

New Software to assess retinal non-perfusion on Optomap® wide-field fundus fluorescein angiography (WF-FFA) in diabetic macular oedema (DMO)

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Introduction

Diabetic Retinopathy

- Leading blindness → 20-65 years
- 20 years : 75 % any type DR
- Duration + ↑ life expectancy = blindness ↑

Diabetic macular oedema

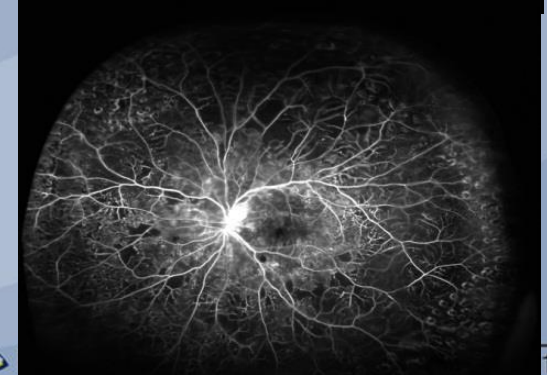
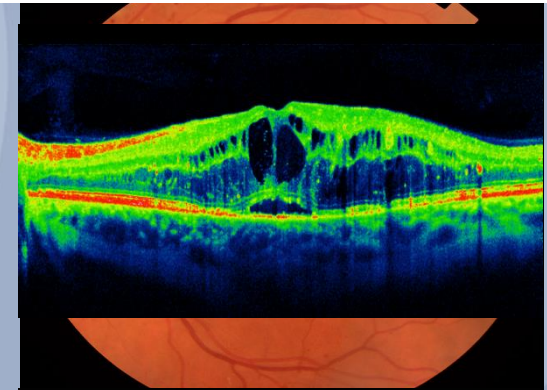
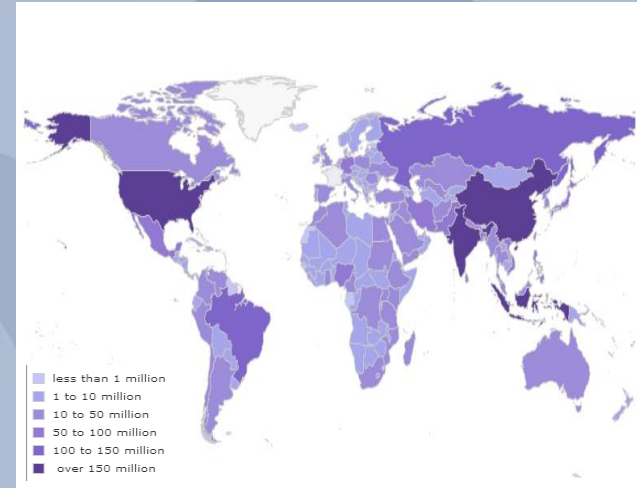
- 1st cause of visual loss in diabetic
- 20 years diabetes → 28%

Retinal ischaemia may be associated to DMO

1. In DR hypoxia/ischaemia → stimulates VEGF

- break down of blood-retinal barriers
- retinal vessel permeability

2. Anti-VEGF treatment successful in DMO

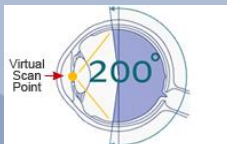
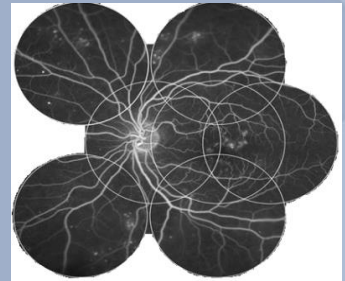


Retinal Ischaemia Imaging

- **Conventional retinal imaging:** makes challenging study association

- **Retina ischemia**

- Best characterized with FFA
- Traditional FFA employs RP able image 30° - 40° : 1 time
- The ETDRS develop (7SF) protocol: 75°
- WF-FFA: it is now possible to view up to 200° of retina in single photograph



