MAIA microperimeter for central vision loss: Repeatability of short-duration fixation stability measurements

[1]Yulia Pyatova, [1,2]Samuel N Markowitz, [1,2]Robert Devenyi, [2]Luminita Tarita-Nistor

[1]Department of Ophthalmology, Toronto Western Hospital, Toronto, Canada; [2]Donald K Johnson Eye Institute, Krembil Research Institute, University Health Network, Toronto, Canada

Introduction

Fixation stability has become an important outcome measure for evaluating intervention and/or disease progression in patients with central vision loss.

The most common instruments to assess fixation stability in these patients are the Nidek MP (1 and 3) and MAIA microperimeters.

Repeatability of short-duration fixation stability has been reported for the MP1, but not for MAIA.[1,2]

Purpose

To examine:
1) the repeatability of fixation stability measured with MAIA for a fixed 20s-duration, and
2) the agreement between MAIA and the MP1

Participants

N = 24 patients with low vision (12 F; 12 M)

Mean age 77 ± 9 years

Based on visual acuity, n = 19 BE (better eye) and n = 19 WE (worse eye) tested

Total N = 38 eyes tested

Methods

Fixation stability recorded for 20s fixed intervals:

- With MAIA microperimeter (CenterVue, Padova, Italy)
- With the MP1 microperimeter (Nidek Technologies Srl., Padova, Italy)

- 4 fixation recordings per eye (twice with MAIA and twice with the MP1), in the same visit

- The instrument order changed with each patient

Procedure

For fixation recording or each eye the following measures were obtained:

- 95% BCEA (bivariate contour ellipse area) as provided by the examination output

- Eye position raw data

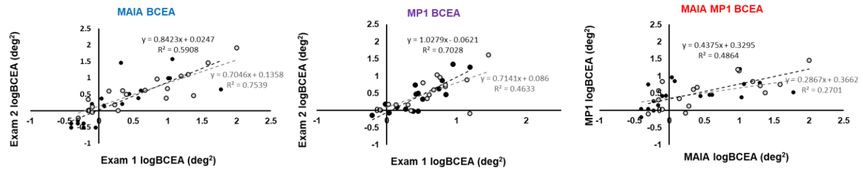
Data Analysis

To normalize the data, a log transformation was applied to the BCEA

Repeatability of 20s-fixation stability was assessed with Bland-Altman plots; bias and the 95% limits of agreement were determined for MAIA, MP1, and MAIA – MP1 combined

Results

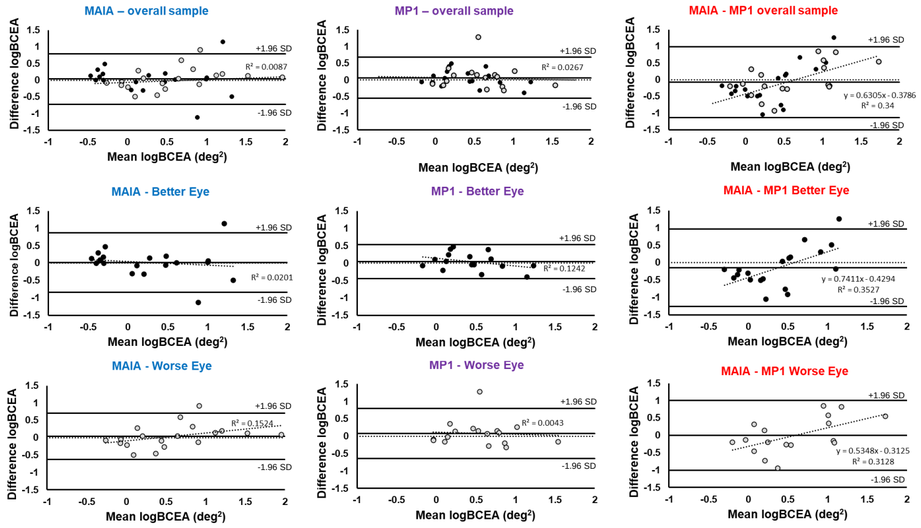
Relationships between fixation examinations



Strong correlations between exam 1 and 2 for BE and WE with MAIA and MP1 (black symbols indicate BE and gray symbols indicate WE)

Weaker relationships between exam 1 of MAIA and of MP1, particularly for WE

Bland-Altman plots



MAIA: larger 95% limits of agreement for BE, similar for WE

MP1: limits of agreement in accordance with past research

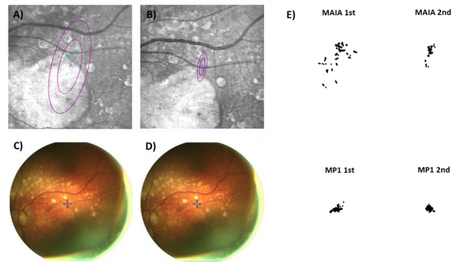
Poor agreement between the 2 instruments. Evidence of proportional bias

95% limits of agreement (deg²)	MAIA Bias (ULA; LLA)*	MP1 Bias (ULA; LLA)	MAIA – MP1 Bias (ULA; LLA)
Overall sample	0.03 (-0.72; 0.79)	0.07 (-0.55; 0.68)	0.08 (-1.13; 0.98)
BE	0.02 (-0.84; 0.88)	0.05 (-0.44; 0.54)	0.15 (-1.26; 0.96)
WE	0.04 (-0.62; 0.71)	0.08 (-0.64; 0.80)	0.0 (-1.0; 1.0)

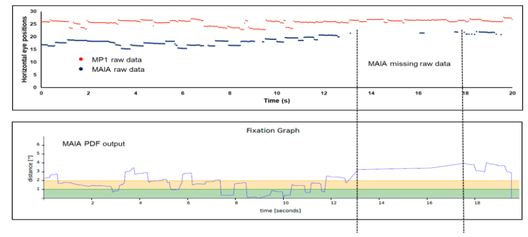
**ULA = upper limit of agreement; LLA = lower limit of agreement*

Commercial interests: None

Problems revealed by the raw eye position data



1) MAIA includes far outliers in the BCEA calculation (panels A and E). MP1 does not (panel C,D, and E)



2) MAIA does not always capture all the expected eye position data points; as little as 60% of data are used for the BCEA calculation. Upper panel shows traces plotted from raw data; lower panel shows traces presented by the MAIA output.

Conclusions

1) The MAIA's 95% limits of agreement for 20s-fixation stability are larger than those of the MP1 for BE, and similar for WE

2) Proportional bias exists: MAIA underestimates stable fixations (smaller values) and overestimates poor fixations (larger values) compared to the MP1

3) MAIA presents shortcomings in data acquisition and BCEA calculation that could be easily addressed by the manufacturer

Repeatability of fixation depends on the instrument used. Same type of microperimeter should be employed when using fixation stability as outcome measure in clinical trials or when monitoring disease progression and treatment.

References

[1]Bedell HE, et al. Invest Ophthalmol Vis Sci 2015;56:2624-30
[2]Samet S, et al. Can J Ophthalmol. 2018;53:229-35