Società Oftalmologica Italiana

99° CONGRESSO NAZIONALE

da mercoledì 20 a sabato 23 novembre 2019

Centro Congressi Rome Cavalieri

ROMA ...dove si incontrano i protagonisti dell'oftalmologia

150° Società Oftalmologica Italiana SOI 1869 • 2019

CORSO 136 - Corso di Diagnostica Strumentale

Direttore: A. Lucente

Istruttori: A. Carnevali , A. Lucente , P. Patteri, E. Peiretti , A. Spinello

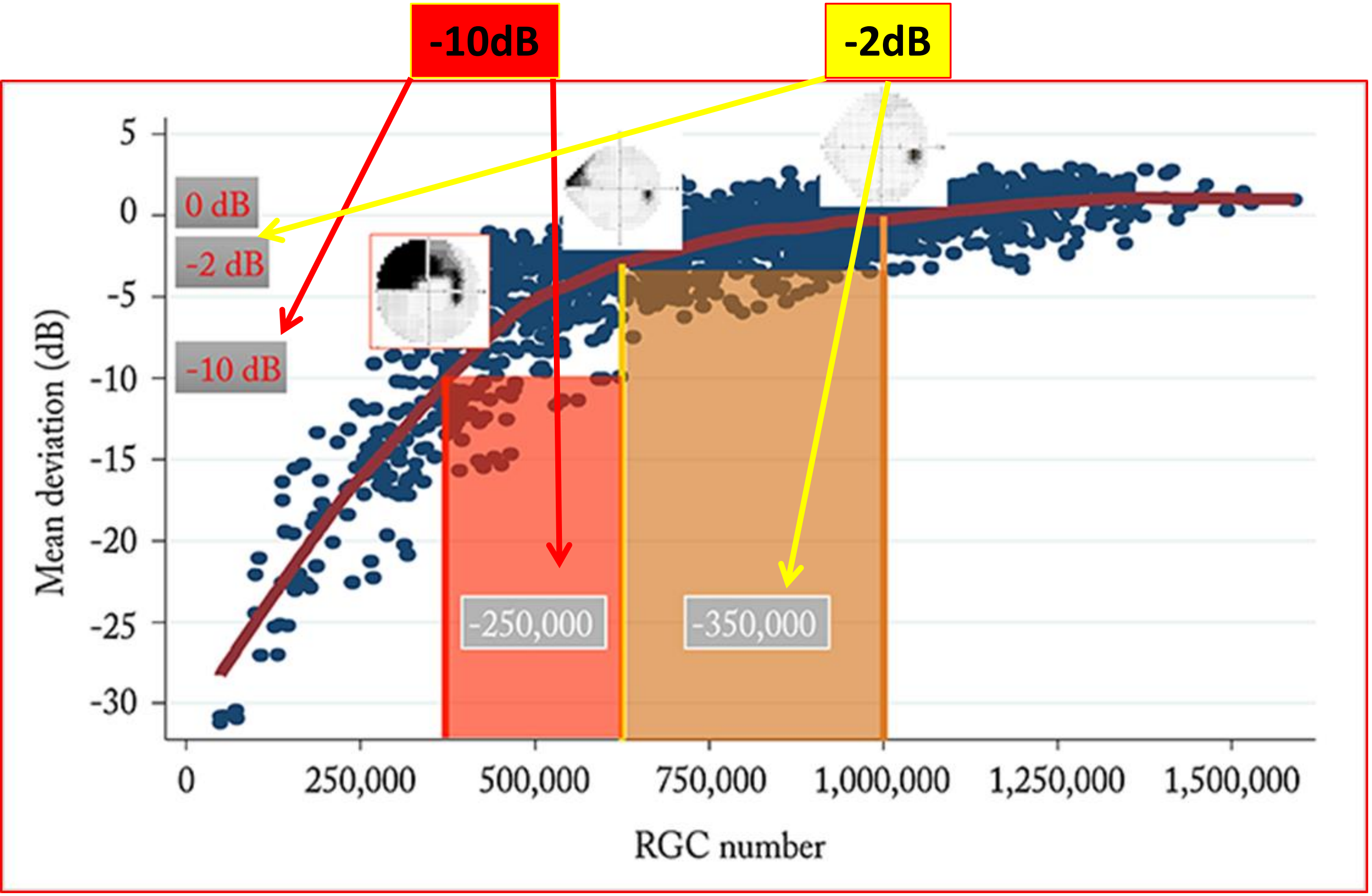
Panel: C.A. Calabro', O. Caparello, S.L. Formoso, A. Mancini, A.F. Stilo

