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RESPONSE TO LETTER

Response to Optimizing the Wilkins Egg and Ball Test: Overcoming Limitations for Accurate Astigmatism Detection [Response To Letter]

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Dear editor

Thank you for the opportunity to respond to the publication in Clinical Ophthalmology entitled "Optimizing the Wilkins Egg and Ball Test: Overcoming Limitations for Accurate Astigmatism Detection".[1] We welcome the opportunity to engage in this valuable discussion to contribute to the collective knowledge in our field.

Our study focused on evaluating the effectiveness of the Wilkins' Egg and Ball Test in identifying uncorrected residual astigmatism and its impact on form symmetry perception. This goal was achieved by testing a normal participant group with induced astigmatism, and two clinical cohorts with keratoconus and astigmatism greater than 1.00DC, using both full and spherical-only corrections. The study's scope was specifically on the test's utility, not its validation, which is a separate consideration for clinical applicability. Thus, we did not "overlook" inter-session repeatability and inter-observer reproducibility.

However, we do have data from 15 normal participants who were examined with the Wilkins' Egg and Ball Test on two different dates, ranging from 7–15 days apart. Wilcoxon tests comparing the results of each of the conditions found no significant differences between the Z-scores of two sessions (Table 1).

Further, ceiling and floor effects are common methodological limitations in clinical tests. Notably, in the near point of convergence test, a substantial proportion of patients demonstrate the capacity to achieve convergence "to the nose" with a documented break point of "0". Similarly, in stereopsis tests, the minimal disparity measured (Titmus Stereofly: 40",

Table 1 Means, Standard Deviations (SD), Medians, and Upper and Lower Interquartile Ranges (IQR1, IQR2) of the Z-Scores of First and Second Sessions for the Five Conditions (Baseline, and Induced Cylinder at 45/90/135/180 Degrees)

Condition	Session	Mean Z (SD)	Median Z (IQR1, IQR3)	Min Z	Max Z	Wilcoxon Test
Controls Baseline	1 2	−0.56 (1.51) 0.00 (1.03)	−0.88 (−2.54, 1.90) −0.29 (−0.66, 2.41)	−2.62 −0.66	2.00 3.54	p=0.13
Controls 45 deg	1 2	2.18 (2.14) 1.33 (1.17)	2.28 (−1.60, 5.30) 1.23 (−0.42, 3.73)	−1.65 −0.58	5.52 4.31	p=0.06
Controls 90 deg	1 2	1.46 (2.04) 0.79 (1.12)	1.52 (−2.39, 4.47) 0.87 (−0.45, 3.42)	−2.47 −0.50	4.95 4.37	p=0.21
Controls 135 deg	1 2	0.96 (2.06) 0.99 (1.39)	1.07 (−2.34, 3.63) 0.27	−2.70 −0.46	3.66 4.29	p= 1.00
Controls 180 deg	1 2	0.91 (2.13) 0.96 (1.42)	0.22 (−1.58, 5.12) 0.41 (−0.14, 4.33)	−1.59 −0.17	5.68 4.44	p=0.53

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Table 2 Floor and Ceiling Effects for Each Study Condition and Group

	Control Cohort (N=32)					Astigmatic Cohort (N=23)			Keratoconic Cohort (N=22)		
	Baseline	**Induced 45**	**Induced 90**	**Induced 135**	**Induced 180**	**Uncorrected**	**Spherical Correction**	**Full Correction**	**Uncorrected**	**Spherical Correction**	**Full Correction**
Floor	6.06%	6.06%	6.06%	6.06%	6.06%	8.70%	8.70%	8.70%	9.10%	9.10%	9.10%
Ceiling	6.06%	3.03%	3.03%	3.03%	0	8.70%	8.70%	8.70%	9.10%	9.10%	9.10%

Randot: 20") is often much higher than the capability of the human visual system (for example 14" reported by Gantz & Bedell[2]). Instances of ceiling effects are observed in visual acuity charts whose top lines are easily read by patients with normal or corrected-to-normal vision and in color vision tests that may not be sensitive to detect subtle variations of color discrimination in individuals with normal color vision. In the Wilkins' Egg and Ball Test examined in our study,[3] possible floor and ceiling effects were evaluated by calculating the percentage of participants with lowest and highest test scores, as done by Kara et al[4] with values exceeding 15% considered significant.[5] As seen in Table 2, the values were lower than 15% for all study cohorts and conditions, indicating low ceiling and floor effects for the test. Another approach to handling ceiling and floor effects is to apply non-parametric statistics and report medians and confidence intervals,[6] which were employed in the original study.[3]

We concur with Shuja and Abbasi[1] in recognizing that, as with any clinical research study, a common constraint is the generalizability of the findings, specifically to populations closely resembling the study sample.[7] We were very careful to specify in our conclusions that our findings are applicable to accommodating young adults, in alignment with the demographic characteristics of our study cohort. Further studies should address cohorts of a wider range of ages.

Our study concluded that the test cannot be recommended as a useful clinical or research tool for examining alterations in visual perception in cases with uncorrected residual astigmatism. Therefore, we are not sure that it would be valuable to address validity across age groups and inter-rater reliability to strengthen the overall reliability and applicability of a test that was deemed not useful for its intended purposes. Modifying the test targets' properties could potentially improve the test's usefulness, which would require further investigations.

Disclosure

The authors report no conflicts of interest in this communication.

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