



Preliminary comparison study of the EyeQue Insight™ and the standard Snellen letter chart in measuring visual acuity

Introduction

Visual acuity (VA) measures the sharpness of vision, or the ability to distinguish fine differences in the environment as measured with printed or projected visual stimuli, such as letters or other symbols. The measurement of visual acuity is typically the initial step in the evaluation of ocular health and visual function. Results of visual acuity testing can indicate whether an individual's current prescription glasses or contact lenses need updating or if correction is now needed to achieve good vision.

Several visual acuity tests are available in the industry today. The Snellen chart consists of letters or symbols of different sizes, arranged in rows. The Tumbling-E chart rows contain the letter "E" in various rotated positions (up, down, left, or right) and sizes. Both are viewed at a 10 or 20-foot distance (Figure 1). The Snellen chart historically is the most commonly used in practice. The Tumbling-E chart is an alternative visual acuity test useful for children or adults who cannot communicate verbally due to a physical or mental disability, or a language barrier. The EyeQue Insight is an electronic visual acuity chart designed to accurately evaluate the visual acuity of individuals without the need for a specific testing distance, literacy level, or trained test administrator. The aim

of this study is to compare the visual acuity outcomes of the EyeQue Insight against the Snellen chart in a clinic population seven years of age and up.

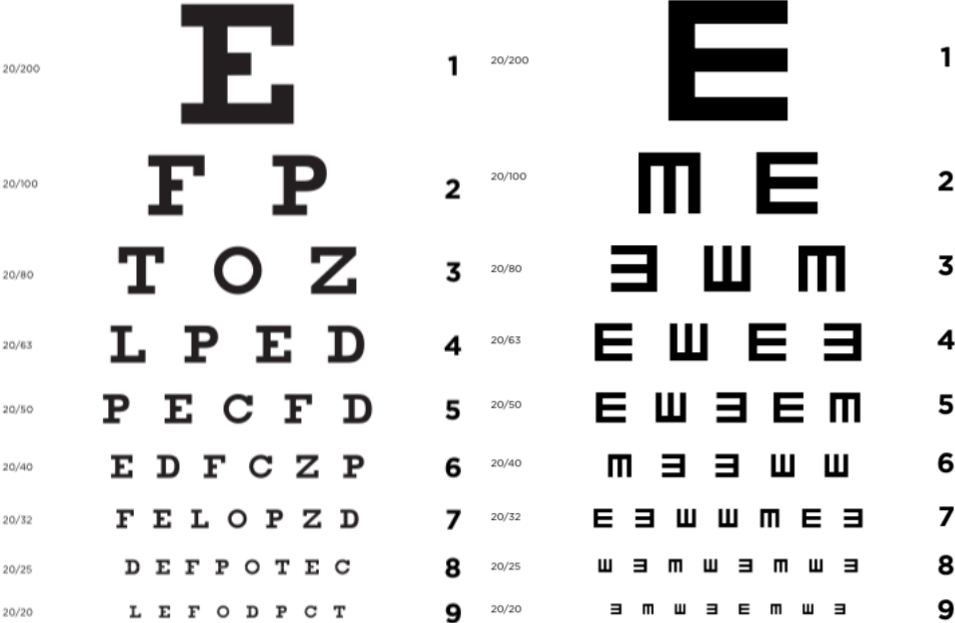


Figure 1. Snellen charts (left) and Tumbling-E charts (right)

Source: All About Vision, 2018

The EyeQue Insight is a personal, portable visual acuity measurement system using a binocular viewer to look at the letter "E" in various rotated positions (up, down, left, or right) and sizes on a smartphone display, at a virtual distance of 20 feet, which is similar to the Tumbling-E chart. The myEyeQueVA mobile application interface guides the user through a series of interactive visual acuity tests for right, left, and both eyes. Users completing all three tests are shown their visual acuity results in standard Snellen notation with the option to choose other reporting methods, including LogMAR, Snellen (metric), and Decimal. The user's results are securely stored in the EyeQue Cloud™ and are visible within the user's online account.

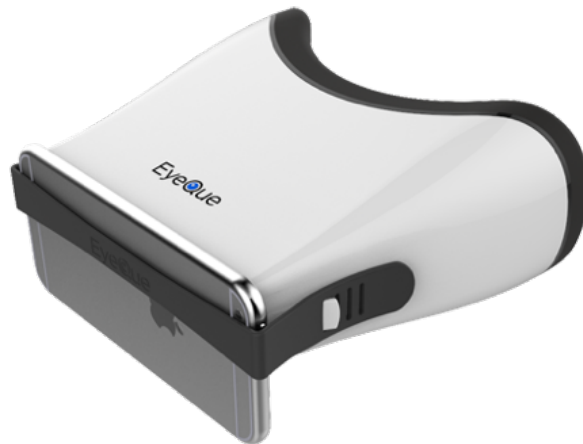


Figure 2. The EyeQue Insight binocular viewer with smartphone.

