Objective horizontal heterophoria measurements using a new vision analyzer

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Purpose: To compare the results of two subjective methods used to measure horizontal heterophoria with an objective method implemented in a prototype of a new vision analyzer (EVA) that records eye movements while the patient watches a true-3D videogame.

Introduction:

- **Heterophoria is the relative deviation of the visual axes after breaking fusion.**
- **Nowadays, in clinical practice heterophoria can be measured using subjective methods (influenced by patient and examiner) or objective methods (influenced by examiner).**
- **An objective method based on the Alternating Cover Test has been implemented in a prototype (Figure 1) of a fully autonomous and automated vision analyzer (Eye and Vision Analyzer, EVA, DAVALOR, Spain), those eliminating examiner influence.**

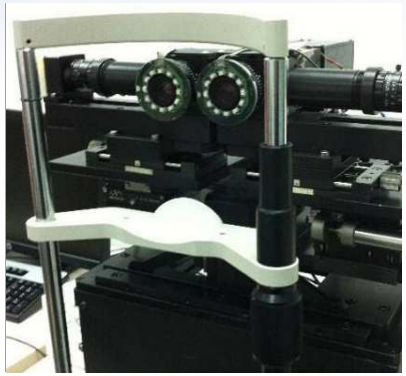


Figure 1: Prototype of Eye and Vision Analyser, EVA, used in this study.

Methods:

- **Patients: 54 young healthy patients were selected for this study. The mean age ± standard deviation (SD) was 21.5±1.5 years (range:19 to 24).**
- **Inclusion criteria: Far and Near Visual Acuity (VA) ≥ 0.0 logMAR; Spherical Ametropia ≤ ±6.00D; Astigmatism ≤ 3.00D; No previous history of amblyopia or strabismus, ocular pathology or history of eye surgery..**
- **Test distance: 40 cm**
- **Run time, including time for instructions, was also measured**

Von Graefe with a line of letters (VGL)

- Stimulus dissociation: 15 PD BD (RE); 8PD BU (LE) using phoropter Risley prism.
- Optotype: Vertical line of letters corresponding to a VA of 0,2 logMAR.
- Increment speed of prismatic diopters was 2PD/sec
- E≈450 lux
- 3 measurements with a time interval of 5 sec.
- The mean heterophoria value for each patient was considered.

Modified Thorington (MT)

- Stimulus: Spotlight
- Stimulus dissociation: Maddox rod with horizontal orientation (RE)
- E≈50 lux
- 3 measurements with a time interval of 5 sec.
- The mean heterophoria value for each patient was considered.

Objective Alternanting Cover Test (OACT)

- While watching binocularly a 3-D video game, one of the patient eyes was occluded for 2 seconds. This procedure was repeated 5 times alternating between each eye.
- Optotype: Letter corresponding to a VA of 0,2 logMAR
- Eye movements were recorded by the eye-tracker (30Hz).
- The mean heterophoria value for each patient was considered.

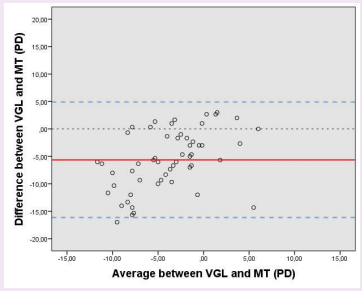
Results:

	Mean phoria±SD (PD)*	Run Time (sec)
VGL	-6.7 ± 6.0	137 ± 20
MT	-1.0 ± 3.8	83 ± 13
OACT	-2.0 ± 3.0	26 ± 5

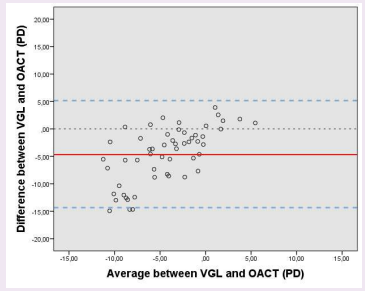
Mean phoria and run time for each method.
** Negative (positive) value exophoria (esophoria)*

	Mean difference (PD)	95% CI (PD)	ICC (%)
VGL vs MT	-5.6 ± 5.3	4.8 to -16.0	61.2
VGL vs OACT	-4.6 ± 4.6	9.0 to -13.6	61.9
MT vs OACT	0.9 ± 2.8	6.4 to -5.5	80.4

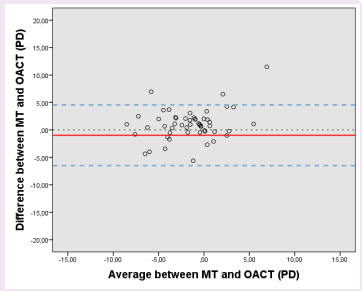
Mean difference, confidence interval and intraclass correlation when methods were compared.



Bland & Altman graph, VGL and MT comparison.



Bland & Altman graph, VGL and OACT comparison.



Bland & Altman graph, MT and OACT comparison.

Conclusions:

- **The EVA prototype is a useful device to objectively measure horizontal heterophoria.**
- **Difference in heterophia values obtained using OACT and MT (considered the gold standard of subjective methods) is lower than 1PD (not clinically significant)**
- **OACT is over 3 times faster than MT and over 5 times faster than VGL.**

References:

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