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# Repeatability and agreement of an automated and objective cover test

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## Abstract

**Purpose :** To analyze the repeatability of an automated and objective cover test to measure near phoria and its agreement with the prism cover test (PCT) and the modified Thorington test (TH).

**Methods :** Participants were asked to fixate a 20/50 Snellen E letter at 40 cm while two occluders comprising two crossed polarizers and driven by stepper motors were used to cover the right and left eye alternately. Meanwhile, eye movements were registered with the EyeLink 1000 Plus (SR-Research). The cover test sequence consisted of three repetitions of binocular fixation, left eye occlusion, binocular fixation and right eye occlusion. Each period lasted 5 seconds. Phoria was computed as the displacement of the occluded and fixating eyes from their positions in the previous binocular period. The final phoria was the median of the six values obtained at each occlusion. It was repeated twice in two different sessions separated by a rest of 40 minutes for test-retest repeatability analysis. Horizontal phoria at near was also assessed with the PCT and the TH once at the beginning of the first session.

**Results :** 30 non-presbyopic adults participated in the study. The mean accuracy  $\pm$  SD of eye-tracker's recordings was  $0.27^\circ \pm 0.10^\circ$ . The direction of the measured deviation with the automated and objective cover test was the same between sessions in all subjects. The mean difference of the magnitude of phoria between sessions  $\pm$  SD was  $0.15 \pm 0.79$  prism diopters (PD) ( $p=0.32$ ) and both measurements were highly correlated ( $r=0.98$ ,  $p<0.001$ ). Concerning the agreement between methods, the direction of the deviation did not differ significantly with either the PCT or the TH (Chi-square,  $p<0.05$  for the three pairs of tests). Repeated

measures ANOVA showed no significant differences between the magnitude of phoria measured with the three methods ( $p=0.71$ ). The 95% limits of agreement of the automated and objective cover test were  $\pm 7.47$  PD and  $\pm 5.23$  PD while mean differences were 0.10 PD and 0.38 PD when compared with the PCT and the TH, respectively.

**Conclusions :** The use of eye-trackers to measure phoria has several advantages: (1) movements of the occluded eye can be recorded; (2) it provides better resolution and repeatability than conventional clinical methods and (3) the measure is objective. 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.

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