The relationship between peripheral refraction and retinal electrophysiology

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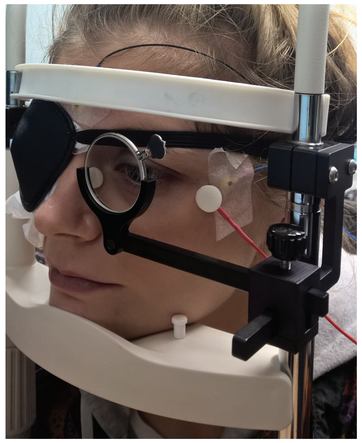
Background

Understanding how the retina detects and responds to optical blur may improve current myopia control technologies.

Previous multifocal electroretinography (mfERG) experiments have shown that the **peripheral retina responds differently to positive or negative defocus induced with spectacle lenses.**

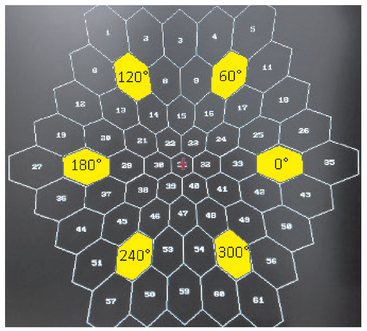


However, the magnitude of defocus achieved at these peripheral regions was not be directly measured during these experiments.

Aim

To measure the relationship between peripheral refraction and retinal electrophysiology within individual retinas.

Methods



Following cycloplegia, peripheral refraction and retinal electrophysiology was measured from the left eye at six equidistant retinal locations. To create optical blur, foveal refractive error and working distance were left corrected (n = 20 participants).

***Figure 1**: Corresponding retinal location of the six peripheral refraction measurements within a 61-hexagon mfERG stimulus.*

Peripheral refraction

Peripheral refraction measurements were converted to their vector components (MSE range = -5.13D to +2.00D). There was no difference between relative MSE refraction and retinal position

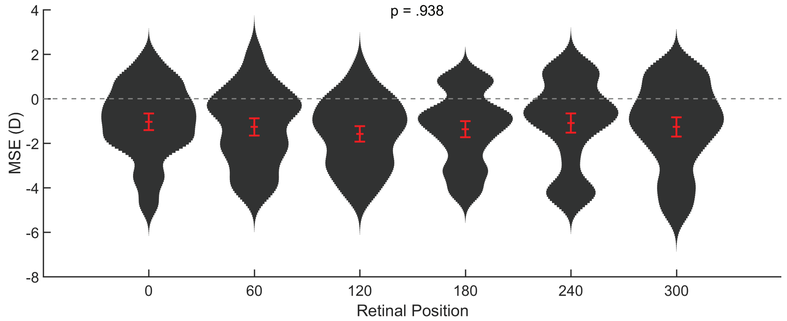


***Figure 2:** Distribution of MSE measurements across each of the six retinal locations (n = 20 participants).*

Multifocal electroretinography (mfERG)

The P1 and N2 components of the mfERG waveform were calculated for each of the six retinal locations.

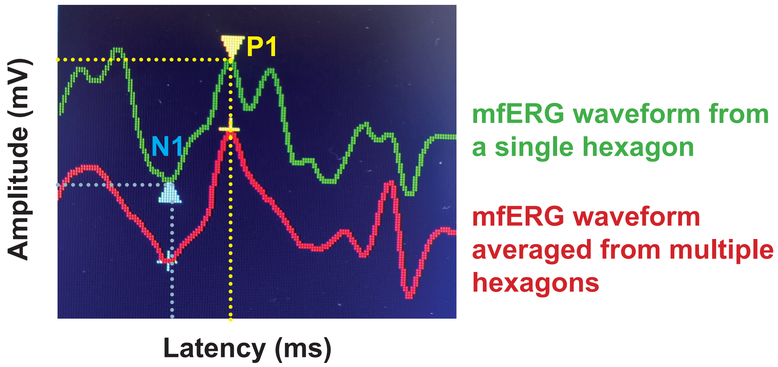


***Figure 3**: Example mfERG waveform measured from single or multiple hexagons located equidistant from the fovea.*

Retinal electrophysiology vs peripheral refraction

The MSE was significantly correlated with both the P-wave amplitude and the N-wave latency.

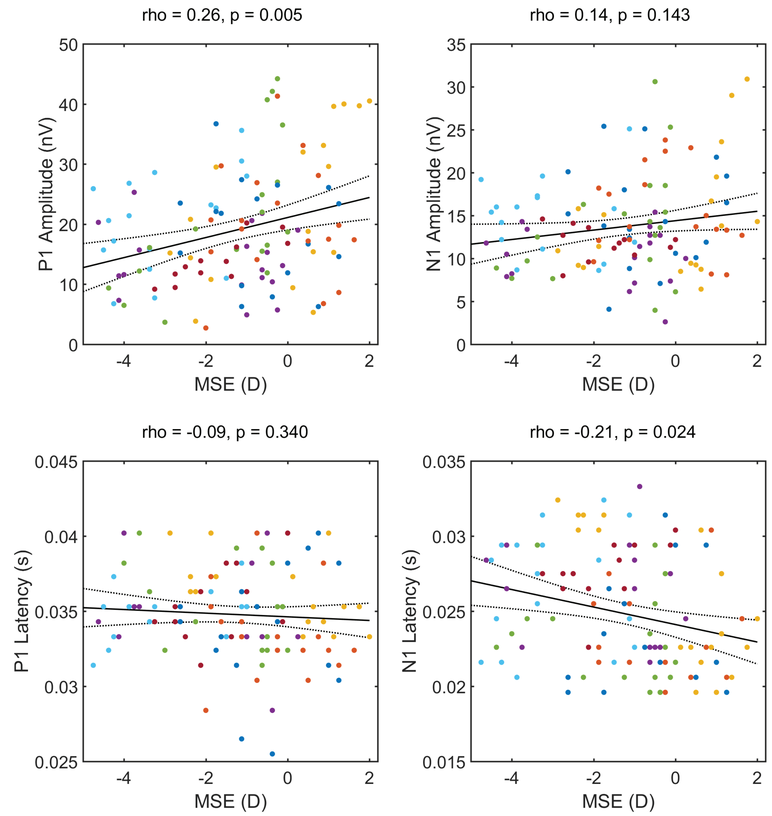


***Figure 4:** Correlation between mean spherical error and mfERG components (n = 20 participants, 6 points per participant).*

Conclusions

Within an eye, the local retinal response correlates with the magnitude of spherical defocus. Higher P1 amplitudes and longer N1 latencies are observed under positive compared to negative defocus. Peripheral refraction measurements are important for studying defocus detection at these non-foveal locations.