Angio-OCT nella diagnosi del glaucoma

Studio Oculistico

In Oculis Salus

dott. A. Lucente



OCTA
3 Zone of interest for Glaucoma

Angio-OCT

Peri-Optic Disc Blood Flow

Optic Disc Blood Flow

Lamina Cribrosa

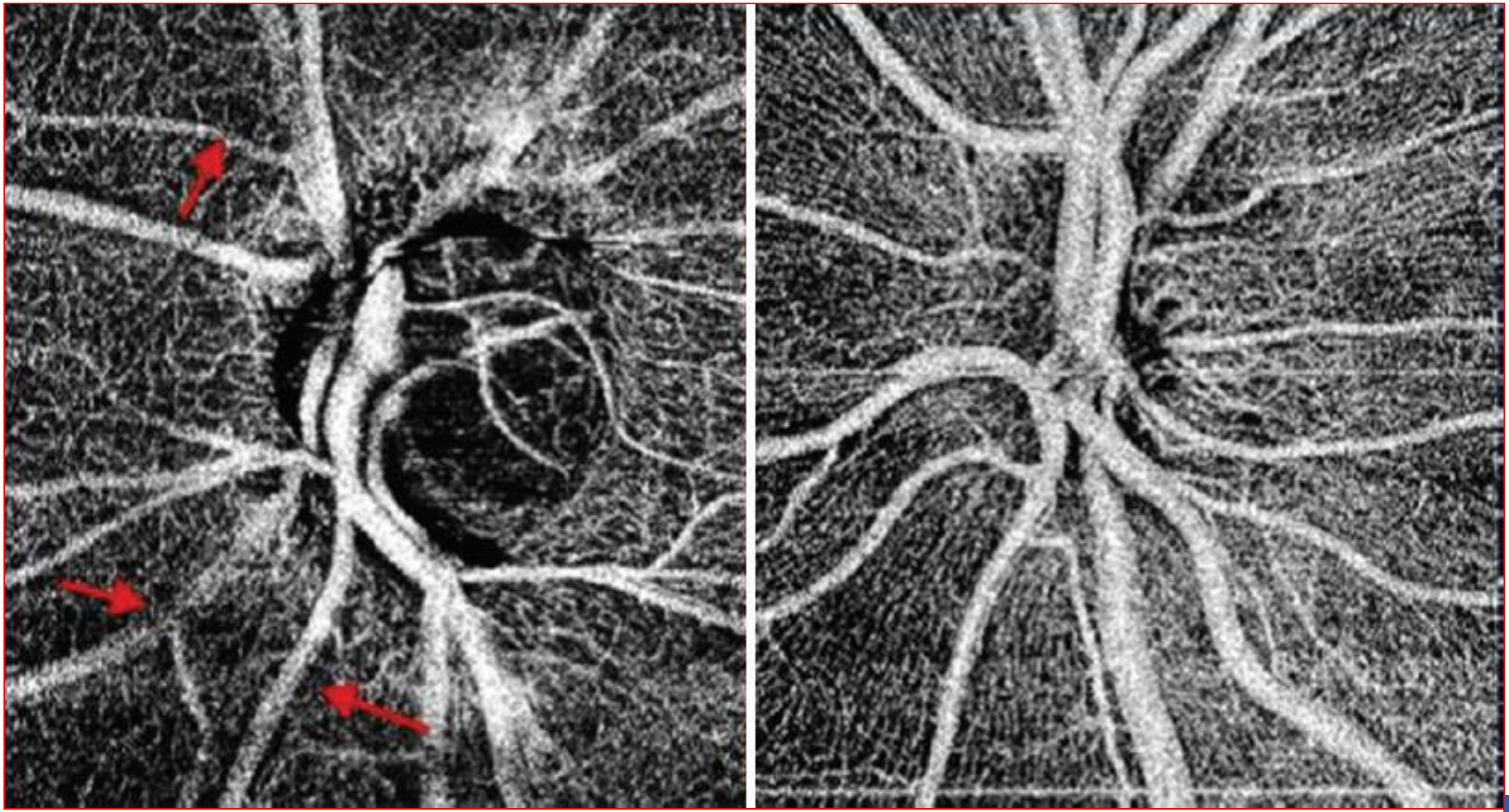
Michel Puech
Explore Vision di Parigi

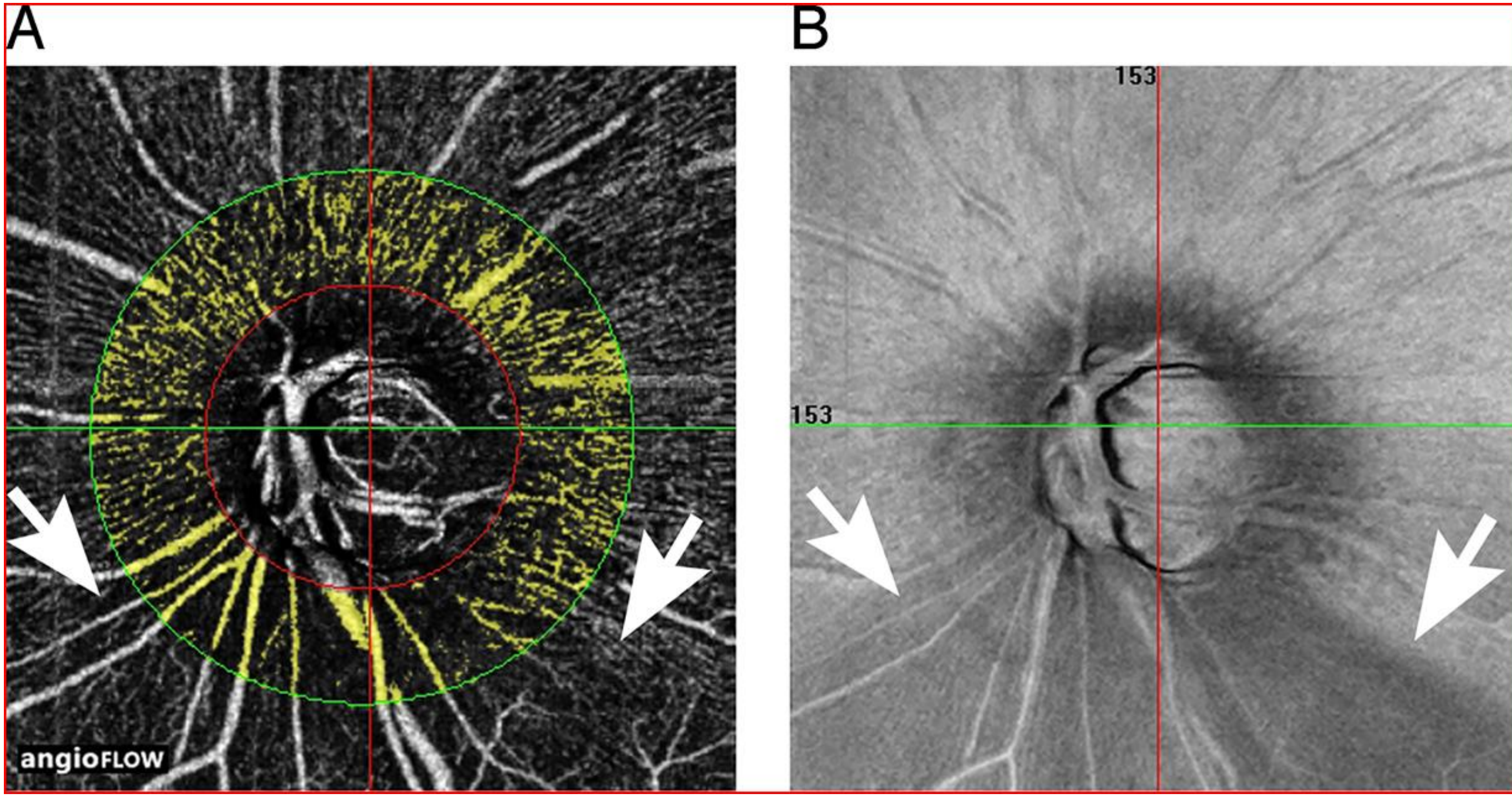
Relationship between **visual field loss** and **RGC numbers.** A normal visual field in a healthy individual has approximately **1 million RGCs**. At a **mean deviation of *-2 dB*,** which equates to an **early field defect**, **RGC number** has decreased by around **350,000 cells**. At ***-10 dB*,** a field defect that can result **in functional impairment** and **quality of life decline**, **RGC number** has **decreased** by **a further 250,000 cells from the RGC number at -2 dB**

