Alterations in Retinal Blood Flow Autoregulation in Human Subjects with Early Glaucoma as measured with Laser Speckle Imaging

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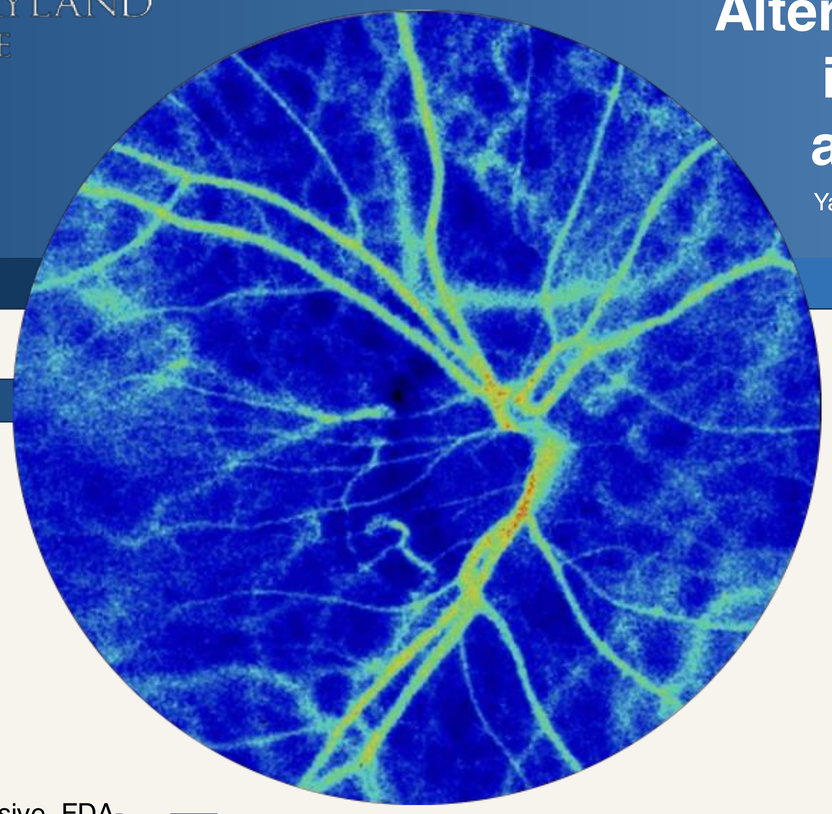

1 Introduction

Glaucoma is one of the leading causes of permanent vision loss, with 80 million people suffering from it worldwide. Early detection and intervention are critical to vision retention, but diagnosis typically occurs after onset of vision loss. Risk factors include hypertension, diabetes, old age, and more.

The XyCAM RI is a minimally-invasive, FDA-approved device that uses laser speckle contrast imaging to visualize and obtain ocular blood flow metrics. Dynamics of ocular blood flow are shown to be altered in glaucoma and may have clinical utility as an early biomarker for glaucoma.

2 Objective

The objective of this research study is to evaluate the ability of ocular blood flow metrics to differentiate between eyes with glaucoma and eyes without glaucoma using the XyCAM RI. We do so by assessing the change in retinal blood flow at baseline and under conditions of induced hyperoxia in a cohort of controls, preperimetric glaucoma (PPG) subjects, and early primary open angle glaucoma (POAG) subjects.

References

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3 Materials and Methods

Our recruitment groups were divided into the following categories:

A	Primary Open-Angle Glaucoma	50 subjects Mild POAG in at least one eye 64% enrolled High Myope subgroup
B	Pre-Perimetric Glaucoma (PPG)	50 subjects PPG in at least one eye 12% enrolled High Myope subgroup
C	Control	50 subjects No glaucoma in either eye 20% enrolled High Myope subgroup