Peripheral retinal ischaemia, as evaluated by ultra-widefield fluorescein angiography, is associated with diabetic macular oedema

Matthew M Wessel, Nandini Nair, Grant D Aaker, Joshua R Ehrlich, Donald J D'Amico, Szilárd Kiss

Aim:

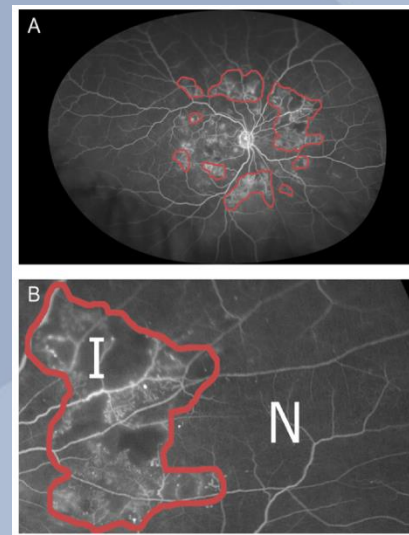
Determine relationship retinal ischaemia - DMO

Methods:

122 treatment naïve DR eyes and presence of DMO: WFFA + OCT

Results:

- 62% eyes retinal ischaemia
- Direct correlation peripheral ischemia – DMO ($p < 0.001$)
- Retinal ischaemia had 3.75 times increased odd of DMO



New software to assess retinal non-perfusion on Optomap® Wide-Field Fundus Fluorescein Angiography in Diabetic Macular Oedema

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Aim

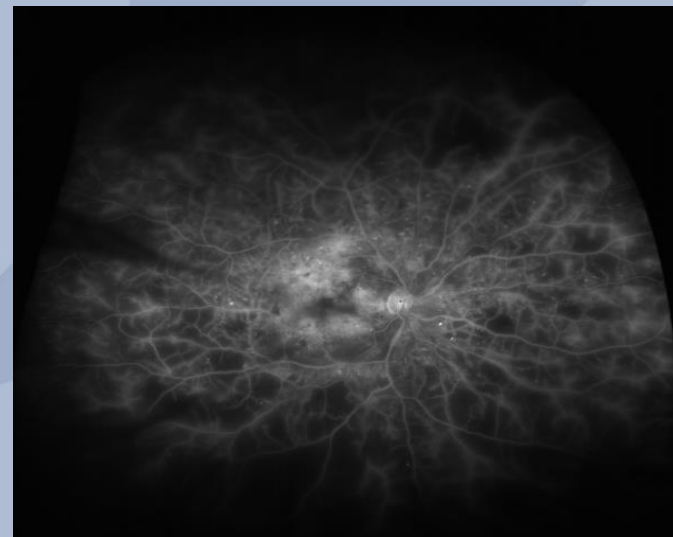
To create a software that takes into account peripheral image distortion

1. Assess location + quantify area of retinal non-perfusion
2. Relationship retinal non-perfusion with
Central Macular Thickness (CMT)