by Felipe Medeiros The Ophthalmologist May 2017

A. Lucente, Glaucoma tra struttura e funzione. Oftalmologia domani - N. 1 - Anno 2014

Optical coherence angiography of the **optic nerve head** of a **glaucomatous disc (left)** and a **healthy disc (right)**. In addition to the general reduction in the visibility of the disc and peripapillary microvasculature in the glaucomatous disc, **focal areas** of **vascular attenuation** are visible **(arrows)**. **OCTA images can help our understanding of the pathogenesis of ONH diseases.**

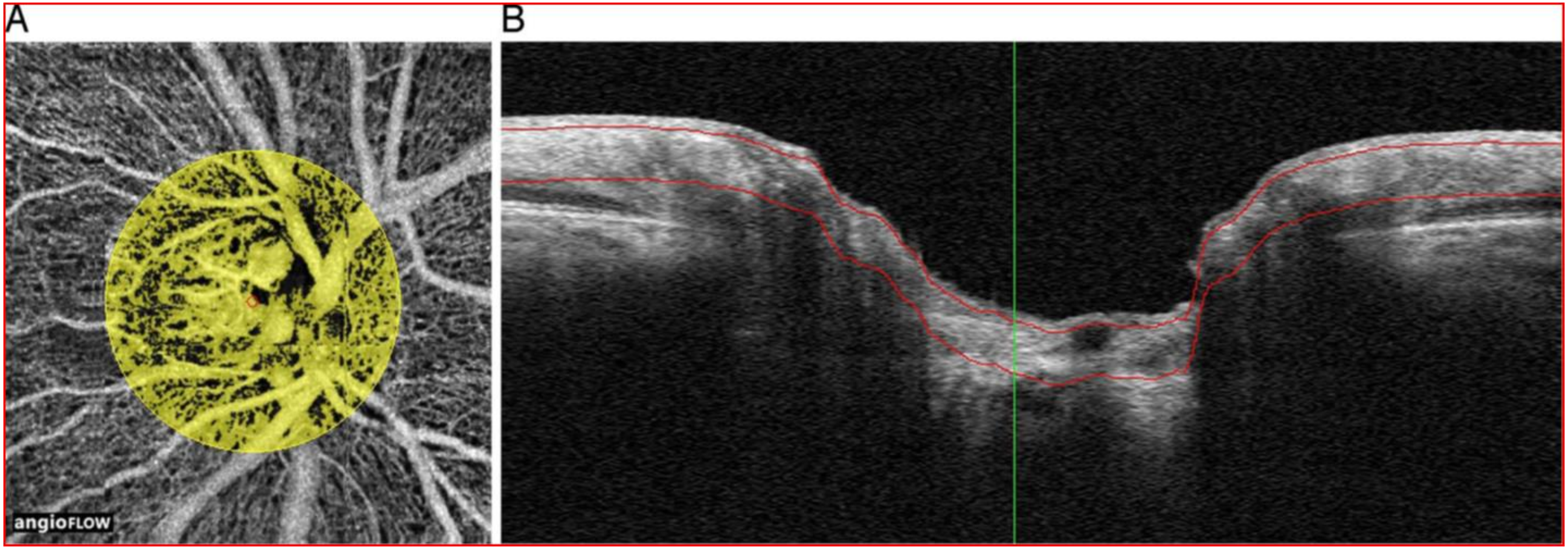




Limit Depth 0 ≤ 80 µm; limit area 700 µm

(A) The highlighted RPC (Radial Peripapillary Capillary) of the superficial retina
(B) En face image of the retinal nerve fiber layer defects (between arrows) in an eye with **POAG.**
In this image, there is a **defective RPC** between the arrows and a **corresponding** retinal nerve fiber layer defect between the arrows. In this case, the tissue depth is between **0 and 80 µm**, and the highlighted **area is 700 µm from the disc margin** (size, 4.5mm x4.5 mm)

