Functional Correlates of Intrinsically Photosensitive Retinal Ganglion Cells Among Individuals Exposed To Cocaine

Rima Patel, MD,[1,2] Adnaan Zaffer, BS,[1,2] Alma Ramic, MD,[1] Bruce I. Gaynes, OD, PharmD[1,2]

1. Edward Hines Jr. VA Medical Center

2. Loyola University Medical Center Department of Ophthalmology

Introduction

- Intrinsically photosensitive retinal ganglion cells (ipRGC's) are considered to be a subset of retinal ganglion cells that are inherently photosensitive and provide a function in entrainment of the circadian clock[1].
- Previous studies have documented the maximum absorption wavelength by which human ipRGC's are sensitive, thus allowing for evaluation of ipRGC function by study of pupil responses to various forms of light stimuli[2].
- Understanding that ipRGC action mediates circadian rhythm[1], it is posited that known sleep abnormalities found among cocaine users is related to abnormality in ipRGC function.

Purpose

The purpose of this study is to assess ipRGC function among individuals with recent or concurrent cocaine exposure.

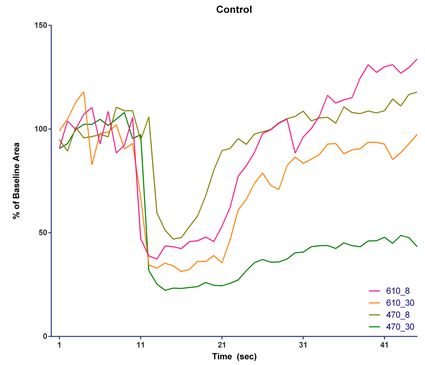
Methods

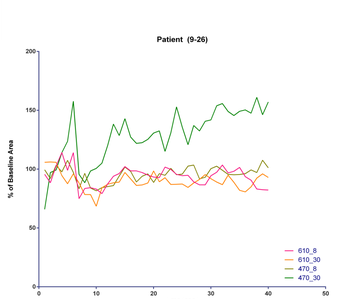
- After pupillary dilation, the consensual pupillary response was measured in the contralateral eye following 5-second stimulation in the dilated eye with 610nm and 470nm illumination at both 8 and 30 µW energy levels.
- The integrity of the ipRGC's was verified by the finding of a marked photopotentiation effect and prolongation of pupillary constriction following stimulation of the consensual eye with 30µW 470 nm light.

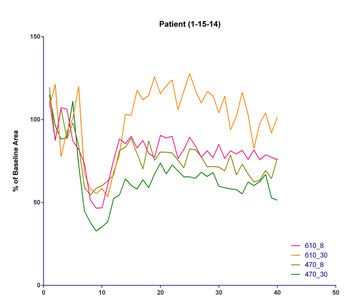
Results

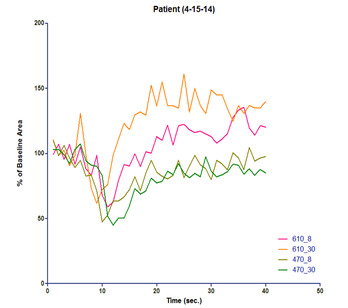
- 10 subjects and 1 control were enrolled for study.
- At 30 seconds post stimulus, our control patient's pupil size following 470 nm at 30 µW was 43.37%, while pupil size at the 30 second off response for the 470 nm 8 µW, 610 8 µW and 610 30 µW levels were 117.84, 133.79 and 97.44% of baseline pupil size, respectively. This constitutes normal pupillary behavior.
- At 30 seconds post stimulus, our patient's pupil size following 470 nm at 30 µW was 99.07%, while pupil size at the 30 second off response for the 470 nm 8 µW, 610 8 µW and 610 30 µW levels were 94.10, 111.97 and 89.81 % of baseline pupil size, respectively.

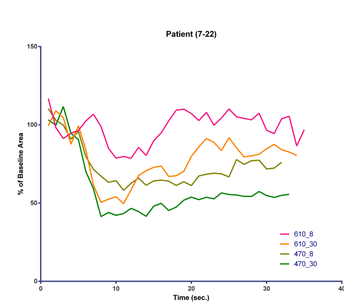
Graphs

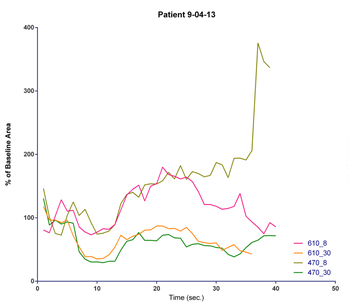


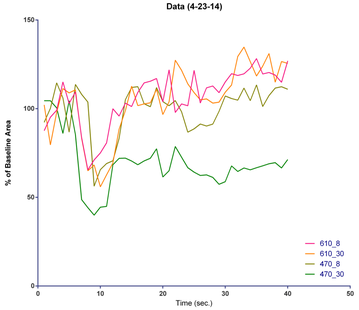












Conclusion

- Pupillary response appears abnormal among patients with history of cocaine exposure.
- The extent of abnormality is demonstrated by frank loss of ipRGC function as well as atypical pupil response to 610 nm chromatic stimulation at both 8 and 30 uW energy levels.
- Abnormal ipRGC function in this cohort may be related to alteration in retinal dopaminergic sensitivity due to cocaine exposure or as a consequence of withdrawal.
- Future study is planned to examine the correlation between degree of ipRGC abnormality and character of sleep disturbance.

References

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•2.Mcdougal, David H., and Paul D. Gamlin. "The Influence of Intrinsically-photosensitive Retinal Ganglion Cells on the Spectral Sensitivity and Response Dynamics of the Human Pupillary Light Reflex." Vision Research 50, no. 1 (2010): 72-87.