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Real Depth Versus Randot Stereotests

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Abstract

Purpose—To compare the performance of real depth and Randot® stereotests in strabismic and nonstrabismic patients.

Design—Observational case series.

Methods—Stereoacuity was tested in 182 patients with a variety of strabismic conditions, using the Frisby-Davis 2 (FD2) distance stereotest, the near Frisby (nF) (both real depth tests), the Preschool Randot, and Distance Randot® tests (both based on Polaroid vectographs).

Results—Patients appreciated finer disparities with the nF test than the nR test at near and with the FD2 test than the dR test at distance.

Conclusions—The type of stereotest influences measurable thresholds, and the results from different tests are not interchangeable. The choice of test should depend on the question being asked; nF and FD2 would be appropriate for determining presence or absence of stereopsis and best measurable stereopsis. The more rigorous Randot® tests would be appropriate for determining subtle changes.

Two commonly used categories of stereotests are “real depth” tests, such as the near Frisby (nF)¹ and the distance Frisby-Davis 2 (FD2),^{2, 3} and Polaroid vectograph “randot” tests, such as the near Preschool Randot® (nR)⁴ and the new Distance Randot® (dR).⁵ To determine whether there are systematic differences between these categories of tests, we evaluated their performance in a large cohort of patients.

182 patients in a strabismus practice, ages 4 to 84 years, with visual acuity of 20/40 or better in each eye, up to 70 prism diopters (pd) of esotropia, 55 pd exotropia and/or 30 pd of hypertropia, completed the nF, FD2, nR and dR stereotests as part of routine evaluation. Criterion of 20/40 or better in each eye was used to avoid bias against Randot® tests due to dot resolution. All 4 tests were administered using previously described presentation protocols.³⁻⁶ The study was approved by respective Institutional Review Boards and conducted in a HIPAA compliant manner. To eliminate potential bias of comparing tests with different ranges of stereopsis, results were rescored as “fine” (20 to 60 seconds of arc [secarc]), “moderate” (75 to 200 secarc) or “coarse/nil” (400 secarc to nil) stereo (Table 1). We compared these rescored stereopsis levels between tests and determined the frequency of one test indicating a finer or measurable threshold compared to the alternative test.

At near, patients appreciated finer disparities with the nF than the nR test (median “moderate” vs. “coarse/nil,” $p < 0.0001$). At distance, patients appreciated finer disparities on the FD2 than

the dR test (median “moderate” vs. “coarse/nil,” $p < 0.0001$). Only 4% of patients had better stereoacuity with nR than nF, and no patient had better stereoacuity with dR than FD2. When one test indicated nil stereopsis, the patient was much more likely to have measurable stereopsis with a real depth test (nF or FD2) than a Randot® test (Table 2).

One possible explanation for different median thresholds is that one or more tests were more prone to false positives. We therefore analyzed patients with ≥ 20 pd of constant deviation. Only one of 21 (5%) such patients had measurable stereopsis with the nF and 1 of 25 (4%) with the FD2 (none with the Randot® tests), and that individual patient had Duane's syndrome with marked incomitance. It is possible that, despite attempting to measure the stereoacuity in primary position, this patient adopted a subtle face turn during stereoacuity testing, reducing his angle of deviation. Previous studies have suggested that our standardized presentation protocols^{3, 7} reduce the impact of monocular cues to a negligible level.

There are at least three possible explanations why the real depth tests might demonstrate measurable stereopsis when the Randot® tests demonstrate no stereopsis 1) patients had intermittent tropias that were better controlled when viewing real world targets 2) there was greater dissociation under conditions of Randot® testing (when the deviation by alternate cover test (ACT) > simultaneous prism cover test [SPCT]) and 3) the tests measure different aspects of stereoacuity. Of 17 patients with measurable nF and nil nR, 4 were intermittent and an additional 8 had ACT > SPCT. Of 52 patients with measurable FD2 and nil dR, 11 were intermittent and an additional 22 had ACT > SPCT. Nevertheless, 24 other discrepancies (5 at near and 19 at distance) cannot be attributed to either intermittency or dissociation, suggesting that real depth tests (FD2 and nF) and Randot® tests measure different aspects of stereoacuity.

We conclude that the type of stereotest influences measurable thresholds and results from different tests are not interchangeable. Real depth and Randot® tests measure different aspects of stereopsis. Choice of stereotest should depend on questions being asked; real depth stereotests such as the near Frisby and FD2 would be appropriate for determining presence or absence of stereopsis and for determining best measurable stereopsis. The more rigorous Randot® tests would be appropriate for determining subtle changes in stereoacuity and sensitivity to loss of stereoacuity.

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Table 1

Method of scoring each possible result of the 4 stereotests into 3 comparable categories in order to correct for possible bias of different minimum and maximum thresholds in each test.

Category	Near Frisby (nF)	Near Preschool Randot (nR)	Distance FD2 (FD2)	Distance Randot (dR)
Fine (20-60 sec arc)	40	40	20	
	60	60	40	60
Moderate (75-200 sec arc)	75			
	85		80	
	100	100		100
	200	200	160 200	200
Coarse/Nil (400-nil)	400	400		400
	600	800		800
	Nil	Nil	Nil	Nil

Table 2

Frequency of major discrepancies between stereotests. Discrepancies were defined as one stereotest indicating “nil” stereopsis and the other stereotest indicating measurable stereopsis. For this analysis, only distance tests were compared to each other and near tests to each other.

	Near Frisby Nil	Near Preschool Randot Nil	FD2 Nil	Distance Randot Nil
Near Frisby measurable (n=92)	-	18% (17/92)		
Near Preschool Randot measurable (n=76)	1% (1/76)	-		
FD2 measurable (n=137)			-	38% (52/137)
Distance Randot measurable (n=85)			0% (0/85)	-