by: Etsuo Chihara et al. http://arvojournals.org/ on 06/04/2017

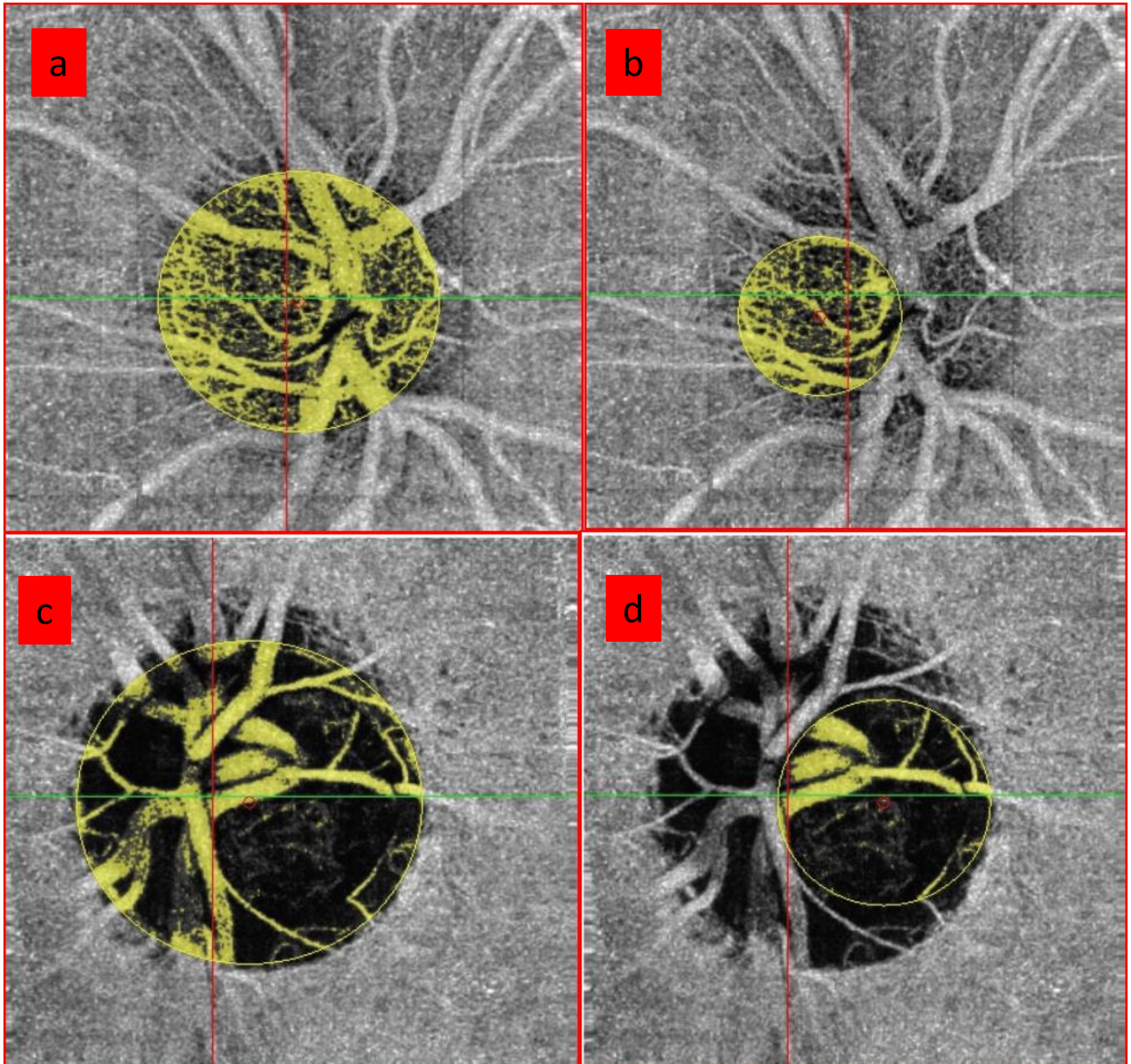


Limit: 50 ≤ 250µm

A) An example of highlighted prelaminar vessels in a **normal eye.** The vascular flow index of the prelaminar area is calculated by measuring the **mean decorrelation** in the column between **50 and 250 µm deep within Elschnig's scleral ring**

B) In the sagittal section image of the same optic **nerve head**, a large part of the *prelaminar region is included between the two red lines* **50 and 250 µm from the disc surface (size, 3x3mm)**

