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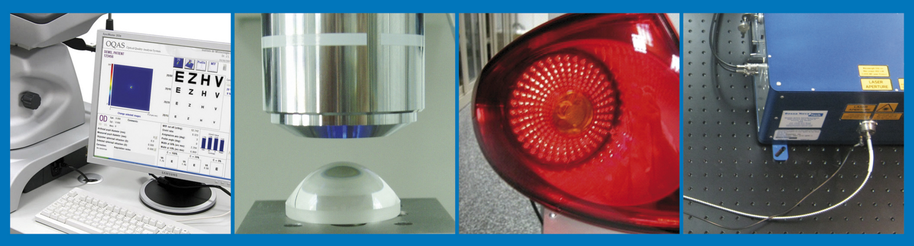

REPEATABILITY AND AGREEMENT OF COMMERCIAL INSTRUMENTS FOR PUPIL MEASUREMENTS: VIP-200, POWEREREF II, WAM-5500 AND EVA

AUTHORS:

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1 - PURPOSE

To compare the pupil measurement performed with four instruments: VIP-200 (Neuroptics), PowerRef II (Plusoptix), WAM-5500 (Grand Seiko) and EVA (Davalor Salud).

2 - INTRODUCTION

Measurement of the pupil diameter: standard element of refractive surgery.
There are several pupillometers:

- The VIP-200 [1] (Neuroptics) (Figure 1): considered a gold standard of pupillometry.
- The WAM-5500 [2] (Grand Seiko) (Figure 2) and PowerRef II [3] (PlusOptix) (Figure 3): open-field autorefractometers, gold standard for accommodation studies.
- The Eye and Vision Analyzer (EVA) [4] developed by Davalor Salud, S.L. (Spain), based on a stereoscopic virtual reality system with matching convergence and accommodation planes. It is designed to perform binocular and accommodation tests (Figure 4).

Figure 1. VIP-200

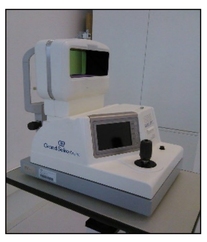


Figure 2. WAM-5500

Figura 3. PowerRef II

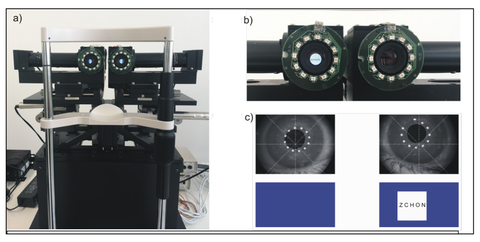


Figura 4. Eye and Vision Analyzer prototype.

3 - METHODS

Forty patients, with mean age of 26.98±7.89 years, participated in the study.

Pupil diameter was measured in each instrument under three illumination conditions:
low mesopic (0.05 lux), mid mesopic (1.00 lux) and high mesopic (20.00 lux)

Measurements in each instrument were taken in ascending order of illumination.

For each instrument and condition two measurements were performed (test-retest).

The order of the instruments was randomized.

Repeatability of each instrument was studied as the difference and **standard deviation (SD) of the differences** between the first and the second measurement (i.e., test-retest) of each instrument compared with itself.

