Santa Clara, CA). Each of the three wavefront aberrometers was used to repeatedly (n=5) measure wavefront aberrations in four model eyes that were supplied by a third party and contained a fixed but masked amount of third to sixth order aberrations. The RMS error between the actual aberrations and the measured aberrations was calculated for each model eye and aberrometer. A fifth model eye with an adjustable simulated retina was used on all three aberrometers to determine the linearity of low order aberration measurements for a refractive error of between –8D and +12D.

Results: The average RMS errors of the third to sixth order measurements over all four test eyes for the Ophthonix, Alcon, and VISX aberrometers were 0.22, 0.55, and 0.28 microns, respectively. The standard deviations of repeated measurements of high order aberrations for the Ophthonix, Alcon, and VISX aberrometers were .004, .011, and .006 microns, respectively. For the spherical refractive error measurement of model eye #5, all three tested aberrometers showed excellent correlation to the predicted values of defocus (R^2>.998).

Conclusions: The Z–View aberrometer shows excellent accuracy and reproducibility of high order aberration measurements as determined in model eyes. Its performance is comparable to existing high–end surgery–based instruments on the market.