by: Etsuo Chihara et al. **http://arvojournals.org/ on 06/04/2017**



50 glaucoma patients and 30 normal subjects

In the glaucoma group

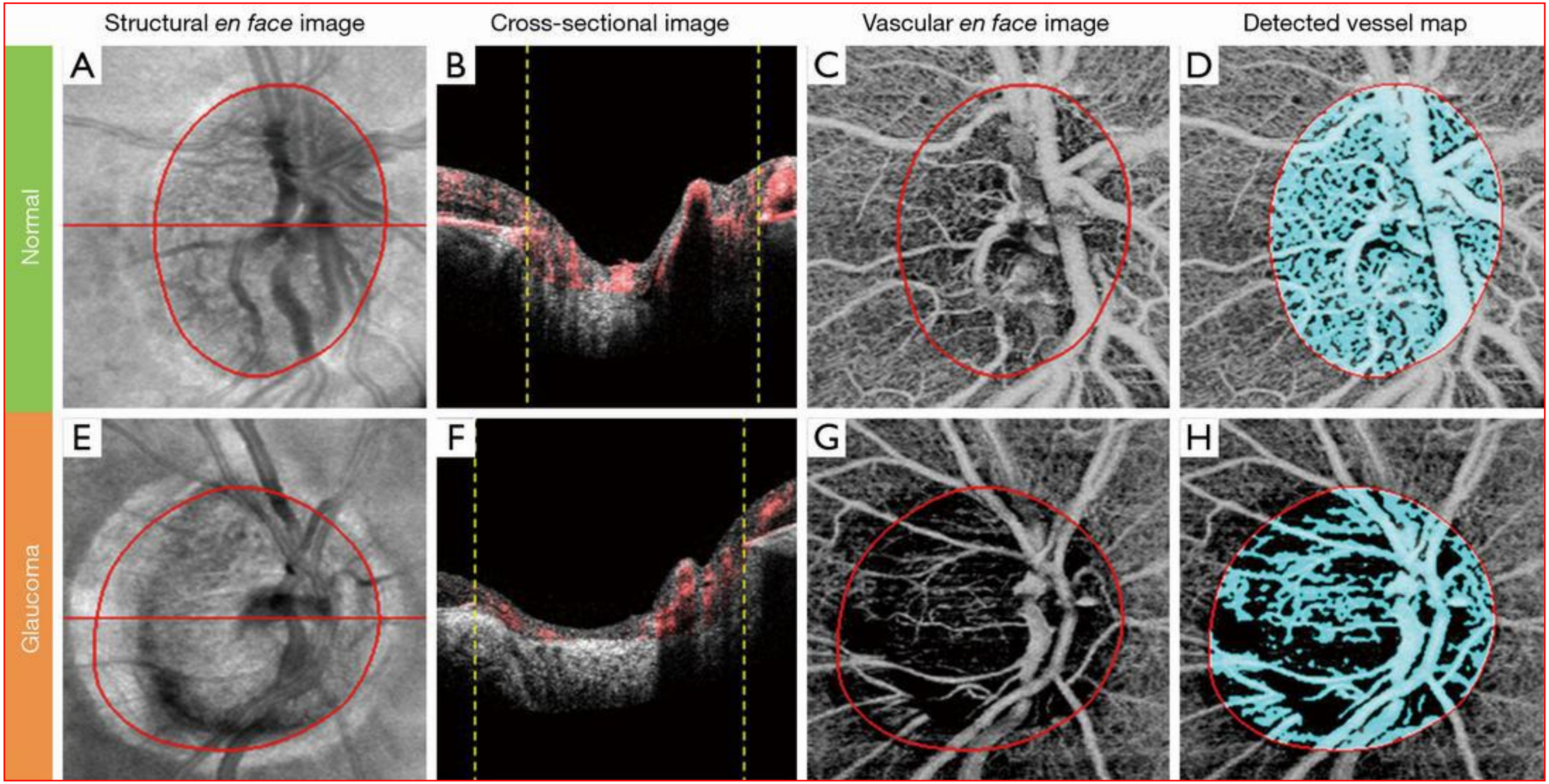
- **total ONH vessel density** were reduced by **24.7%** (0.412 versus 0.547; $p < 0.0001$)

- **temporal ONH vessel density** were reduced by **22.88%** (0.364 versus 0.472; $p = 0.001$).

Significant correlations were found between **temporal and total ONH vessel density and**

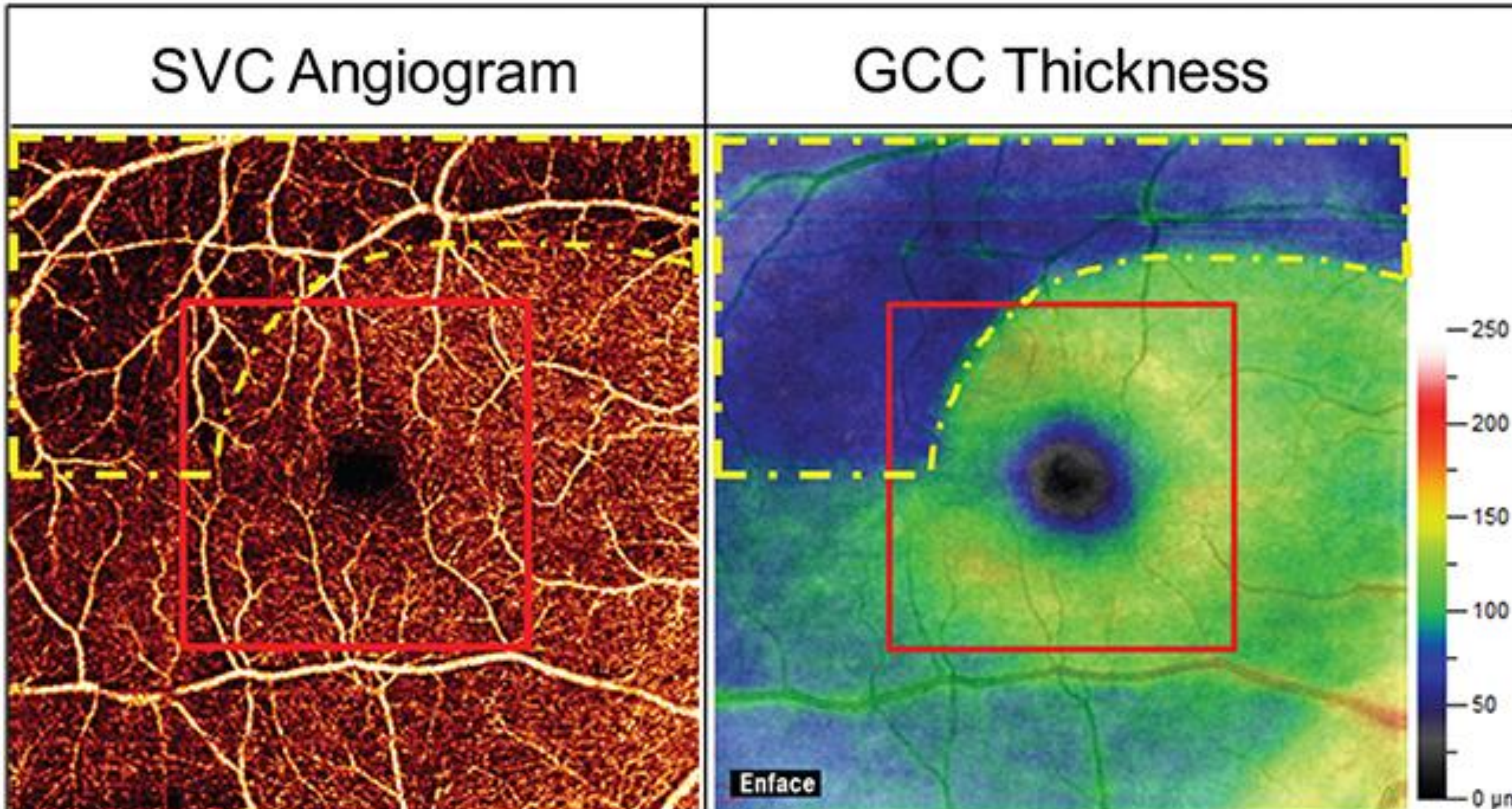
- ***RNFL***
- ***GCC***
- ***VF MD** mean deviation* -
- ***Visual field index**.*

