Introduction

Visual acuity (VA) assessment is a critical component of every eye examination. If performed correctly, a visual acuity measurement will help to identify individuals with significant vision problems. This is particularly important in children, where high refractive error, amblyopia, strabismus, and occular disease may permanently impair their vision.

Advances in technology have allowed computerized versions of visual acuity stimuli to become available for distribution to ophthalmic and optometric offices. These programs typically include isolated, crowded HOTV optotypes for testing young children. The Electronic Visual Acuity (EVA) Test has been used to test pediatric visual acuity in NIH funded research projects, including the Amblyopia Treatment Studies (ATS) and Vision in Preschoolers (VIP) Study. Smart System PC (SS) by M&S Technologies is currently the only one being used by many well-known institutions such as The Vision Care Institute, LLC. However, there is no clinical evidence to support the validity of computerized HOTV system compared to the standard charts. Visual acuity is a sensitive measure that may differ based on differences in contrast and illumination levels. Therefore, it is important to standardize VA charts to ensure accurate and reproducible assessment of visual acuity.

Purpose

The aim of this study is to evaluate the three computerized VA charts (the EVA, the Stimuli Acuity System (SAS) by Accommodate Corporation and the Smart System PC (SS) by M&S Technologies) in terms of the accuracy of visual acuity measurements and test-retest repeatability as compared to the standardized back-illuminated LogMar HOTV plastic chart using these tests under habitual-conditioned conditions.

Methods

Subjects: 30 optometry students, mean age was 25 years old (+/- 4.5)

Inclusion Criteria:  
- Habitually-corrected VA of 20/20 or better in the right eye, verified at the beginning of each session by using ETDRS Chart.
- Refractive error between +2.50 and -6.00 D with 0.2 D with or without astigmatism, and anisotropia of 1.5 D or less.
- Subjects requiring refractive correction wore the same optical correction for both test sessions.
- No history of amblyopia, strabismus, ocular surgery, or current or previous eye disease other than resolved anterior segment inflammatory or infectious disease

Screening:  
All charts were tested in the same exam room with an ambient illumination of 345 lux.

HOTV Control (by Good-Lite)  
- Standardized 500 mm back-illuminated LogMAR HOTV plastic chart
- Yellow illumination of 340 nit over the entire visual acuity chart surface
- Displays 5 optotypes surrounded by crowding bars at equal presentation rate and is used within a LogMAR progression validated by the Committee of Vision for VA tests used with adults

Method:  
- All computerized charts presented isolated standardized optotypes surrounded by crowding bars of 1 arcmin width and 2 arcmin angular separation. Contrast was measured by Spectra Photometer at a distance of 1.5 meters and a dot size of 6 arcmin.

HOTV Control (by Good-Lite)  
- Standardized LED back-illuminated LogMar HOTV plastic chart
- Yellow illumination of 341 nit over the entire visual acuity chart surface
- Displays 5 optotypes surrounded by crowding bars at equal presentation rate and is used within a LogMAR progression validated by the Committee of Vision for VA tests used with adults

Method:  
- All computerized charts presented isolated standardized optotypes surrounded by crowding bars of 1 arcmin width and 2 arcmin angular separation. Contrast was measured by Spectra Photometer at a distance of 1.5 meters and a dot size of 6 arcmin.

Statistical Analysis:  
Bland-Altman methods and paired two-sample t-test were utilized in the statistical analysis.

Results

Table 1: shows repeatability of VA measurements in LogMAR units as compared between week 1 and week 2.

Table 2: shows mean LogMAR Visual Acuity (%) as compared to HOTV Control.

Conclusions

As compared to HOTV control, SS showed statistically insignificant difference in the mean visual acuity measurements. The test results were a substantial contrast that the border line values of p=0.058. EVA underestimated visual acuity measurements with a statistically significant difference in mean LogMAR VA of -0.087, which is not a clinically significant difference. Based on Bland-Altman plot analysis, SS showed the best results with the narrowest 95% limit of agreement.

References


None of the authors had financial interest in any of the devices.