



June 2022
Volume 63, Issue 7
ISSUE

OPEN ACCESS

ARVO Annual Meeting Abstract | June 2022

Assessment of flickering chromatic pupillometry in patients with risk of glaucoma

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Investigative Ophthalmology & Visual Science June 2022, Vol.63, 127 – A0289. doi:

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Abstract

Purpose : Chromatic pupillometry is increasingly used for assessing human retinal function through measurements of pupil responses to different colored light stimuli. The discovery of intrinsically photosensitive retinal ganglion cells (ipRGCs) adds a new dimension to the detection and monitoring of retinal and optic nerve disorders, including open-angle glaucoma (OAG) through pupillometry. However, the detection of pre-perimetric glaucomatous deficits still remains a challenge. We hypothesize that early damage in OAG risk could be reflected in affected flickering pupil responses.

Methods : All participants underwent ophthalmological assessments and were classified in healthy controls (HG) and OAG risk patients (GR). The GR group was characterized with high intraocular pressure and/or a family history of OAG with no pre-existing OAG; assessed by OCT and ERG. Pupillary recordings were obtained using a lab-made photostimulator-pupillometer system with monochromatic stimuli of blue (468 nm), green (516 nm), and red (632 nm). Flickering sinusoidal stimuli of 1Hz frequency and 10s duration were presented in an integrating sphere-like dome with a Lambertian inner surface at two modulation levels: 100% and 70%. Each participant was monocularly tested and was light-adapted to the mean chromaticity during 60 s., previous to the stimulus onset. In the frequency domain, amplitude (mm) and phase (degrees) parameters were assessed. In the temporal domain (% initial diameter), initial constriction, and post pulse plateau parameters were evaluated.

Results : The amplitude was significantly reduced ($p<0.05$) in GR group for green (100%), red (100%), and red (70%). The phase was significantly reduced ($p<0.05$) in the GR group for blue (100%), green (100%), red (100%), blue (70%), and green (70%). The Initial Constriction was higher ($p<0.01$) in the HC group for blue (100%), green (100%), red (100%), and red (70%) with respect to the GR group. No significant differences were found for the post pulse response parameter.

Conclusions : We found differences in transient pupil responses between healthy control and glaucoma risk groups, especially for high-modulation red and green stimuli. These results suggest that flickering chromatic pupillometry can reveal early changes in patients with potential OAG, not detected by other clinical methods. Furthermore, early signs of OAG might contain detriments in cone afferences to ipRGCs.