



**DEVELOPMENT OF A NOVEL PROTOCOL USING THE INTUITIVE
COLORIMETER TO TEST THE EFFECTS OF COLOR ON PHOTOPHOBIA**

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Background

Close to 80% of migraine patients have been reported to be sensitive to light (Digre, Brennan et al., 2013), but prior work focuses only on the effects of white light, and little work has focused on the impact of color (Elliot et al., 2015). Colors exist in three dimensions: hue (color), saturation (depth or strength of color) and brightness. The Intuitive Colorimeter was developed to allow identification of custom-colored lenses to treat visual stress and enables a precise ophthalmic tint to be efficiently chosen in these three dimensions, according to a patient's subjective assessment of its effects on visual perception and comfort. Our goal was to adapt the Intuitive Colorimeter testing to investigate the effects of hue and saturation changes on light sensitivity in migraine and other headache disorders.

Methods

For each trial, we begin by having the participant position their eyes in front of a square opening in the box frame of the colorimeter machine, while looking at a custom-developed Colorimeter Testing Scale (CTS) placed within the center of the box. The brightness levels are held constant throughout the duration of the test, while we vary the hue dial for angles 0-360 and the saturation modulator from no to full saturation between each color trial. Within each trial, the participant is asked to rate their level of comfort from 1-5: 1 being most soothing/pleasant/comfortable, 2 being more soothing than harsh, 3 being neither, 4 being more harsh than soothing, and 5 being most harsh/unpleasant/uncomfortable. These data metrics are then collected on our Hue Comfort Tracking Sheet for later analysis and reference.

Results

During the preliminary stage of protocol development, we piloted the protocol on two study participants: one with high light sensitivity and the other with low light sensitivity. Interestingly, we found that colors such as pinks, reds, and yellows were "extremely piercing to the eyes" for the light sensitive subject, while colors like greens and blues were more comforting. An opposite trend was seen in the light tolerant subject, who preferred the pinks, reds, and yellows over the greens and blues. However, it is important to note the subjectivity and intuitive nature of the test, and that many subjects might see unique results. Once we begin prospectively testing headache participants in the research setting, we expect to see a wider variation between these groups, reflective of the individual and group characteristics of light intensity and color preferences.

Conclusions

Custom tinted lenses are currently used clinically in the ophthalmology setting using Intuitive Colorimetry to provide individualized treatment in patients with visual symptoms. Our protocol will enable further investigation as to the factors providing this clinically observed therapeutic benefit and allow chromatic-specific testing of color-specific light sensitivity and various lighting intensities. Beyond our current protocol development and planned follow-up work, we hope to use these data to provide an evidence basis for the use of custom tinted lenses as a form of treatment for light sensitivity (Wilkins et al., 2009). Beyond the scope of our group's work, the range of disorders in which such tinted lenses might be of value include dyslexia, photosensitive epilepsy, multiple sclerosis, and acquired color vision deficits.