Validity and Acceptance of Color Vision Testing on Smartphones

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Introduction:
Color vision testing (CVT) is an important part of the neuro-ophthalmic examination. The validity of CVT may be affected by the quality of the displayed image, background illuminance, image distance, and visual acuity. iPhone® and Android® smartphones provide diagnostic testing applications including CVT. There is minimal evidence to support the validity of these non-standardized smartphone applications. The purpose is to assess the validity of smartphone CVT by comparing results using the Eye Handbook (EHB) CVT application with Ishihara color plates (ICP).

Methods:
An IRB-approved prospective, randomized study was performed of 193 patients with near visual acuity of ≥ 20/60 at 14 inches. The study group included patients with ocular pathology. The control group included patients with no known pathology. CVT was performed with both ICP and EHB under a standardized background illuminance, randomized by order of testing and phone model. OD was the study eye. The testing was scored by number of correct plates out of eleven test plates for each modality. A paired-samples t-test was performed.

Results:
In the control group (n=80), mean score for ICP was 10.91 +/- 0.284 correct plates and for EHB was 10.94 +/- 0.291, with a difference of 0.0250 +/- 0.0274, p = 0.4176, SD= 0.274, 95% CI -0.036 to 0.086. In the study group (n=113), mean score on ICP was 10.08 +/- 2.109 correct plates and for EHB was 10.29 +/- 2.073, with a difference of 0.212 +/- 0.784, p = 0.0048, SD = 0.784, 95% CI 0.066 to 0.359. Using ICP as the “gold standard” for CVT, the sensitivity of EHB was 89% and specificity 99%. For all subjects, 60% preferred EHB, 12% preferred ICP, and 29% had no preference.

Conclusions:
In patients with ocular pathology, there was a statistically significant difference in CVT results comparing EHB with ICP. In control patients, this difference was not statistically significant. The majority of subjects preferred EHB to ICP testing.

References:

1. Eye Handbook Color Plate application (Copyright © 2009 Cloud Nine Development LLC).
   http://www.eyehandbook.com/

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