Methods

A retrospective 113 DMO eyes underwent
Optos[®] (WF-FFA) was recorded

1. The software
2. Grading
3. Statistical analysis



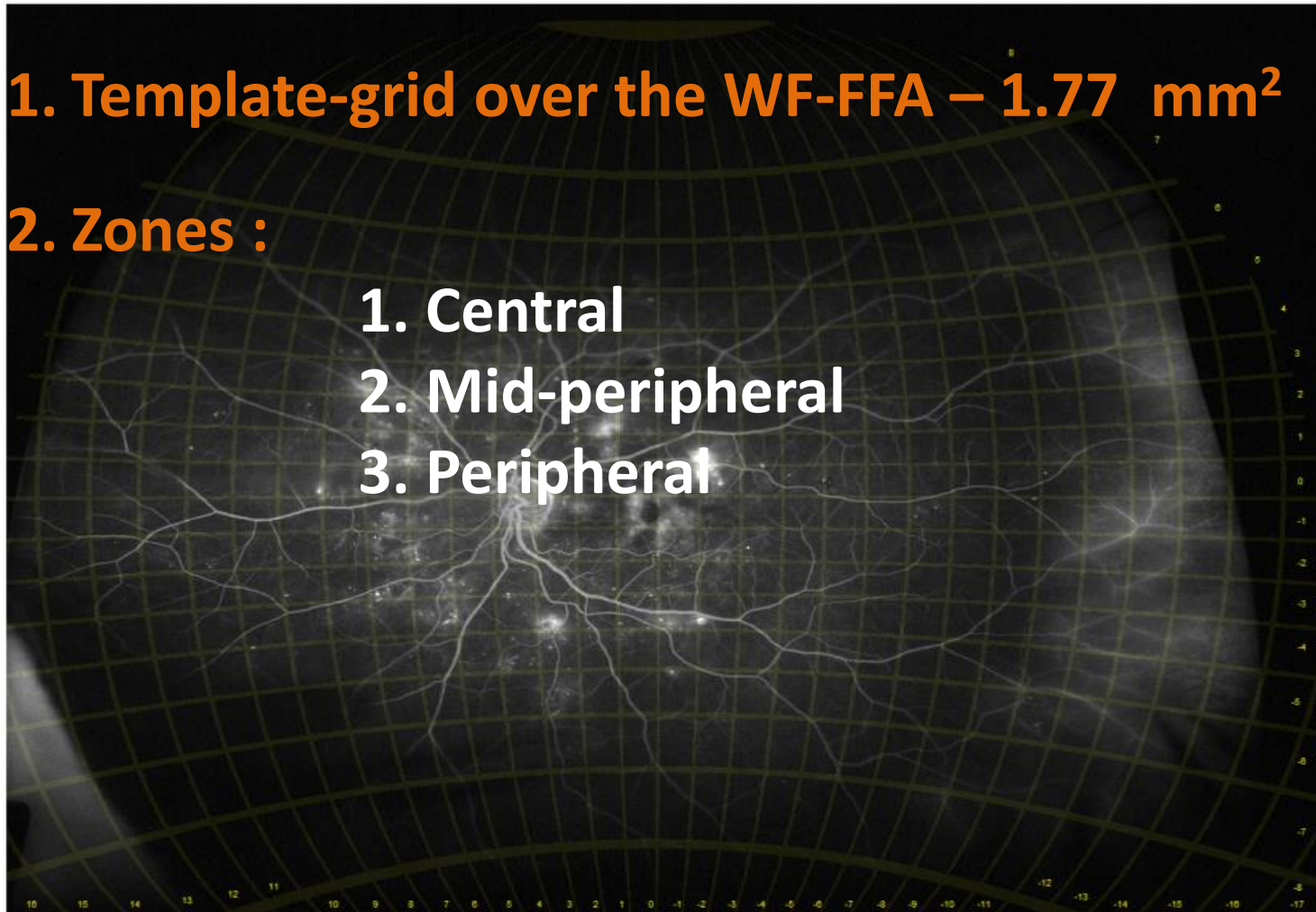
1. The software



1. Template-grid over the WF-FFA – 1.77 mm²

2. Zones :

1. Central
2. Mid-peripheral