Total **(a)** and temporal **(b)** ONH acquisition in a **normal** patient.
Total **(c)** and temporal **(d)** ONH acquisition in a **glaucoma** patient
by: Pierre-Maxime Lévêque et al. Journal of Ophthalmology 2016



An example result of the vascular en face image of pre-laminar tissue (preLC) of a **normal (A-D)** and a **glaucomatous eyes (E-H).** (A,E) Show the structural en face images; (B,F) display the cross-sectional structural images sampled at the horizontal red lines in (A) and (E) superimposed with blood flow signals from preLC, and vertical yellow dashed lines indicate the optic disc margin by detecting the end of Brush's membrane; (C,G) are the vascular en face images from preLC; (D,H) present the detected blood vessel maps from preLC. by Chieh-Li Chen

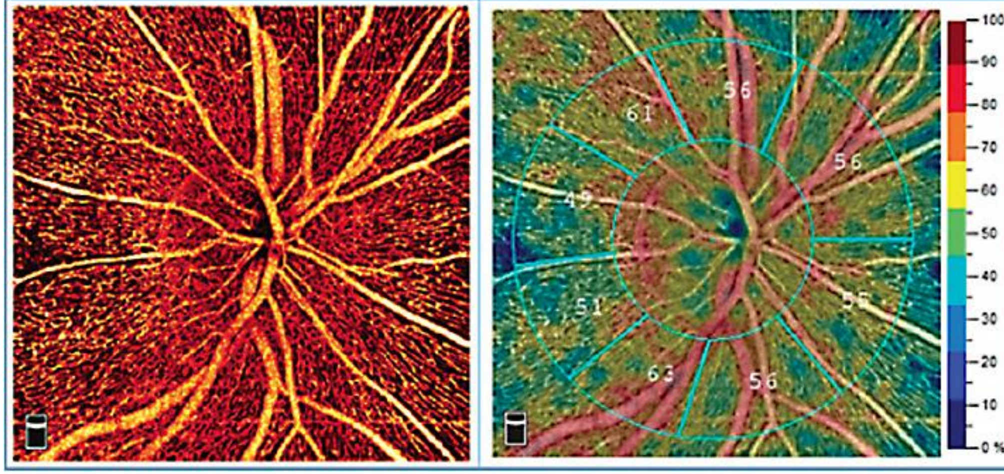
Measurement of NFLP nerve fiber layer plexus is highly correlated with NFL thickness, and SVC Superficial Vessel Complex is highly correlated with GCC



6 x 6-mm superficial vascular complex (SVC) OCT angiogram (left) and **6 x 6-mm ganglion cell complex GCC thickness** map (right) of a typical glaucomatous eye. **The glaucoma damage (yellow dashed outline) was mostly outside the central 3 x 3-mm area (the red outline)**. Thus **the larger scan area is needed for early detection of the pattern of damage common in glaucoma.**

David Huang, MD, PhD, Liang Liu, MD, Yali Jia, PhD, Portland, Oregon
Managing Glaucoma With OCT Angiography Published 26 April 2019 Rewiew of Ophthalmology

RPC Angiogram	RPC Vessel Density Map	RPC OCTA Parameters

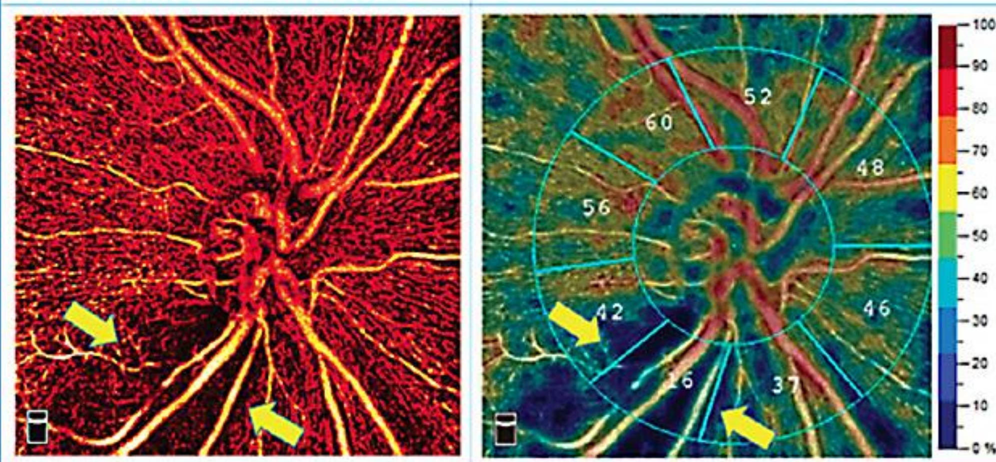


RPC Density (%)	Capillary	All
Whole Image	53.3	60.5
Inside Disc	55.3	65.7
Peripapillary	55.4	62.5
- Superior-Hemi	55.0	62.5
- Inferior-Hemi	55.9	62.4

COURTESY DAVID HUANG, MD

The most superficial vascular plexus, the **Radial Peripapillary Capillaries (RPC),** was analyzed. The sectoral vessel densities were showed in the RPC vessel density map. The RPC parameters provide capillary density (vessel density measured after excluding larger vessels from analysis) in the first column and vessel density in the second column.

