Sensitivity of the Traditional vs. Paul Harris Randot Stereotests in Detecting Aniseikonic Stereoanomalies

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Abstract:

Introduction/Purpose: Stereopsis is a high form of binocular vision that requires equal visual acuities in the two eyes and coordination between the eyes that provides a useful clinical screening tool**.** Aniseikonia is an intraocular difference in the perceived retinal image size between the two eyes that is prevalent in 1%-3.5% of the population and is likely to grow as a result of the aging population and the increase in cataract and refractive surgery (Kramer et al., 1999; Rutstein et al., 2006). Aniseikonia deteriorates binocular visual performance by elevating the stereothreshold. We compared the sensitivity of the traditional Randot Stereotest and the Paul Harris (PH) version of the Randot Stereotest, which does not contain monocular cues in detecting aniseikonic stereoanomalies.

Methods: Thirty volunteer subjects, aged 18 – 32 (mean: 26 ± 3, 18 female, 12 male) with normal visual acuity and binocularity were included. Size lenses that lack optical power but magnify all meridians thereby increasing retinal image size with magnifications of 3.1%, 5%, 10%, and 19% were placed in front one eye while obtaining two measurements with the traditional Randot and PH Randot stereobooklets. The magnification, the tested eye, and the stereotest type were tested in a random order. The stereothreshold obtained with each stereobooklet was plotted as a function of the size lens magnification to determine the effect of the monocular magnification on stereopsis. A Bland Altmann analysis was conducted to examine if the two stereotests were interchangeable. In addition,

Results: Only the PH Randot demonstrated a consistent deterioration in stereothreshold due to the induced aniseikonia. Bland &Altmann analysis demonstrated that the two tests are not interchangeable, and that there is a consistent bias between the traditional Randot and the PH Randot. The traditional Randot consistently yields lower stereothreshold measurements than the PH Randot. .

Discussion: It is probable that the monocular positional cues in the traditional Randot aided the subjects with the induced aniseikonia in detecting which figure contained depth. However, the random dot stereogram targets in the PH Randot require full binocularity to detect depth and were therefore not detected by the subjects with the induced aniseikonia.

Conclusion:
Because the traditional Randot did not demonstrate a deterioration in stereothreshold with the induced aniseikonia, we recommend that clinicians use the PH Randot test to detect aniseikonic stereoanomalies.

Methods:

Subjects

- Thirty volunteer subjects ages 18 – 32 (mean age: 26± 3, 18 female, 12 male)
- Inclusion criteria: Visual Acuity, Stereopsis, Near Point of Convergence, and Amplitude of Accommodation, "within normal limits".

Procedures:

Medical History Questionnaire, Tests for Inclusion Criteria (VA, Stereopsis, NPC, AA)

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Size Lenses (3.1%, 5%, 10%,19%) placed in front of OD or OS (random order and random eye)

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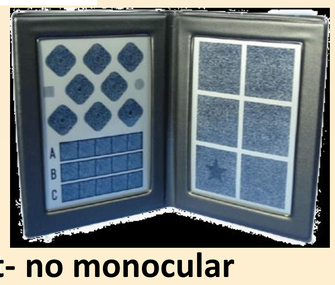
Traditional and Paul Harris Ranot Stereopsis Measurements (Random Order) for each test condition

Traditional Randot stereotest- contains monocular cues



Paul Harrisl Randot stereotest- no monocular cues

Introduction:

Aniseikonia

- An intraocular difference in the perceived retinal image size between the two eyes (Millodot, 2009)
- Affect binocular visual performance (Jimenez, Ponce, Jimenez del Barco, Diaz & Perez-Ocon, 2002; Jimenez, Ponce & Gonzalez Anera, 2004).
- Prevalent in 1% to 3.5% of the population (Fullard, Rutstein & Corliss, 2007), and is likely to grow as a result of the aging population, the increase in cataract and refractive surgery (Krameret al.,1999; Rutstein et al., 2006).
- Occurs primarily in patients with anisometropia, oblique astigmatism and other inherent optical or acquired anatomic differences between the two eyes (e.g. aphakia, pseudoaphakia and post- corneal refractive surgery), as well as retinal diseases (Rutstein et al, 2006).
- The human eye is capable of overcoming only 5-6% of 2.00-3.00 Diopters (DS) of anisometropic aniseikonia (Friling, 2008).
- Aniseikonia of 2% or more frequently causes visual symptoms (Fullard, et al, 2007) including subjective distortion of space, discomfort, suppression, amblyopia, **difficulties with stereopsis**, and various visual dysfunctions (Rutstein et al, 2006).
- Optometrists should seek a sensitive method to ascertain if the subject suffers from aniseikonia.

