Reliability of vergence facility measured subjectly. There are agreement with a new vision analyser?

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Purpose: To determine the agreement between the results of the near vergence facility (VF) obtained objectively in a prototype of a new fully autonomous and automated vision analyser (Eye and Vision Analyzer, EVA, DAVALOR, Spain) with the subjective method commonly used in clinics. Also were determined the intra-subjects and inter-examiner repeatability.

Introduction:

Evaluation of binocular vision skills includes analysis different accommodative and motor fusion skills. Vergence facility, defined as the number of cycles per minute (cpm) that a stimulus can be fused through alternating base-in (BI) and base-out (BO) prisms, attempts to capture the ability of the fusional vergence system to respond rapidly and accurately to changing vergence demands over time.

In clinics, vergence facility is a subjective method because is the patient has to indicate every time he is able to fusion one stimulus.

To try to avoid the observer and examiner effect, the objective vergence facility is implemented in a prototype of a new fully autonomous and automated vision analyser (Eye and Vision Analyzer, EVA, DAVALOR, Spain) (*Figure 1*) that records eye movements while the patient watches a true-3D short video game.

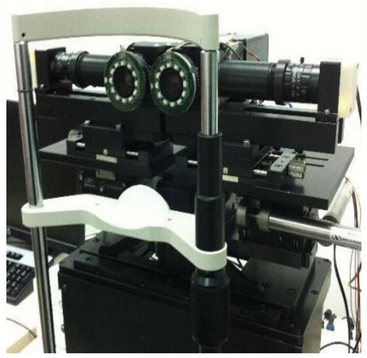


Figure 1: Prototype of Eye and Vision Analyzer, EVA, used in this study

Methods:

This study was performed in two groups using two different methods. The subjective vergence facility (SVF) was performed in 54 young healthy subjects (mean age 21.5±1.5 years) and the objective vergence facility (OVF) was performed in a subsample of 16 subjects (was 22.1±2.7 years). All of them didn't have previous history of strabismus or amblyopia. The monocular visual acuity required at far and near distance was ≥ than 0.0 logMAR.

Subjective vergence facility (SVF)

The measurements were performed with flip prism of 3ΔBI and 12ΔBO during 1 minute.

· Intra-observer repeatability: The measurements were performed in 2 sessions, separated 5-10 days and done by the same examiner.

· Inter-examiner repeatability: The measurements were performed in the same session by 2 different examiners, in a random order.

Objective vergence facility (OVF)

The measurements were performed in 3 different combination of prism magnitude:
· C1: 3ΔBI / 12ΔBO
· C2: 8ΔBI /8ΔBO
· C3: 6ΔBI / 6ΔBO

Measurements were done during 20 seconds in each combination for each measurement in random order and repeated three times.

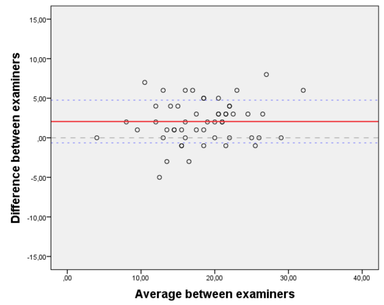
Results:

Inter-examiner and intra-observer repeatability for SVF

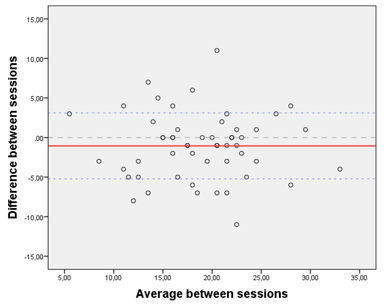
- **Inter-examiner reliability: The mean difference was 2.06±2.7 cpm (p<0,001) and the Pearson Coefficient (PC) was 0.89 (p<0,001) (*Graph 1*).**
- **Intra-observer repeatability: The mean difference was 1.06±4.2 cpm (p=0.74) and the PC was 0.74 (p<0,001) (*Graph 2*).**

Agreement between OVF and SVF

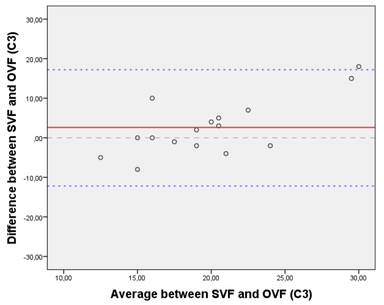
- **The mean OVF values were 9.5±11.3 cpm for C1, 14.1±9.3 cpm for C2 and 20.8±8.2 cpm for C3.**
- **The mean SVF values was 18.3±1.9 cpm.**
- **The best agreement was between SVF and OVF (C3) with a difference of 2.5±7.2 cpm (p=0.19) and PC of 0.58 (p=0.02) (*Gaph 3*).**
- **In ANOVA test there were not statistically significant differences (p=0.136) between all four methods.**



Graph 1: Bland and Altman plot. Comparison between examiners.



Graph 2: Bland and Altman plot. Comparison intra-subjects.



Graph 3: Bland and Altman plot. Comparison between SVF and OVF (C3)

Conclusions:

1. **The EVA prototype is a useful device to objectively measure VF. The OVF measured with EVA (6ΔBI/6ΔBO criteria) have a good agreement with the SVF (3ΔBI/12ΔBO criteria).**
2. **For SVF the inter-examiner results show that the agreement is better than the intra-observer results.**
3. **Further studies can improve the best prism combination to optimize the clinical pass/fail cut-off with EVA.**

References:

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3. S. Jainta, J. Hoormann, W. Jaschinski. (2007). Objective and subjective measures of vergence step responses. *Vision Research* 47. 3238–3246

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