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OPTIMA Ophthalmic Image Analysis

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Deep-learning supported pointwise structure-function correlation from healthy eyes to intermediate and late non-exudative age-related macular degeneration

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Objective

-- Understanding the impact of structural biomarkers and localized functional changes is essential for evaluation of novel **therapeutic targets in non-exudative AMD**

-- Pointwise correlation between morphological **OCT** changes and **microperimetry** by precise 1:1 co-registration between **DL**-quantified biomarkers in OCT volumes and **sensitivity changes in MP**

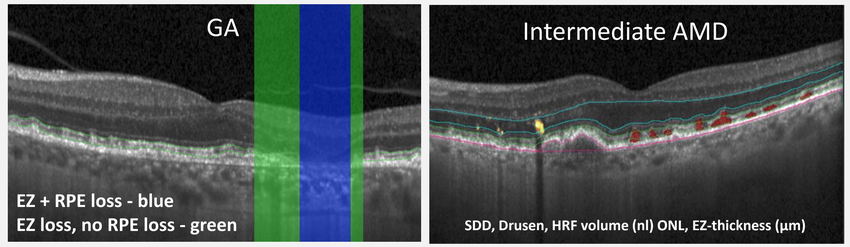
Methods

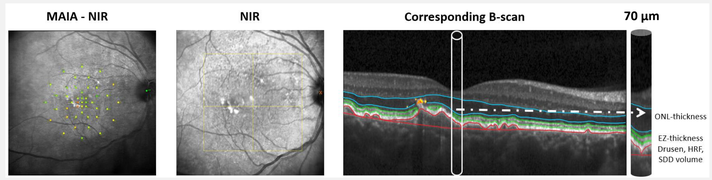
- **60 eyes of 60 patients**
- 20 **controls**, 20 **iAMD**, 20 **GA**
- OCT imaging (Spectralis)
- 4 x Microperimetry / patient
  2 x MP-3, 2 x MAIA

	MP3	MAIA
Size Duration	Goldman III, 200 ms	Goldman III, 200 ms
Test strategy	4-2	4-2
Range	34 dB	36 dB
Background	31.4 asb 10 cd/m²	4 asb 1.27 cd/m²
	photopic	**mesopic**

References
Macular Sensitivity Endpoints in Geographic Atrophy Exploratory Analysis of Chroma and Spectri Clinical Trials Chang et al., Oph. Science 2023
Structure-Function Analysis in Patients With Intermediate Age-Related Macular Degeneration Saßmannshausen et al., IOVS 2018

Deep-learning based biomarker quantification





Results

Healthy age-matched controls

- Increased **EZ thickness (+0.05/µm [0.03;0.1])** and **ONL thickness (+0.03/ µm [0.03;0.04])** associated with **higher PWS** *(p < 0.001)**.

Intermediate AMD

- Increased **EZ thickness** associated with **higher PWS** with strongest **effect at 0° foveal eccentricity** *(p < 0.005)*.
- Increased **ONL thickness** associated with **higher PWS** with strongest **effect at 5.2° foveal eccentricity** *(p < 0.001)*.
- **Drusen, HRF and SDD** associated with **lower PWS** *(all p < 0.05)**

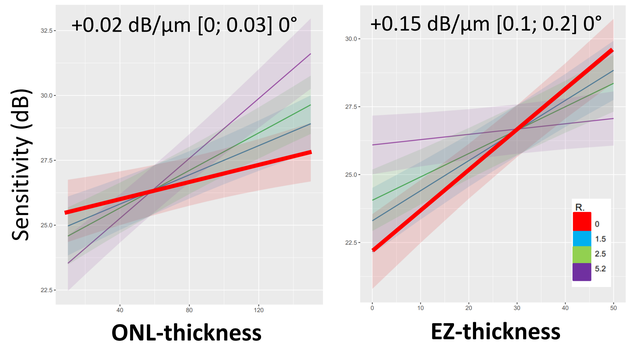
**Accounting for age*

GA

- Both, areas with **EZ loss, without RPE loss** and areas **with EZ loss and RPE loss** have significantly lower PWS compared to areas with intact EZ *(both p = 0.001)*** with stronger effect with increasing eccentricity.

***Accounting for age, HRF and drusen volume*

iAMD predicted Sensitivity (dB)

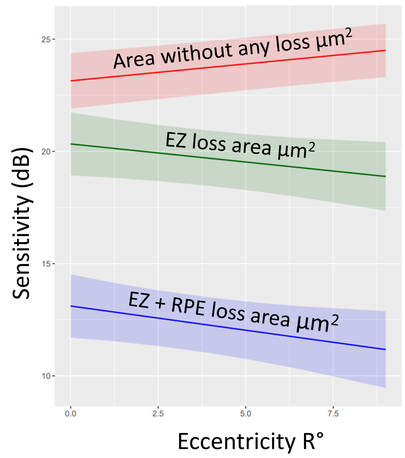


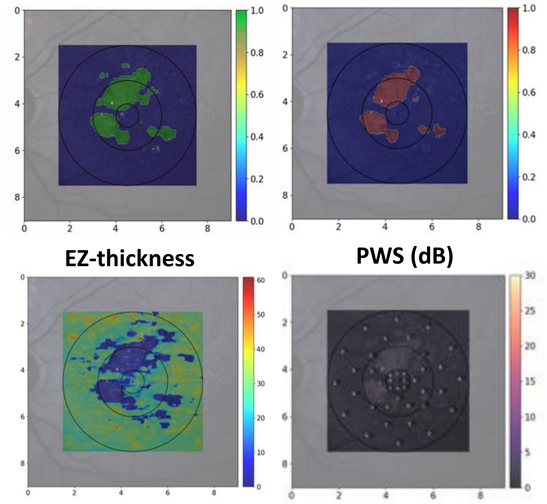
Multivariate mixed-effect models

	iAMD
Drusen (nl)	-1 dB/nl [CI -1;-0.2]
HRF (nl)	-10 dB/nl [CI -13;-6]
SDD (nl)	-1 dB/nl [CI -2;-0.3]
	GA
EZ, no RPE loss	-3 dB [CI -4;-2]
EZ + RPE loss	-10 dB [CI -11;-9]
EZ-thickness	+0.3 dB/µm [CI 0.3;0.4]

Accounting for age and R°

GA predicted Sensitivity (dB)





Conclusion

Topographic pointwise correlation between DL-quantified pathognomic **non-exsudative AMD** biomarkers and function in MP shows high potential for detecting **subclinical changes**, understanding the **pathomechanism of progression, as well as personalized definitions of perilesional** changes in **GA**