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

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Br J Ophthamol 2012;96:694e698. doi:10.1136/bjophthalmol-2011-300774
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

2. Image divided in 3 zones

Zone 1
Central
- Elipse 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. Image divided in 3 zones

Zone 3
Peripheral

Beyond the Midperiphery or Anterior to the MP zone
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
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:

Manchester Vision Regeneration (MVR) Lab at NIHR/Wellcome Trust CRF

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Prof Paulo Stanga

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