Detection of Acquired Tritan Deficiency in Glaucoma

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Abstract:

**Purpose:** Tritan color deficiency has been identified as an early sign of glaucoma and other eye diseases. While most color tests are designed to disclose hereditary red-green deficiency, few offer metrics to quantify sensitivity of the blue (S) cone pathway. Our purpose was to assess the efficacy of the Moreland Anomaloscope (MA) and S cone contrast test (SCCT) for detection of acquired tritan deficiency in glaucoma.

**Methods:** The MA (Oculus HMC and Interzeag) presents a split circular field with a mixture of deep blue & blue-green on one side which are mixed in proportion to appear perceptually matched to an adjacent intermediate blue. Tritan deficiency is revealed by a need for increased deep blue light to achieve the Moreland match, with match midpoint and range indicative of the severity of the deficiency. The computer-based CCT presents a series of red, green and violet letters visible only to L, M or S cones in decreasing steps of cone contrast to determine L, M and S cone letter recognition thresholds.

Retrospective analysis of USAF aircrew diagnosed with glaucoma or ocular hypertension, based on glaucomatous visual field and optic nerve defect(s) and/or two separate IOPs > 21mmHg, was conducted to compare MA and SCCT scores obtained during vision exams. Exclusion criteria included other ocular pathology, pseudophakia, history of eye trauma or surgery, or other disease. Mean scores were obtained from visually normal observers (MA n=94; SCCT n=1,397) and subjects were considered outside normal limits if >2SD from the mean.

**Results:** MA and SCCT scores were obtained from 211 eyes of 111 subjects. MA matching midpoints shifted significantly (>2SD) in the blue (tritan) direction and/or expanded matching ranges were detected in 19 of 211 eyes (9%). SCCT scores >2SD below normal were detected in 31 of 211 eyes (15%). Agreement between MA and SCCT for detection of tritan deficiency was low with only 3% of eyes showing a tritan defect on both tests. Average retinal nerve fiber layer (RNFL) thickness in subjects who failed the SCCT (86.6 u) was less than the RNFL in subjects who passed (94.1u; p<0.05); while RNFL in subjects who failed the MA (93.9u) vs. subjects who passed (92.9u) were not significantly different (p>0.8).

**Conclusions:** Both the MA and SCCT quantify sensitivity of the S cone pathway but differ in type of task; the MA uses suprathreshold color matching while the SCCT uses cone specific letter recognition. The threshold nature of the SCCT may offer greater sensitivity for detection of acquired color loss in glaucoma and other diseases.