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Color Space Distortions in Patients With Type 2 Diabetes Mellitus

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Abstract

Purpose: To compare psychophysical color vision spaces calculated from data on similarity judgements made by nonretinopathic diabetes mellitus type 2 (DM2) patients and controls.

Methods: DM2 patients (n=32) and age–matched controls (n=23) were tested monocularly in both eyes; all underwent an ophthalmological examination. Color vision was assessed with the Farnsworth D–15 test, to screen for congenital deficiencies, and with the Lanthony D–15d test. For their color space estimation, subsets of caps from both tests were employed in a triadic procedure. Based on each subject's 'odd–one–out' choices, subjective dissimilarities between the caps were computed and processed with multidimensional scaling. Two–dimensional color spaces were reconstructed for individuals and groups. Dimensions were interpreted as the R/G and B/Y perceptual opponent systems.

Results: Lanthony D–15d scores of patients were not significantly different from controls (TCDS for controls: 60.25 ± 5.84 OO; for DM2 patients: 66.04 ± 13.61, OD, and 67.29 ± 17.32, OS). Color spaces of DM2 patients, compared to controls, were compressed along the B/Y and R/G dimensions: residuals (average square difference) for right eye (OD) and left eye (OS) along the B/Y dimension were: OD = 0.17 and OS = 0.26; along the R/G dimension were: OD = 0.15 and OS = 0.21. However, the degree of the space compression varied dramatically among individual patients.

Conclusions: The present findings are in agreement with earlier studies demonstrating diffuse losses in early stages

of DM2. The proposed method of testing, which includes caps varying in saturation and lightness, and uses color spaces to represent discrimination, provides an opportunity for more differentiated, quantitative diagnosis of the type (the perceptual color system affected) and the severity of color vision loss.

Key Words: perception • neuro-ophthalmology: diagnosis • retinopathy of prematurity