RPC Angiogram	RPC Vessel Density Map	RPC OCTA Parameters



RPC Density (%)	Capillary	All
Whole Image	43.8	49.8
Inside Disc	47.2	55.4
Peripapillary	45.6	51.6
- Superior-Hemi	53.4	58.6
- Inferior-Hemi	37.1	44.0

COURTESY DAVID HUANG, MD

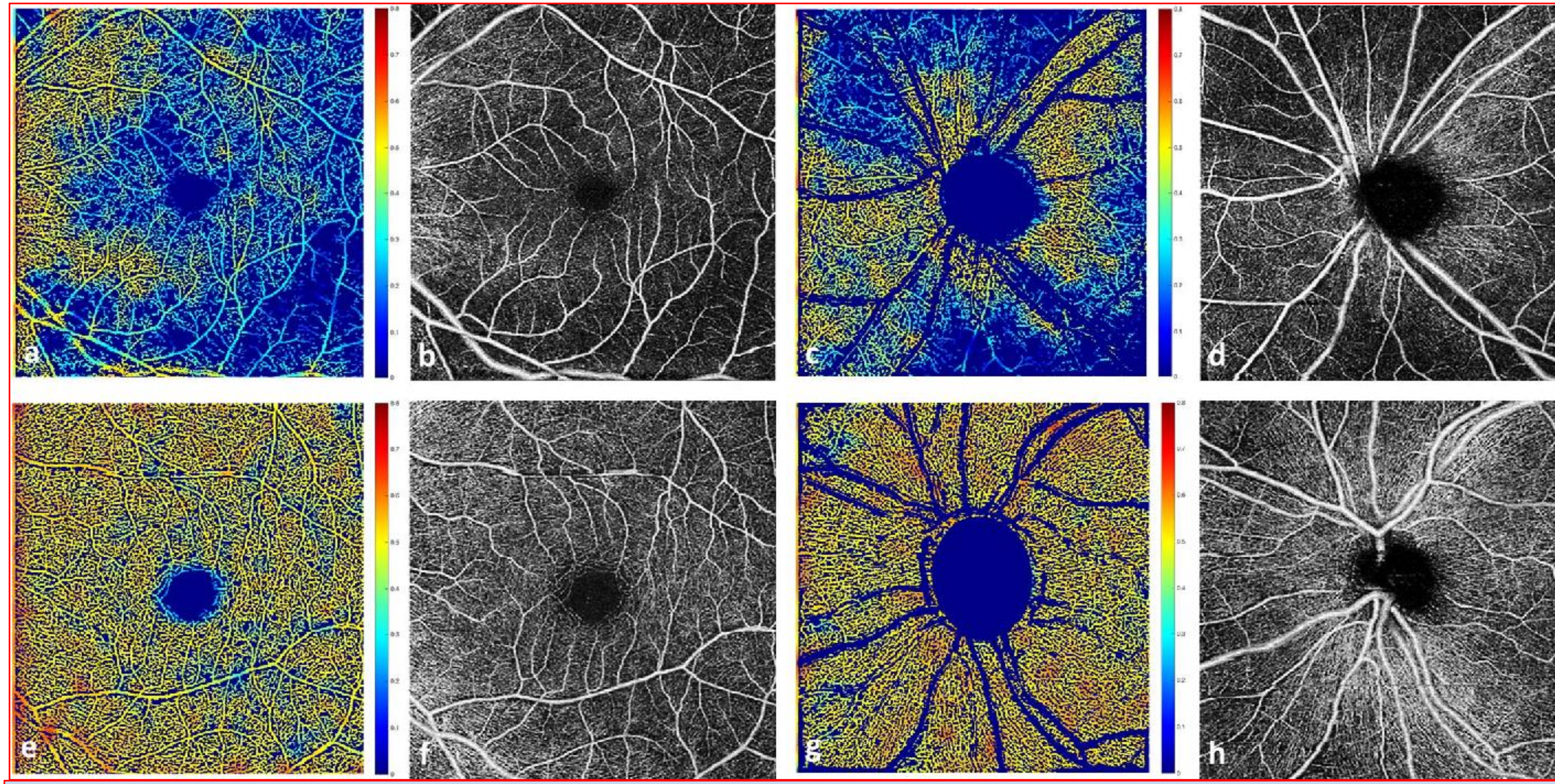
The glaucomatous perfusion defect could be visualized in the RPC angiogram and vessel density map (arrows). The **vessel density and capillary density were significantly reduced in the inferior hemisphere, more specifically in the inferior temporal sectors**.

By OCTA: A new tool for glaucoma evaluation, David Huang et al. Ophthalmology Management, Volume: 22, Issue: June 2018, page(s): 22-24