The EyeQue Insight visual acuity screener combines the required 20-foot testing distance, constant luminance, and standardized optotype (standardized symbols for testing vision) size within a portable binocular device. A single or a series of Tumbling-E optotypes are displayed to the user in four randomized directions (up, down, left, or right), with different sizes. The visual acuity range tested by the Insight is from 20/400 to 20/20 (6/120 to 6/6, Snellen-metric). Prior to testing, the user's pupillary distance (PD) is measured with an adjustable, built-in ruler on the smartphone and dialed into the binocular. Users hold the binocular viewer against their faces and simply swipe the smartphone screen in the direction the opening of the "E" faces, similar with gesturing the direction when testing with a Tumbling-E wall chart. The Insight tests the visual acuity on right eye, left eye, and both eyes in sequence. No occlusion is needed as the application automatically turns the display on or off to either eye. The visual acuity results are displayed instantly on the smartphone and stored securely on the cloud server. An animated version of the test is available to get children more engaged in the vision test. Throughout the test, neither addition personnel, nor requirements on the

environment such as the physical space or the lighting condition are needed. Since the optotypes are randomly generated each time during the test, memory cannot affect the accuracy of the vision test, even if it is used daily, which make it a perfect in-home vision tracking kit.

Methods

The EyeQue Insight study was conducted on 43 randomly selected individuals. Visual acuity was measured by both a standard illuminated Snellen wall chart at a 20-foot testing distance, and the EyeQue Insight, together with an iPhone 6 running the myEyeQueVA mobile application, on all participants during the same visit. The phone brightness is set at the maximum level. The ambient light illuminance is between 300 to 400 lux for the standard Snellen wall chart. Each participant was instructed to read out loud the letters on the Snellen chart with left eye occluded, then right eye occluded, and lastly with both eyes together. Similarly, the same participant was instructed to swipe in the direction of the opening of the "E" on the smartphone screen using the Insight viewer, using the myEyeQueVA mobile application. The participant's monocular and binocular visual acuity were tested in sequence beginning with right, left, then both eyes. Visual acuity was recorded in imperial Snellen notation to the lowest whole line of acuity for each participant for both the Snellen wall chart test and the Insight visual acuity test. Both the Snellen visual acuity and Insight visual acuity was then converted into LogMAR notation for data analysis (Table 1). The agreement between the two visual acuity tests was assessed using paired t tests, limits of agreement, and linear regression.

Results

In total, 43 people were tested with an average age of 34 and range between seven to 64 years of age. All participants completed both tests on the same day. Greater than 80% of participants had visual acuities of 0.10 LogMAR (20/25) or better either without correction or with best corrected visual acuity (BCVA). The visual acuities ranged from 0.0 LogMAR to 1.0 LogMAR. The mean LogMAR acuity when using the

Table 1. Visual Acuity Conversion Chart

20 ft	6 m	Decimal	Log MAR
20/200	6/60	0.1	+1.0
20/100	6/30	0.2	+0.7
20/80	6/24	0.25	+0.6
20/63	6/19	0.32	+0.5
20/50	6/15	0.4	+0.4
20/40	6/12	0.5	+0.3
20/32	6/9.5	0.63	+0.2
20/25	6/7.5	0.8	+0.1
20/20	6/6	1.0	0.0

Snellen chart was 0.08 (SD 0.18) and the mean LogMAR acuity using the Insight was 0.07 (SD 0.16), both of which equate to approximately 20/25 Snellen. Overall, the mean difference in LogMAR acuities between the two methods was 0.01 LogMAR (95% limits of agreement 0.14, -0.12 LogMAR), with the Insight giving a slightly better visual acuity reading. The difference of 0.01 LogMAR is much smaller than one line difference of 0.1 LogMAR.

Overall, the visual acuity measured was identical between the Insight and the Snellen wall chart on the same participant, as demonstrated in Figure 3, with 77% of the right eye, 74% of the left eye, and 91% of the both eye VA results being exactly the same.

Lastly, more than 93% of the tests among either right, left, and both eyes are within 1 line of difference between the Insight and the Snellen wall chart.

