Structural and functional effects of anisometropic amblyopia on ganglion cell development

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BACKGROUND

• Amblyopia is the unilateral or bilateral loss or underdevelopment of visual acuity, which is not accounted for by clinically presenting anatomic defects of the eye or visual pathways.

• Two major causes of amblyopia are strabismus and anisometropia, existing during the period of visual development in early life.

• Researchers have recently investigated anatomical changes in the retina following diagnosis of amblyopia, in particular through the assessment of retinal nerve fiber layer (RNFL) thickness using optical coherence tomography (OCT). Although some studies report significant RNFL thickness differences between amblyopic and fellow eyes, others do not.

• There is a dearth of research studying retinal functional changes in the case of amblyopia. Electroretinography (ERG) is a well-recognized mode of detecting functional abnormalities of retinal cells independent of the responses of the visual pathway and cortex. The ERG provides the photopic negative response wave (PhNR), which has been found to reflect retinal ganglion cell activity.

• PhNR amplitude may be a good functional correlate to assess, given the uncertainty in the literature regarding RNFL thickness changes in amblyopes. If the RNFL is indeed thicker in anisometropic amblyopes—suggesting an increased cell count, it would be logical to hypothesize that the PhNR amplitude would be larger in the ERG of the affected eye.

• In this study, we investigate the role of retinal structural and functional correlates in strabismic and anisometropic amblyopia in adults and children.

METHODS

• 16 adults and 6 children with strabismic (n=11) or anisometropic (n=11) amblyopia were examined. Clinical examination included best corrected visual acuity, refractive error, slit lamp exam, anterior segment exam, strabismic evaluation and IOP. RNFL was measured in the peripapillary region with the SLO/OCT (Optos Inc), using an average of 3 circular scans of 3.4 mm diameter. PhNR was recorded using brief 4 msec flashes of 640 nm wavelength at 5 cd·s/m² over a rod-adapting background (470 nm) at 10 cd/m². ERGs were recorded with DTL-Plus™ electrodes using Espion e2 (Diagnosys LLC) with a 0.3 – 300 Hz bandpass and 50 sweeps of 150 msec duration were averaged. The peak latency and amplitude of the PhNR were compared between the amblyopic and unaffected eyes in each of anisometropic and strabismic amblyopic eyes. Also, means of RNFL and PhNR were compared between the amblyopic and fellow eyes.

• Regression analysis was performed to determine correlation between RNFL and PhNR in strabismic and anisometropic amblyopic eyes.

• This study was approved by the Ottawa Health Science Network Research Ethics Board (OHSN-REB).

REFERENCES