OCTA: A new tool for glaucoma evaluation

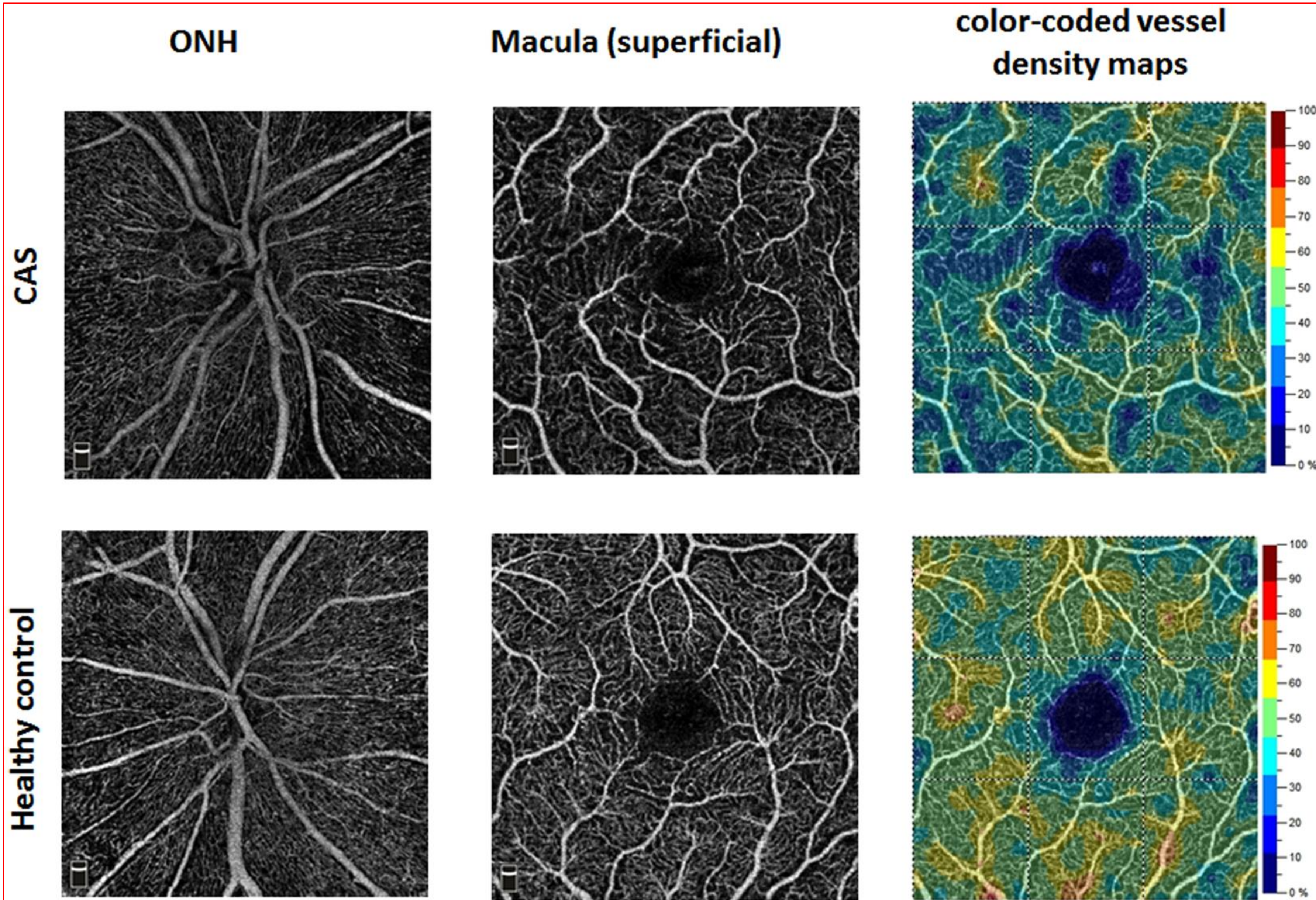
- Two clinical studies have shown that **OCTA can detect early pre-perimetric glaucoma better than structural OCT**
- **OCTA detects both dysfunctional (sick)** and **lost (dead) ganglion cells**, while **structural OCT only detects lost ganglion cells.**
- I speculate that in very early glaucoma, **sick dysfunctional ganglion cells have lower metabolism** that leads to **reduced capillary density.**
- **This reduced density is detectable by OCTA, prior to the apoptosis these ganglion cells** undergo and the **subsequent thinning of NFL and GCC that can be detected by structural OCT.**
- Other studies have shown that **OCTA parameters correlate better with visual field parameters than structural OCT parameters such as NFL thickness.**
- **The floor effect** describes the fact that while **NFL thickness is correlated with visual field mean deviation in early glaucoma**, it reaches a **floor value** in **moderate glaucoma**, and then doesn't decrease any further in **advanced glaucoma**. **This limits the utility** of **NFL thickness** for monitoring glaucoma progression **in the moderate and advanced stages.**
- While vessel density also **eventually reaches a floor**, **it appears to do so only in advanced glaucoma.** Thus **OCTA** has the potential **to improve the monitoring** of glaucoma in the **moderate to advanced stages.**

By David Huang, MD, PhD; Liang Liu, MD; Qisheng You, MD, PhD June 1, 2018



Top row: from a representative patient, left eye with severe glaucoma. (a) Vessel density map of the macula region overlaid on binary vessel map; (b) OCTA en face image, within the SRL, of the macular region with microcirculation defects greatest inferotemporally; (c) vessel density map of the peripapillary region overlaid on binary vessel map; and (d) OCTA SRL en face image of the peripapillary region also with inferior and superior microcirculation defects. Bottom row: from a representative healthy subject, left eye (e–h) corresponding images without microcirculation defects. by Grace **M. Richter et al**. Translational Vision Science & Technology 2018, Vol. 7, No. 6, Article 21.

Peripapillary perfusion parameters performed better than macular perfusion parameters for glaucoma diagnosis, supporting the idea that glaucomatous superficial retinal vascular changes are more pronounced in the peripapillary region. SRL Superficial Retinal Layer



OCT angiograms of a patient with CAS carotid artery stenosis (Top row) and a healthy control (Bottom row).

by Larissa Lahme et al. Changes in retinal flow density measured by optical coherence tomography angiography in patients with carotid artery stenosis after carotid endarterectomy. Scientific Reports (2018) 8:17161 | DOI:10.1038/s41598-018-35556-4

REVIEW

Optical coherence tomography angiography in glaucoma: a mini-review

Kelvin H. Wan , Christopher K. Leung
Department of Ophthalmology, Tuen Mun Eye Center and Tuen Mun Hospital, Hong Kong, China
Department of Ophthalmology and Visual Sciences, The Chinese University of Hong Kong, Hong Kong, China

OCT-A abnormality in glaucoma: primary damage or secondary change?

Summary

Vascular abnormalities detected by OCT-A have been consistently observed in glaucoma. However, **it remains unclear whether OCT-A provides additional diagnostic information for the detection of glaucoma compared with conventional OCT measurements such as circumpapillary RNFL thickness, neuroretinal rim width, and ganglion cell inner plexiform form layer thickness**.

F1000 Research 2017, 6(F1000 Faculty Rev):1686 Last updated: 02 OCT 2017

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Thank you for your kind attention!

Studio Oculistico

dott. A. Lucente

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