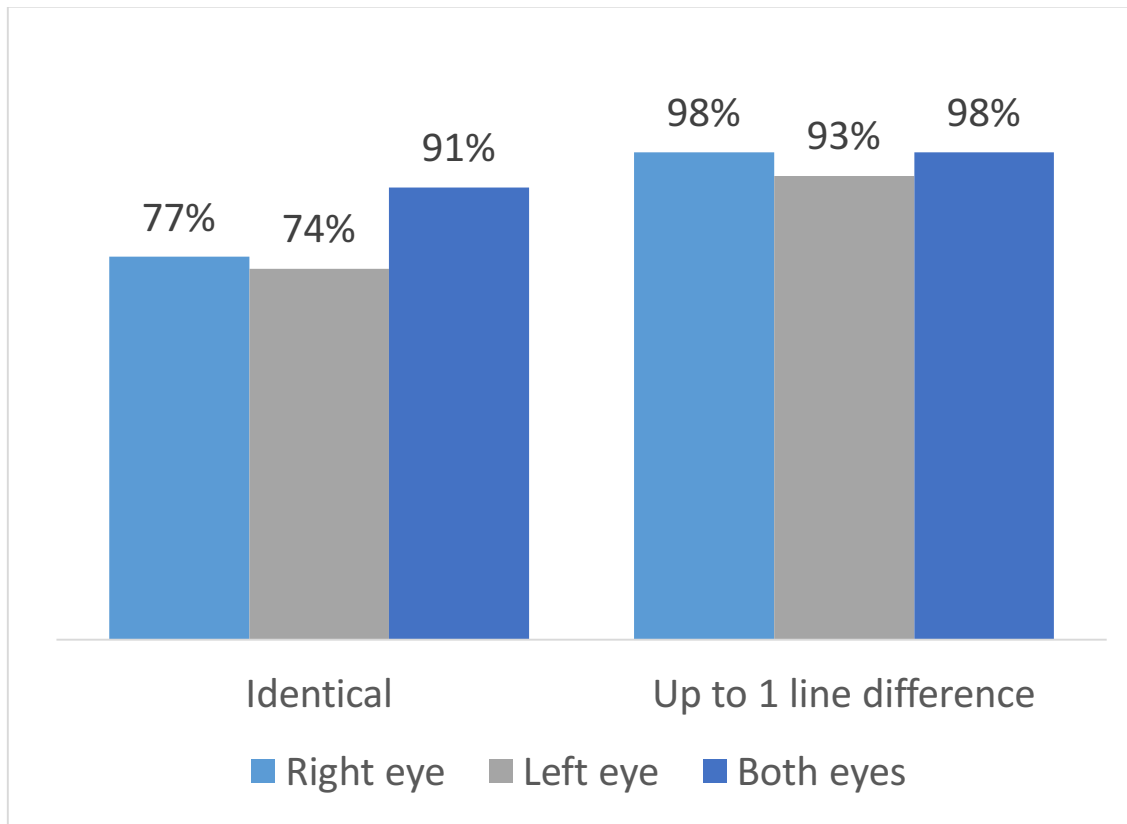


Figure 3. Visual acuity accuracy of the EyeQue Insight compared with the Snellen letter chart

Conclusion

The practical significance of this study is that the margin of error between the two visual acuity screening methods is much smaller than one complete line on the standard Snellen chart. The results of this study validate the EyeQue Insight as a visual acuity measurement tool that is comparable to Snellen wall chart acuity. This comparison study between the EyeQue Insight and a standard illuminated Snellen chart is a

preliminary study. Further studies are underway to explore in greater depth the practical applications of the Insight with a focus on minimizing factors contributing to acuity measurement differences.

The low-cost, portable EyeQue Insight vision screener is an easy-to-use, do-it-yourself, at-home eye care kit that offers consumers great potential to test their vision at home. The visual acuity measured by EyeQue Insight is highly consistent, independent of the environment, and comparable to the visual acuity measured by a Snellen wall chart.

References

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About EyeQue

EyeQue is on a global mission to elevate eye care. The Company is dedicated to inspiring people to learn about and care for their eyes by putting affordable, accurate vision tests directly into their hands. The EyeQue Insight visual acuity screener and the myEyeQueVA mobile application create an intelligent vision solution for anyone to use

anywhere, at any time – accurate, convenient, low-cost, and fun. Results are instantly processed and stored in the cloud, creating a vision record history that can be shared with doctors and used immediately track and monitor vision changes. Founded by serial entrepreneurs, Tibor Laczay and John Serri, the Company innovates from its Silicon Valley headquarters.

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