Purpose:

To examine the effect of induced aniseikonia on stereopsis and determine which type of stereotest is more sensitive (Randot Stereotest and the Paul Harris version of the Randot Stereotest).

Results:

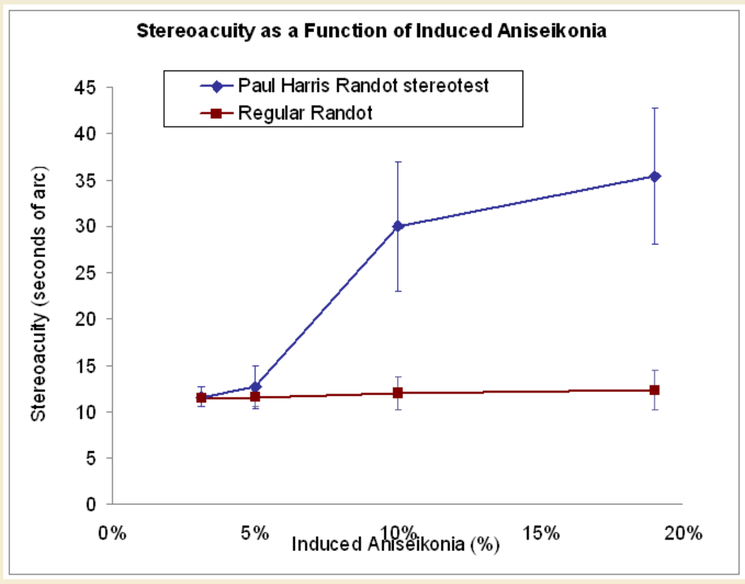


Figure 1 Stereoacuity (seconds of arc) measured with the Paul Harris Randot (blue diamonds) and traditional Randot (purple squares) as a function of induced aniseikonia.

Only the Paul Harris Randot demonstrates a reduction in stereoacuity as a function of induced aniseikonia.

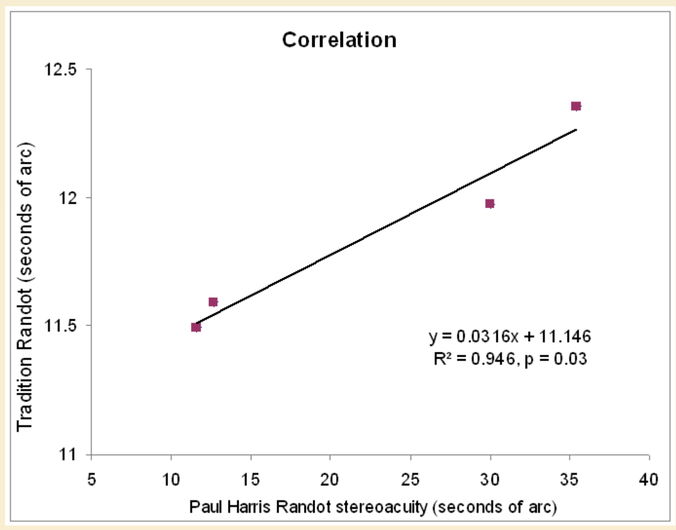


Figure 2: Stereoacuity measured with the traditional Randot stereotest plotted as a function of stereoacuity measured with the Paul Harris Randot stereotest.

The two methods are significantly correlated.
There is a consistent bias- stereothresholds measured with the traditional Randot are consistently lower than the Paul Harris Randot.

Discussion:

Lovasik & Szymkiw (1985) found a reduction in stereoacuity measured with the Titmus stereofuly and traditional Randot with size lenses between 12%-24%.

The current study found a reduction with the Paul Harris Randot (and not with the traditional Randot) with size lenses between 5%-19%.

The effects of size lenses of powers higher than 19% were not measured to simualte "real world" conditions.

Conclusion:

- The Paul Harris version of the Randot stereotest is a more sensitive test for detection of reductions in stereoacuity as a result of aniseikonia.

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