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Abstract Title: **Effect of Adaptive-Optics-Corrected Ocular Aberrations on Visual Acuity as a Function of Luminance and Polarity**
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Purpose: To investigate the effect of correcting ocular aberrations on visual acuity (VA), both for white-on-black (WoB) and black-on-white (BoW) letters at various luminances. To assess the relative contribution of optical and neural factors to the visual acuity measured in those conditions.

Methods: We measured VA with natural aberrations and under static aberration correction with adaptive optics (AO). The custom-made instrument included a Hartmann-Shack wavefront sensor, a magnetic deformable mirror with 52 actuators (MIRAO, Imagine Eyes), a motorized Badal system, a pupil monitoring CCD, and a high brightness minidisplay. VA was measured using a four alternative choice procedure with tumbling Snellen E letters (Quest algorithm with 50 trials presented during 0.5 s, programmed in Psychtoolbox). VA was measured as a function of luminance (0.8, 1.6, 2.5, 5, 16, 25 and 50 cd/m²), starting with the dimmest test, and allowing for adaptation. Three conditions were measured: WoB letters under natural conditions, WoB and BoW letters under dilation and 6-mm artificial pupils. For each luminance and polarity condition, VA was measured with/without the subject's aberrations in random order. Pupil size, centration and aberrations were continuously assessed. Four subjects (age: 29.5±4.4 years; spherical error: -3.00±2.05D; cylinder<0.5 D) were tested.

Results: 1) Mean RMS wavefront error was 0.673±0.120, corrected down to 0.178±0.027 (up to 85% correction). 2) Except for one eye (with the lowest amount of natural aberrations), VA increased significantly with AO correction for all luminance and polarity conditions, by a factor of 1.23 on average. 3) BoW VA increased consistently with luminance, with and without AO correction; WoB tended to show an inverted "U" behavior with luminance, becoming flatter with AO correction (both for dilated and natural pupils). 4) For intermediate luminances WoB VA was higher than BoW, but the difference decreased with AO correction. 5) For both polarities, the largest VA increase with OA correction occurred at the lowest luminances. For intermediate and high luminances, the AO VA improvement was higher for BoW than WoB letters.

Conclusions: 1) In most eyes, correction of ocular aberrations resulted in a significant increase of VA at all luminance and polarity levels. 2) Ocular aberrations play a role in the differences of VA with polarity. 3) The relative change of VA with luminance is primarily determined by neural factors.

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