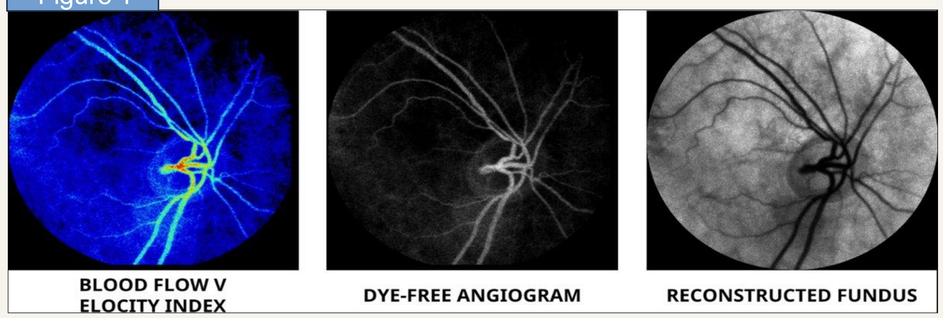
Participants were recruited from the UMSOM Redwood Clinic and categorized into control, pre-perimetric glaucoma, and mild glaucoma as per Hodapp-Parrish-Anderson criteria.

Sequential imaging was obtained with the XyCAM RI at baseline and induced-hyperoxia. Blood flow velocity index (BFVi) metrics were recorded for each patient in each state and were calculated in the optic disc, optic disc vessels and fundus.

Our statistical analysis of the data included paired t-test of BFVI metrics at baseline and hyperoxia. We also conducted unpaired t-tests between our three recruitment groups: control, PPG, and mild POAG subjects.

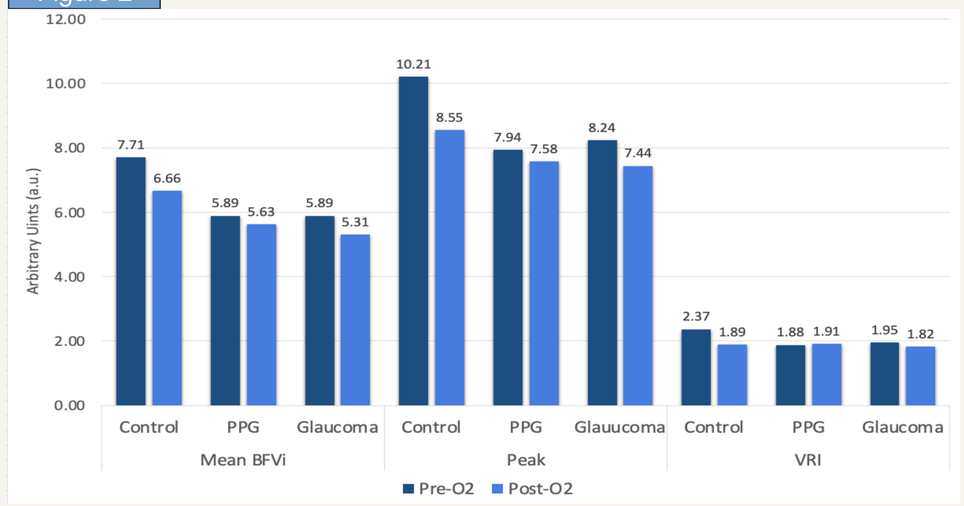
4 Results

Figure 1



81 eyes of 41 subjects were recruited, including 51 eyes of 26 subjects with mild POAG, 12 eyes of 6 subjects with PPG, and 18 eyes of 9 control subjects. 78% of the subjects were female and the average age was 61.0 ± 10.9 years. Control subjects showed a decrease in mean BFVi from 7.7 ± 1.9 a.u. at baseline to 6.7 ± 1.6 a.u. in hyperoxia (p = 0.01), along with reductions in peak (8.2 ± 1.6 a.u. baseline to 7.4 ± 1.3 a.u. hyperoxia, p = 0.01). PPG subjects had no significant change in BFVi metrics between baseline and hyperoxia. Mild glaucoma subjects showed a significant (p = 0.01) decrease in the peak BFVi from 8.2 ± 1.6 a.u. at baseline to 7.4 ± 1.3 a.u. in hyperoxia.

Figure 2



5 Conclusion

Early POAG subjects only had a 9.8% decrease in peak BFVi. The reduced vasoreactivity observed here may be related to impaired autoregulation of blood flow in glaucoma subjects. Further recruitment will allow for improved power to compare the magnitude of change in retinal BFVi metrics across subgroups.

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