3. Peripheral



1. The software

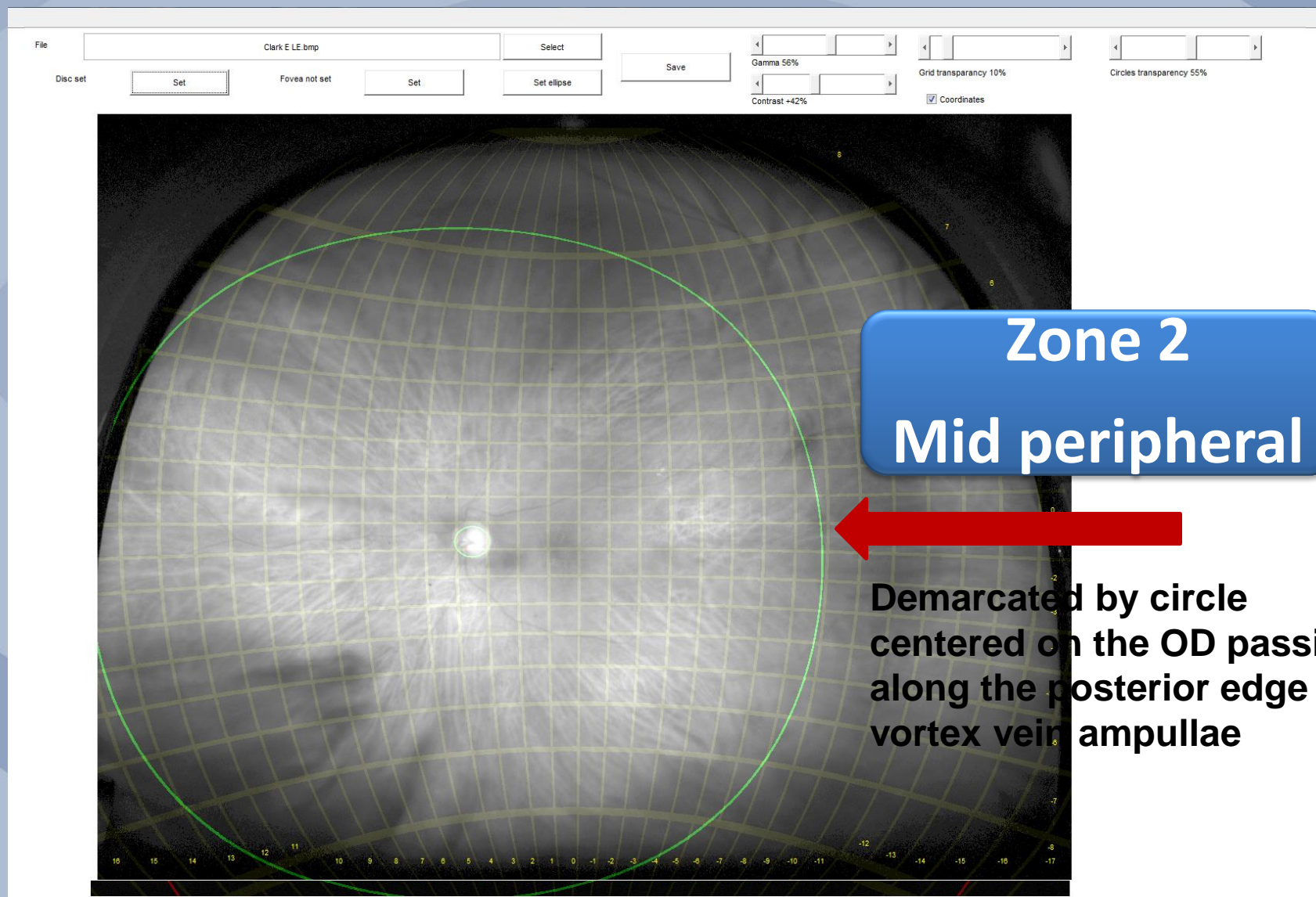
File:
 Disc set: Fovea set: ☒ Coordinates

2. Image divided in 3 zones

**Zone 1
Central**

- Ellipse centered on the fovea
- Passing 1 disc diameter from the nasal edge
- Including vascular arcades

