

Optimal rotation speed for maximum visual acuity using dynamic rotating optotypes

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Introduction: Everyday visual experience involves dynamic objects. However, standard visual acuity (VA) charts contain stationary optotypes that measure recognition acuity. The dynamic optotype (DYOP) VA chart (Chart 2020®) measures motion discrimination of a spinning optotype, and more closely resembles daily experiences. Additionally, DYOPs are devoid of recognition bias or memorization issues, and do not require literacy. Previous studies showed a relationship between rotation speed of Landolt Cs and VA. The goal of this study was to examine the relationship between DYOP rotation speed and VA.

Methods: The VA of healthy participants was measured in random order, two times for each of three rotation speeds (10, 40 and 100 revolutions per minute (RPM)) at 50% contrast, on a 60 Hz, 17"LCD monitor, at a distance of three meters. Participants requiring a refractive correction were randomly examined both in the corrected and uncorrected states. In a two-alternative forced choice paradigm, participants were asked to determine which optotype is spinning and its direction (clockwise or counter-clockwise). Optotype size was reduced after each correct response. The final VA was the target size in which only three of five presentations were correctly identified. VA outcomes of emmetropes and corrected ametropes (group 1) were analyzed separately from outcomes of uncorrected ametropes (group 2). For each sub-group, the VA obtained for each RPM was compared using repeated measures ANOVA.

Results: The study included 75 participants (51 female, 38 ametropes, mean age: 23.87 ± 4.01 , range: 18-38). The mean LogMAR VA was significantly better ($p < 0.02$) in the 40 RPM condition compared with the 10 and 100 RPM conditions for both sub-groups (10RPM: 0.13 ± 0.11 , and 0.5040 ± 0.24 ; RPM: 0.02 ± 0.12 , and 0.46100 ± 0.25 ; RPM: 0.08 ± 0.15 , and 0.59 ± 0.28 , for group 1 and group 2, respectively).

Conclusions: This study found a significant relationship between rotation speed of dynamic optotypes and VA. Similarly to previous studies, our study showed that 40 RPM provided the best VA. This rotation is the default rotation speed of DYOPs in Chart2020®.