An automated and objective cover test to measure phoria

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Purpose: To determine the repeatability of an automated and objective cover test to measure phoria and its agreement with the prism cover test (PCT) and the modified Thorington test (TH). The effect of ocular dominance on the magnitude of phoria was also analysed.

Methods: Two occluders comprising two crossed polarizers and driven by stepper motors covered the right and left eye alternately while participants fixated a 20/50 Snellen E letter at 40 cm. Meanwhile, the EyeLink 1000 Plus (SR-Research) registered eye movements. The test sequence consisted of three cycles of binocular fixation, left eye occlusion, binocular fixation and right eye occlusion. Each period lasted 5 seconds. Phoria was computed as the deviation of the occluded and fixating eyes from their previous binocular positions. The test was repeated in two sessions with a rest of 40 minutes. Horizontal phoria was also measured with the PCT and the TH at the beginning of the first session. Ocular dominance was assessed with the Hole-in-the-Card test.

Results: 30 non-presbyopic adults participated in the study. The mean accuracy ± SD of eye-tracker's recordings was 0.27º ± 0.10º. The mean difference of phoria between sessions ± SD was 0.15 ± 0.79 prism diopters (PD) ($p=0.32$). The direction of phoria was not significantly different with the three tests (Chi-square, $p<0.05$ for the three pairs of methods) nor its magnitude (Repeated measures ANOVA, $p=0.71$). The 95% limits of agreement of the automated and objective cover test were ±7.47 PD and ±5.23 PD compared with the PCT and the TH, respectively. Phoria was significantly smaller in the right eye than in the left eye with a mean ± SD of -0.96 ± 1.07 PD ($p<0.001$) but the effect of ocular dominance was not significant ($p=0.20$).

Conclusions: Advantages of using eye-trackers to measure phoria are: the measure is objective and with better resolution and repeatability than clinical methods, and the movements of the occluded eye can be registered. As eye-trackers become common tools in clinical settings, their use for automated and objective phoria measurement should be the new gold standard for the cover test.