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An expanded nystagmus acuity function: intra- and intersubject prediction of best-correctedvisual acuity.

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Abstract

The Nystagmus Acuity Function (NAF) provides an objective measurement of the foveation characteristics of nystagmuswaveforms and an assessment of potential visual acuity for subjects with congenital (CN) or latent/manifest latent (LMLN)nystagmus. It is based on the subjects' ability to maintain fixation within a physiologically based 'foveation window' of +/- 0.5 degrees and +/- 4.0 degrees/s. However, some subjects are incapable of controlling fixation well enough to remain within this window with duration sufficient for good foveation. To obtain a measure of the CN waveforms of these individuals, we are proposing an eXpanded Nystagmus Acuity Function (NAFX) that relaxes either the position limit, the velocity limit, or both. Data used in this study comes from 11 human subjects with CN (10 idiopathic and 1 with achiasma) and a Belgian sheepdog with achiasma. Visual acuity was tested with a standard Snellen chart and eye movements recorded with infrared oculography or scleral search coil. For the NAFX to be useful, it must not only be applicable for subjects who cannot maintain fixation within the standard limits of the NAF, but also must yield results equivalent to those obtained with the NAF when testing subjects who are capable of maintaining good fixation control. For the latter subjects, the amount of time when position and velocity fell within theexpanded limits was measured, the standard deviations of the position and velocity during these times were calculated, and a tau-surface for the exponential function was generated to guarantee the equivalence between the NAF and the NAFX. We developed an automated NAFX equivalent to the original NAF. We demonstrated that equivalence in 10 subjects and the use of the NAFX on two additional (1 human and 1 canine) subjects who were incapable of maintaining fixation within the standard position and velocity limits. We demonstrated the effects of surgery and related the results to visual acuity. We found the results to be comparable to those seen when applying the NAF to subjects who had good fixation control. The NAFX can be determined for CN and LMLN subjects with poor control of fixation by extending the standard NAF position and/or velocity limits for foveation. The resulting function can be used along with the longest foveation domain (derived from the NAFX to measure breadth of a high-NAFX region) to identify the gaze or convergence angles with the best waveform and to predict the best-possible visual acuity that could be achieved with the reduction of their nystagmus.