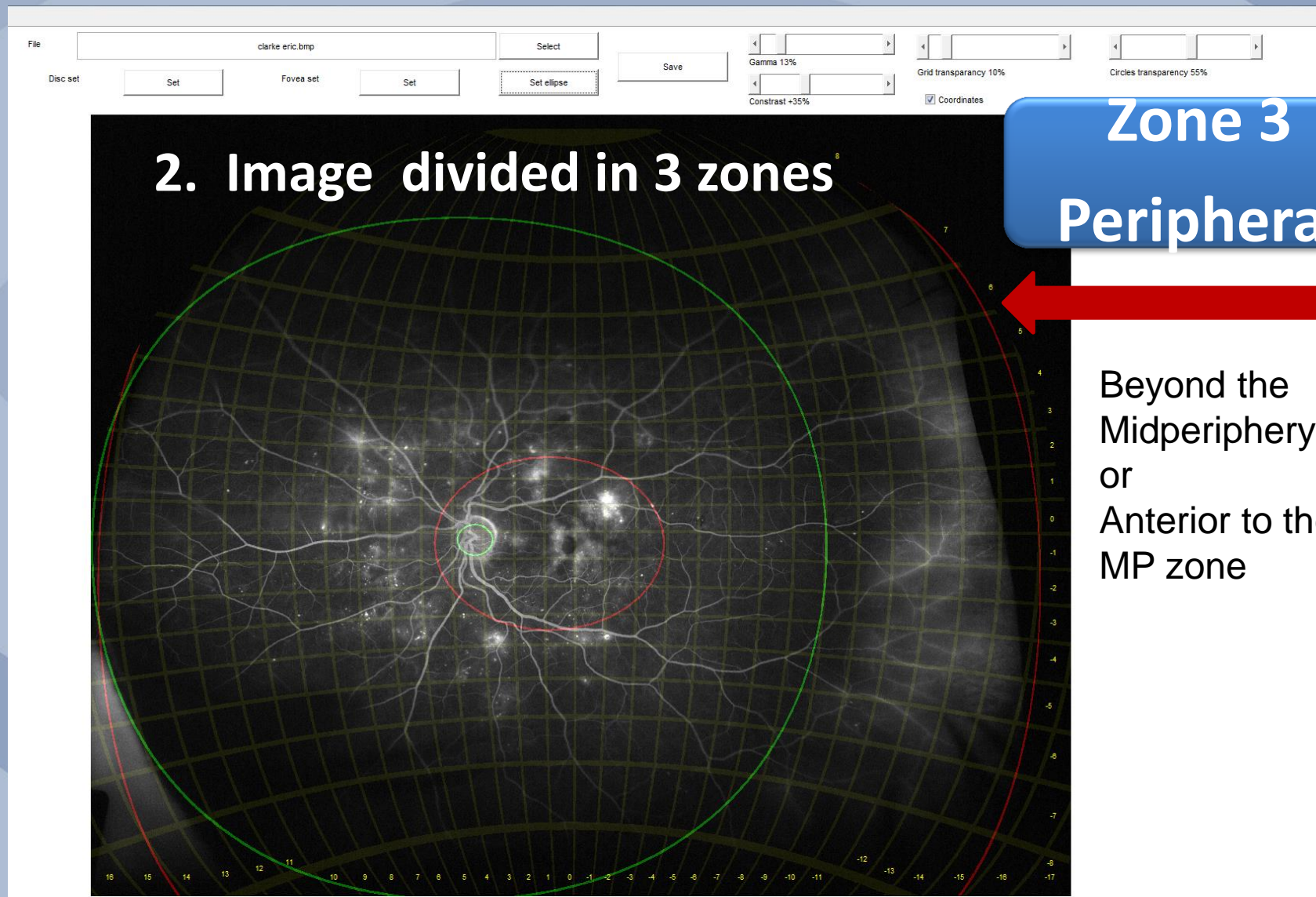
1. The software



Zone 2
Mid peripheral

Demarcated by circle
centered on the OD passing
along the posterior edge
vortex vein ampullae

