Investigating the Effects of Lutein on Retinal Cytoarchitecture in Age-Related Macular Degeneration

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Purpose: Age-related macular degeneration (AMD), a devastating neurodegenerative eye disease leading to total blindness, affects 200 million people worldwide. The project focused on identifying underlying mechanisms of AMD and sought to answer the following: 1) does A2E cause retinal cell death leading to reduced visual acuity? and 2) will lutein protect retinal cells from possible A2E damage thus protecting visual acuity? The carotenoid, lutein, was examined, hypothesizing that it would prove effective at protecting the retina. Procedure: A baseline vision test was performed on each zebrafish using a standard acuity assessment method using optokinetic response (OKR). Eyes were then injected with A2E or an A2E+lutein combination. Vision was re-tested and compared to baseline. Fish were euthanized and eyes were harvested for testing. Eyes were fixed, embedded, and sectioned for imaging. Stained samples were inspected using both bright field and fluorescence microscopy. Results: Visual acuity data followed similar patterns to past research, reinforcing that A2E leads to reduced visual acuity and lutein preserves vision. Histological analysis data showed that lutein protected INL cells. A2E-treated cells experienced a 40% decrease in cell density, whereas A2E+lutein-treated cells saw a 15% drop. The OKR and histological results both indicate that lutein protected the cells from oxidative damage and enhanced visual function. Conclusions: This research demonstrates that for the first time, lutein can protect retinal cells in an in-vivo setting using an AMD model. Human clinical trials that test ocular carotenoid injections should be considered. The development of AMD therapeutic and preventative treatments would help millions worldwide–including my grandmother.

Awards Won: