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Spherical refractive error measurement using a holographic multi-vergence target (MVT)

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Purpose: Holographic refraction is a quick and accurate way to measure spherical refractive error of the human eye. However, holograms use coherent illumination, and how this lighting interacts with vision during subjective measurements is still poorly understood. The purpose of this study is to evaluate the accommodation of young subjects while looking at multiple diverging targets (MVT) in a hologram.

Method: Healthy subjects (n=31) with spherical refractive-error were asked to look into the holographic MVT and report the clearest characters as well as nearest target that is just recognizable. These are a measure of the eye's refractive state and the amplitude of accommodation, respectively. Subjects were separated into younger (mean=22 years, SD=7) and older (mean=54 years, SD=8) age groups, and the amplitude of accommodation measured with the hologram was subjected to a Student t-test to determine whether there was a difference in accommodation between the two age groups. The refractive state of the eye measured with the hologram was compared to conventional spherical subjective refraction using a paired t-test and Bland-Altman's method.

Results: Accommodation was found to be similar between the younger group (mean=1.75 D, SD=1.34 D) and older age group (mean=1.72 D, SD=1.40 D) with the mean difference of 0.02 D being non-significant (p=.97). Subjects were also found to have an average lead of accommodation of 0.68 D (SD=0.76 D) when looking at the holographic MVT. When using the hologram to measure refractive state of the eye, the 95% level of agreement between the holographic method and conventional method was found to be from -0.75 D to 2.11 D.

Conclusions: When attempting to measure subjects' amplitude of accommodation using the hologram, the hologram appears to inhibit accommodation resulting in the reduced ability to recognize near characters. When given ample time to observe the holographic MVT to measure the refractive state of the eye, most subjects exhibited a slight lead of accommodation, resulting in poor agreement with conventional methods.

Biography

Nicholas Nguyen is a full time Optometrist in private practice since 2003. His research interests are in holography and visual optics. Together with his supervisors, he developed the working protocol for holographic refraction and found a possible association between vision measured with laser optometers and myopic progression. Currently, he is working on projects to subjectively measure the dark focus of the eye using a holographic multivergence optometer, the use of a holographic logMAR chart for visual acuity measurements and for color vision assessments.

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