1. The software

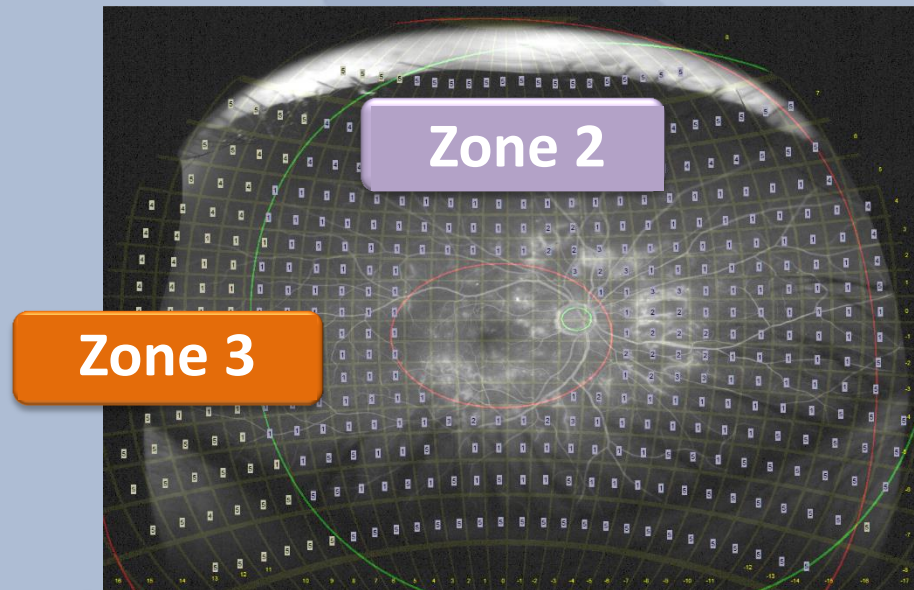


2. Grading

- Images graded using custom software-evaluate image distortion WFFFA within **zones 2 & 3**

- Each cell was scored as:

