

Threshold versus intensity functions in two-color perimetry

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Purpose

To determine the adaptational state and isolation of rod- and cone-mechanisms in two-color perimetry, a technique developed for assessing visual function in inherited retinal disease.

Methods

Seven normal subjects (aged 16-46yr), were examined using a MonCV Perimeter (MetroVision, Paris, France). Visual field tests were undertaken under scotopic conditions and then from $-1.5 \log \text{cd.m}^{-2}$ (0.2 log td) to $2 \log \text{cd.m}^{-2}$ (3.7 log td; white background) in 0.5 log unit steps. Sensitivities were determined using a 4-2-2 dB staircase for 480nm and 640nm Goldmann size V targets at 17 locations within the central 60 degrees. Data were fitted with tvi functions of the form $\log T = \log T_0 + \log ((A+A_0)/A_0)$, where T is threshold, T_0 is absolute threshold, A is background intensity and A_0 is the 'dark-light' constant.

Results

The minimum value for cone T_0 was at the fovea ($-1.7 \log \text{td}$, 640nm stimulus) and for rod T_0 at $\pm 9, \pm 9$ ($-4.2 \log \text{td}$, 480 nm stimulus). Cone A_0 was lowest at the fovea (1.0 log td) whilst rod A_0 was lowest at $\pm 9, \pm 9$ ($-0.70 \log \text{td}$). No clear rod-cone break was

observed for 640nm stimuli at any stimulus location. For 480nm stimuli at all test locations, there was evidence of transition from rod-detection to cone-detection at mesopic illumination levels. Detection mechanisms did not display Weber behaviour until the background luminance approached $1 \log \text{ cd.m}^{-2} / 2.7 \log \text{ td}$ (see Figures 1 and 2).

Conclusions

640nm targets are primarily detected by cones at all intensities; 480nm targets, however, are detected by rods until mesopic illumination levels are reached. These data are in keeping with spectral sensitivity estimates at fixed background intensities (Simunovic MP *et al.*.TVST. 2016;5(3):10). Two-color perimetric tvi functions do not display Weber-like behaviour until photopic illumination levels are reached ($1 \log \text{ cd.m}^{-2} / 2.7 \log \text{ td}$). These findings suggest that two-color perimetry will be vulnerable to perturbations in ocular media and pupil size under clinical conditions, where background intensities are fixed.

Average fovea



