Analysis of Modern Blue-Blocking Lenses in Relation to 405 nm Light

Brent Cole, Anthony Luongo, Charles N. Whittle, OD

Northeastern State University Oklahoma College of Optometry

Purpose

Many commonly used electronic devices emit a significant amount of high-energy blue light. Visible light consists of the wavelengths between 400-760 nm, and the term *blue light* refers to the range of optical radiation between 400-500 nm.[1] These shorter wavelengths have higher energy and are thought to have potentially harmful effects on both ocular health and physiological functioning. There are several modern blue-blocking lenses on the market, which are designed to reduce this high-energy visible light. This project looked to evaluate the performance of some of these products.

Methods

Seven blue-blocking lenses were tested using an optical bench, spectrometer (publiclab.org), and a 405±10 nm laser light source (BluTech), as shown in Figure 1. Five images were captured for each test lens and a control. Peak intensity values were averaged to determine the corresponding means for each data set. To analyze performance, p*ercent reduction* values were then calculated, which compared each test lens mean against the control mean.

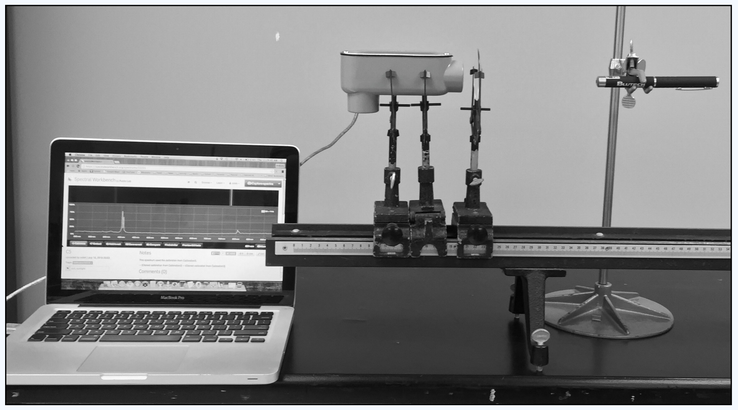

Figure 1. Testing setup using an optical bench, laptop, spectrometer, test lens, and a light source.

Results

All seven lenses demonstrated a significant reduction in the transmission of 405 nm light, as shown in Figure 2. Peak intensity values measured, statistical findings, and percent reduction calculations, are listed in Table 1 for each data set.

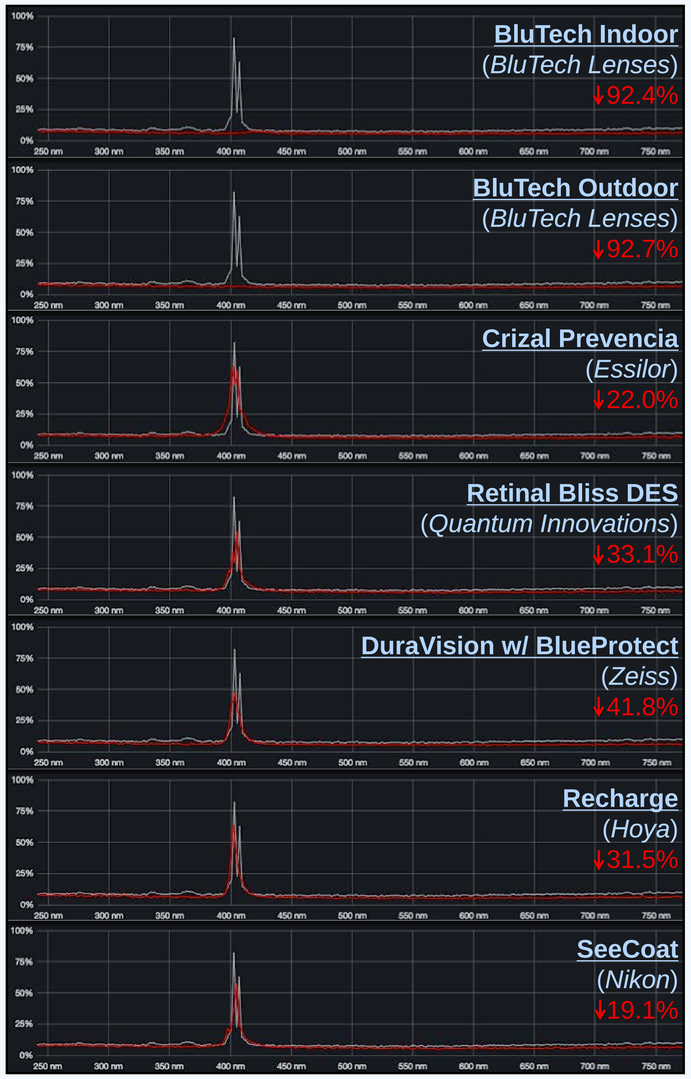

Figure 2. Comparison of a sample test spectrum (red) versus a control spectrum (white) for each test lens, with corresponding percent reduction values.

Table 1. Intensity values (%), means, standard deviations, and percent reduction calculations.

Lenses	1	2	3	4	5	Mean	Std dev	Percent reduction
Control	81	82	82	82	82	81.8	0.447	N/A
BT IN	6	7	6	6	6	6.2	0.447	**92.4%**
BT OUT	6	6	6	6	6	6.0	0.00	**92.7%**
CR PRV	63	59	70	64	63	63.8	3.96	**22.0%**
RB DES	58	56	52	51	55	54.4	2.88	**33.5%**
DV w/ BP	54	43	46	47	48	47.6	4.04	**41.8%**
Recharge	57	55	58	58	53	56.2	2.17	**31.3%**
SeeCoat	68	65	71	64	63	66.2	3.27	**19.1%**

BT IN, BluTech Indoor; BT OUT, BluTech Outdoor; CR PRV, Crizal Prevencia; RB DES, Retinal Bliss DES; DV w/BP, DuraVision with BlueProtect.

Discussion

The lenses tested showed a wide range of reduction values, with the BluTech lenses blocking the most blue light. However, these lenses have significant tints present when compared to the other samples. Most of these products were designed for varying levels of reduction at different parts of the blue light spectrum, while this study only tested one specific portion. There is also much debate on how much blue light reduction is necessary. Therefore, a direct comparison between products should not be made. Future research could test how these lenses perform at other portions of the light spectrum.

Acknowledgements

Special thanks to Essilor, Hoya, Laramy-K Optical, Nikon and Zeiss for providing us with the resources and materials to make this research project possible.

References

1. Mainster M. Intraocular lenses should block UV radiation and violet but not blue light. Arch Ophthalmol 2005;123:550-5.

Heart of America Contact Lens Society, 2/13/16, Kansas City, MO