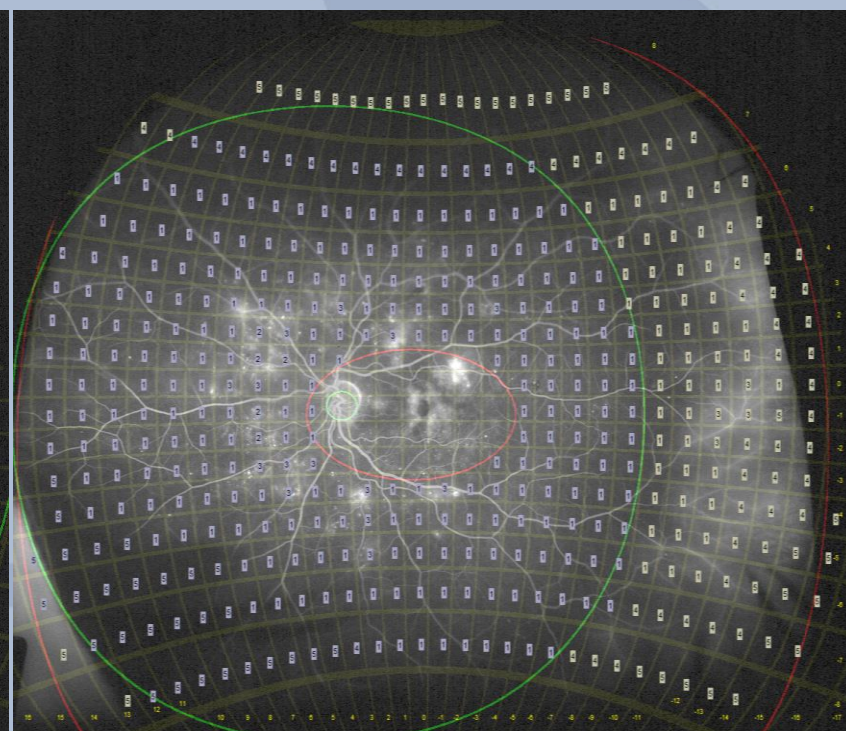
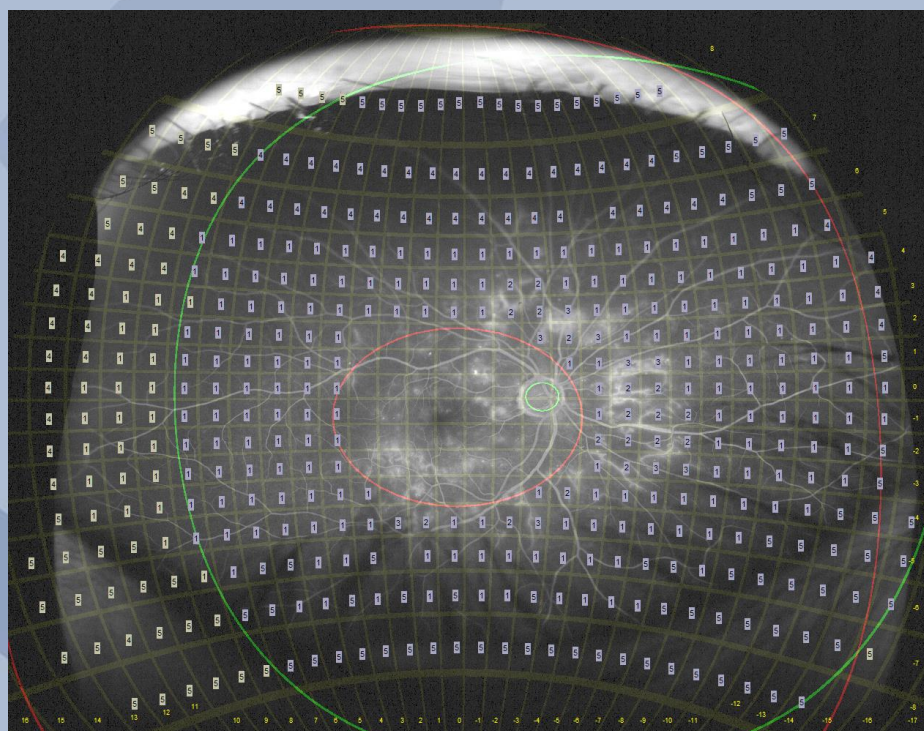
- 1 (> 50% perfused)
- 2 (> 50% ischemic)
- 3 (interface)
- 4 (no possibility to score due to image quality)
- 5 (no possibility to score due to eyelids or eyelashes)