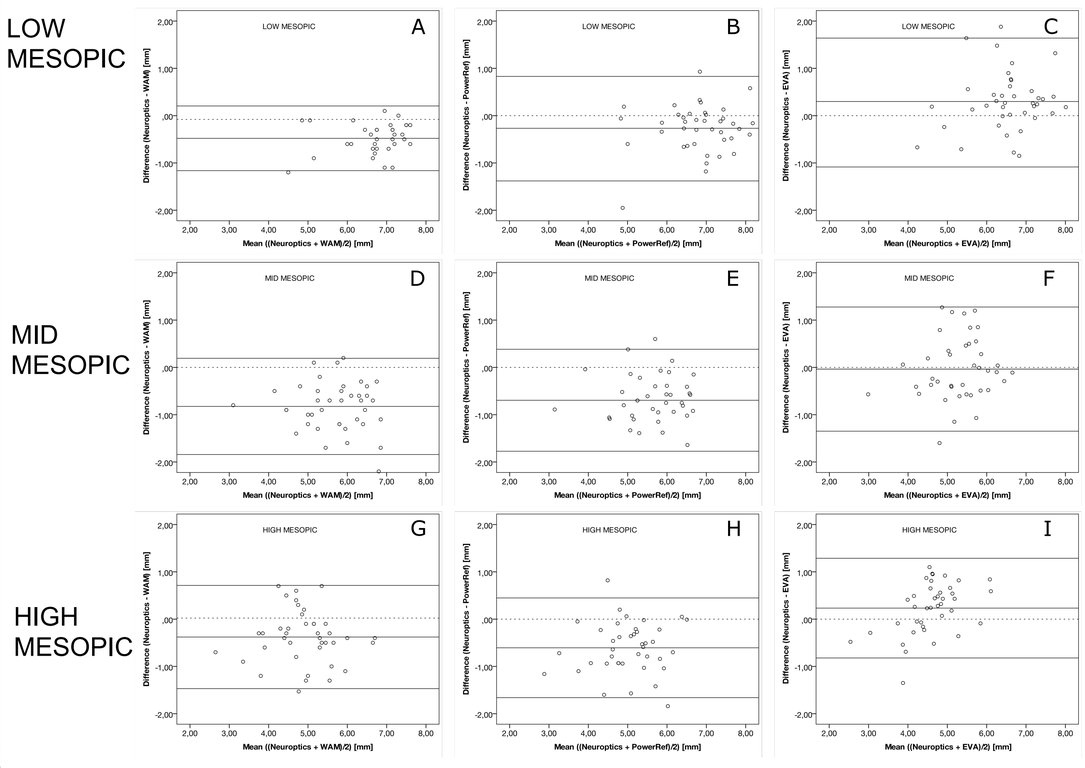
Agreement was studied as the mean difference and SD of the difference in relation to the reference measurement (the VIP-200). **Bland and Altman** plots were also analyzed.

4 - RESULTS

In relation to the agreement, the mean ± SD of the difference with respect the VIP-200 for mesopic low, mid and high conditions were respectively:

NEU - WAM-5500: -0.479±0.349mm, -0.825±0.519mm and -0.378±0.557mm
NEU - PowerRef II: -0.277±0.563mm, -0.695±0.550mm and -0.606±0.538mm
NEU - EVA: 0.279±0.696mm, -0.036±0.670mm and 0.233±0.538mm

Bland and Altman plots for the agreement analysis: comparison of WAM-5500, PowerRef II and EVA with respect the VIP-200:



4 - RESULTS

Table 1. Repeatability (test-retest)

		Mean diff. [mm]	SDdiff. [mm]	CI 95% [Inf., Sup.] [mm]
LOW MESOPIC	VIP-200	-0,093	0,159	[-0,143,-0,042]
	WAM-5500	-0,050	0,166	[-0,108,0,008]
	PowerRef II	-0,035	0,271	[-0,122,0,052]
	EVA	-0,043	0,288	[-0,135,0,049]
MID MESOPIC	VIP-200	-0,045	0,177	[-0,102,0,012]
	WAM-5500	-0,123	0,228	[-0,195,-0,050]
	PowerRef II	-0,131	0,367	[-0,248,-0,013]
	EVA	-0,035	0,464	[-0,183,0,113]
HIGH MESOPIC	VIP-200	-0,075	0,225	[-0,147,-0,003]
	WAM-5500	-0,172	0,335	[-0,279,-0,064]
	PowerRef II	-0,114	0,281	[-0,204,-0,024]
	EVA	-0,094	0,250	[-0,174,-0,014]

5 - CONCLUSIONS

All the instruments showed similar repeatability with small differences among them and the VIP-200 showing the best results.

Regarding the agreement,

- EVA showed the best agreement with the reference instrument
- WAM-5500 and PoweRef II had considerable differences with a bias towards bigger pupils, which is consistent with the results of Bradley et al. [1].

6 - BIBLIOGRAPHY

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7 - ACKNOWLEDGEMENTS

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