Lighting: The Indispensable Low Vision Aid

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Abstract

Arguably lighting is the most prevalent and least understood aid vision rehabilitation professional's use. Instead of measuring the patient's lighting needs we often employ simple rules such as "more is better", although we do realize that factors such as glare are important considerations. In large part our lack of knowledge has corresponded to the limited options available in lighting devices and the absence of means to quantify lighting needs for the individual. A notable exception are light meters, however, we argue that these meters are limited in their specificity to the tasks patients want to do. That is, they measure light output rather than the light input patients benefit from.

Light emitting diodes (LEDs) are revolutionizing the lighting industry. From automobile headlights to home appliances LEDs are becoming ubiquitous. And why not – they are inexpensive, readily mass produced, require little energy, and can be configured into arrays with varying intensity and hue. Importantly, they emit single frequencies of light so that by precisely combining them one can not only tailor light intensity (brightness and color temperature), but also virtually any color within the human visual spectrum. Simply put it is feasible to create lighting conditions that optimize vision for any given task. The problem now is determining what is "optimum" for a given individual.

The human visual system normally tolerates large changes in ambient light. We see relatively well on both dark days (~1000 lux) and on very bright days (~100,000 lux) even though the two vary in magnitude by a factor of 100. In terms of color we normally see a spectrum of colors from 390 nm to 700nm. Newton named major points in this spectrum red, orange, yellow, green, blue, indigo, and violet. The visible spectrum is, as von Helmholtz hypothesized, perceived in the eye by only three distinct receptors: red, green, and blue.

Low vision patients generally do not have the same ability to perceive objects well across the range of brightness the normal eye does, and frequently their ability to perceive color is also attenuated. As a consequence the need to tailor lighting to the low vision patient becomes critical. Low vision practitioners learn this early on, however their ability to quantify lighting need has been limited. This inability combined with the extensive variety of illumination sources, whose characteristics are often not known, generates limitations in the effectiveness of vision rehabilitation to care for the low vision patient.

In this research and practice based symposium, we will briefly overview lighting and the human response to lighting emphasizing the role of lighting in low vision. We will include basic lighting terminology, an overview of the physics of lighting (e.g. Inverse Square Law) and visual perception (e.g. Steven's Power Law). We will discuss measurement tools that can be used and their suitability for use in a low vision practice. This will include a literature overview and presentation of recent research findings and their limitations. Finally, we will speculate on the future implementation of lighting in low vision clinical practice and research. The session will conclude with a question and answer session providing attendees a chance to interact with presenters.