Blue Light Filtering Lenses and the Contrast Sensitivity Function

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Background and Purpose

- The display screens of electronic devices emit a significant amount of blue light. The putative associations between blue light and high levels of digital strain have led to the corresponding surge in the prescription of lenses that selectively filter blue light
- While blue blocking lenses are popular, there is a paucity of research on the effects of these lenses on contrast sensitivity
- Contrast sensitivity (CS) is the visual ability to distinguish an object from its background and is an important metric that describes the subjective quality of vision.
- Prevalent conditions such as cataracts naturally reduce contrast sensitivity in the elderly. If blue blocking lenses reduce contrast, then the effects of this reduction are likely to be exacerbated in the older population.
- The purpose of this study was to compare the effects of blue filtering lenses on CS in older and younger samples. We hope to provide insight into whether the putative benefits of these lenses outweigh any visual compromise, especially in older patients.

Methods

- A sample (N = 20, age 20 - 30) of Michigan College of Optometry students comprised the "Young-Adult" group. A sample of patients (N = 14, age 55 - 80) with cataracts comprised the "Older-Adult" group.
- Baseline contrast sensitivity was measured for each group using the Vistech Contrast Sensitivity Chart (Figure 1).
- Contrast sensitivity measurements were repeated with *the Crizal Prevencia* blue light filter clipped on over the patient's habitual prescription

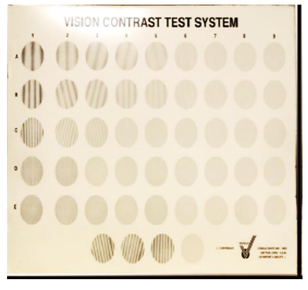
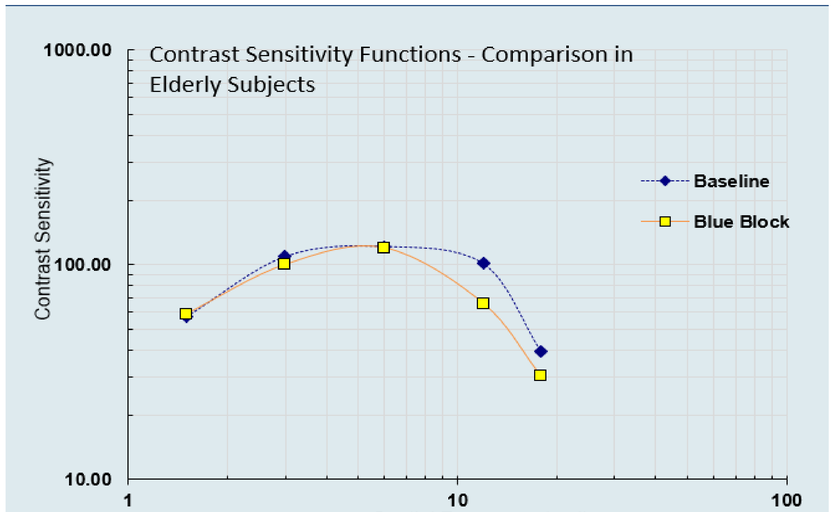
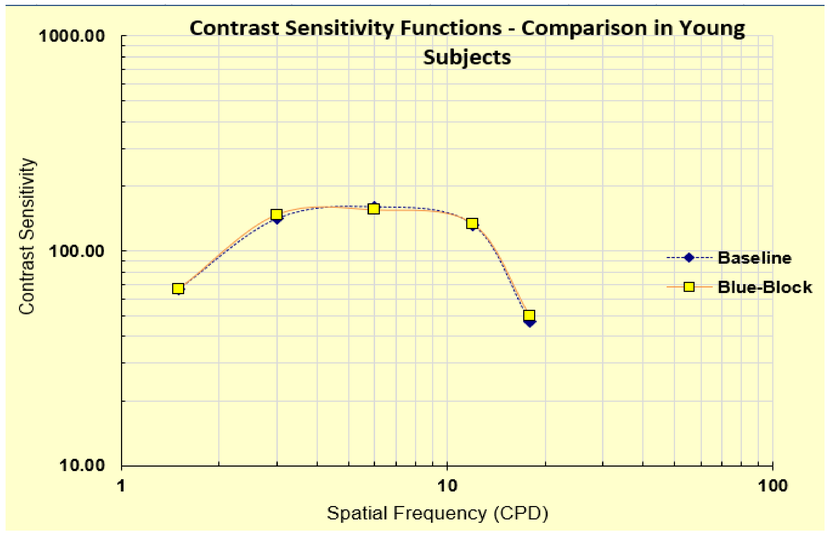


Figure 1: The Vistech Contrast Sensitivity Chart was used to measure the Contrast Sensitivity Function

Analysis and Results



Graph 1: Contrast Sensitivity as a function of Spatial Frequency in the elderly shows a significant reduction in contrast sensitivity at 12 and 18 cpd



Graph 2: : Contrast Sensitivity as a function of Spatial Frequency in the 'young population. No significant difference was seen between conditions

Analysis and Results

- Contrast sensitivity was plotted as a function of the following spatial frequencies 1.5, 3.0, 6, 12, and 18 cycles per degree for a 'no-filter' Baseline condition, and with the blue blocking filter. For each group, the mean threshold contrast was analyzed using a Two-Factor Repeated Measures Analysis of Variance (ANOVA).
- The difference between baseline and filter conditions, was statistically non-significant for both groups.('Young' $F(1,199) = 0.03$, $p < 0.86$); Elderly: $F(1,139)=2.07$, $p < 0.15$) .
- At 12 cpd, the mean contrast sensitivity *was significantly lower* ($T(13) = 2.69$, $p = 0.01$) with the blue-blocking filter in the elderly. Similarly, at 18 cpd, the mean contrast sensitivity was *just significantly lower* ($T(13) = 1.70$, $p = 0.05$) with the blue-blocking filter in this group

Discussion and Conclusions

- Our results indicate that while blue-blocking filters may not cause a significant reduction in contrast sensitivity in younger subjects, they may in fact cause a noticeable reduction in contrast in elderly subjects, especially at the medium to higher spatial frequencies, compromising detailed vision in this group.
- Consistent with previous studies that have investigated the effects of age on contrast sensitivity, our results show that overall, contrast sensitivity was lower in the elderly population
- Our study limitations include a small sample size for the elderly population (N=14). Furthermore, most of the elderly had mild to moderate cataracts. In general, contrast reductions increase with the severity of cataracts
- Our results indicate that blue-blocking filters may cause contrast reductions at high spatial frequencies in the elderly. However, our study had methodological limitations
- Future studies could repeat this investigation on a larger sample size and adopt a more specific inclusion criterion for elderly population by focusing on a subset with more advanced cataracts.

References-
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