Poster 77

Pupillometry of the Swinging Flashlight Test Detects and Quantifies Relative Afferent Pupillary Defects

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Introduction:
Our purpose was to investigate the use of a novel computerized pupillometer as an alternative to the clinical swinging flashlight test to more objectively detect and quantify relative afferent pupillary defects (RAPDs).

Methods:
Binocular pupillary response curves were recorded (RAPDx pupillometer, Konan Medical USA, Inc.) in neuro-ophthalmology patients (n=31) with RAPDs clinically graded by an examiner and normals (n=31) with RAPDs that were simulated using neutral density filters (NDFs) and quantifiable dimmed light intensities. In fourteen normals, testing was repeated within 1-2 months. Pupillary constriction amplitude (CA), velocity (CV), and onset latency (COL) were used to calculate RAPDs.

Results:
RAPDs in normal subjects were 0.16±0.11 log units (LU) (range=0-0.38). Significant correlations were found between RAPD values and dimmed light intensity (Pearson's r=0.94, p<0.001) and NDF strength (r=0.81, p<0.001). RAPDs increased linearly with increasingly dimmed light intensities for all 31 normals. In retested normals, inter-exam variability was 0.21±0.12 LU (range=0-0.42). Significant correlation (r=0.88, p<0.001) was found between clinician and machine grading of RAPDs in abnormal patients. Using the one-sided 95% confidence interval of the ratio of percentage change in CA (LU) as determined from normals, 20/22 (91%) abnormal patients with RAPDs >0.5 LU were distinguished from normals. In 6/6 abnormals, RAPDs were successfully neutralized using NDFs. RAPDs calculated using CA and CV correlated more strongly with the clinician's grading compared to COL (Steiger's test p<0.001).

Conclusions:
RAPD values recorded in normals were consistent with previously reported findings, and inter-exam differences demonstrate long-term variability in intrasubject RAPD. CA and CV are the most sensitive parameters for automated pupillometry. Sensitivity of detecting RAPDs in abnormals can be improved using the ratio of percentage changes in CA instead of differences in CA. RAPD values generated by this novel pupillometer correlated strongly with an examiner's clinical grading, suggesting this device can be used as an objective diagnostic clinical tool.

Keywords: Diagnostic tests, Pupil, Pupillometry, Relative afferent pupillary defect, Swinging flashlight test

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