Grading-score example

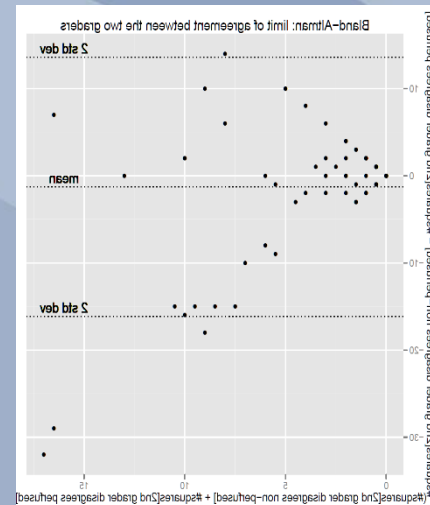
RE

LE

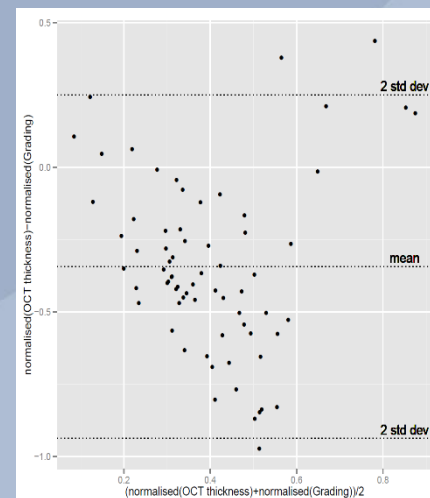


3. Statistical analysis

- Bland-Altman method was used to compare the agreement between the 2 graders
- In case of disagreement of >10 cells scored as 2 or 3 in zone 2 the image was rescored
- The same method used to show the limits of agreement between OCT thickness and grading
- Correlation coefficients were calculated to assess relationship between **CMT** and area of **retina non perfusion**



Bland-Altman: limit of agreement between the two graders



Bland-Altman: limit of agreement between graders and OCT thickness

Results

- 76 Optos[®] images - 76 eyes were included in the analysis
- Average of retinal non perfusion areas in **MP** was 4.17 (range: 0-25)
- Average of retinal non perfusion areas in **P** was 2.01 (range: 0-29)
- Correlation coefficient with CMT was 0.349 $p=0.019$

Meaning:

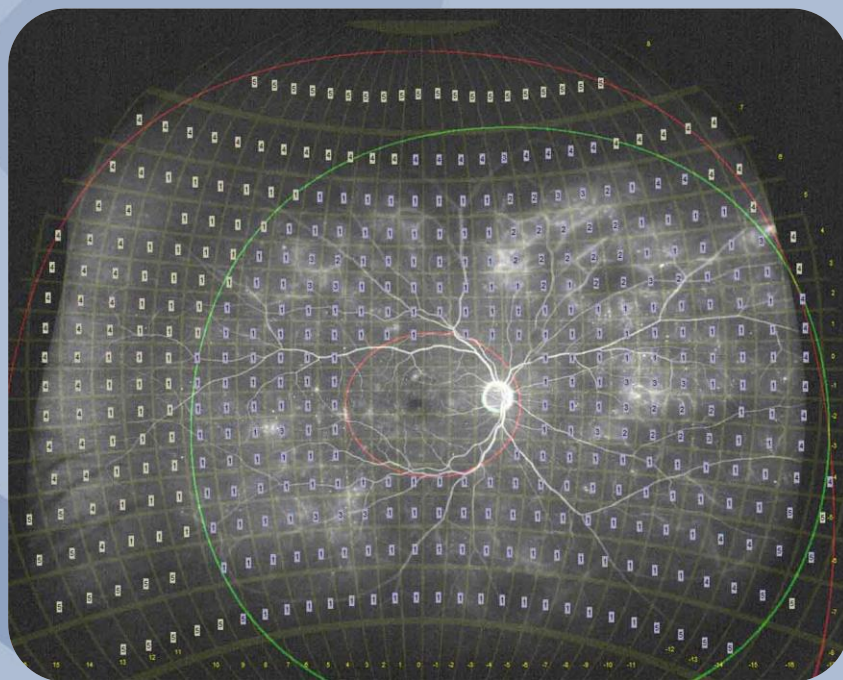
- There was no correlation between CMT - peripheral retinal non perfusion areas
- Retinal non-perfusion associated with DMO is mainly located in the **mid-periphery**

Conclusions

- This new software allows for an **objective and accurate quantification** of the area and location of retinal non-perfusion in the mid and periphery on Optomap® WF-FFA
- We found a weak correlation between CMT and mid-peripheral retinal non-perfusion.
- Retinal non-perfusion associated with DMO is mainly located in the mid-periphery
- The main limitation was the weak agreement between two graders- variations in image quality that could lead to difficulty in quantifying area of ischemic retina

The future...

Further studies using this new software are required to ascertain the area and role of retinal non-perfusion in DMO and in other ischemic retinal diseases



With thanks to:

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