AngioVue OCTA in Early Glaucoma Detection and Monitoring

Prof. Kurysheva N.I.

Ophthalmological Center of the Federal Medical and Biological Agency

Moscow, Russia

7th World Glaucoma Congress

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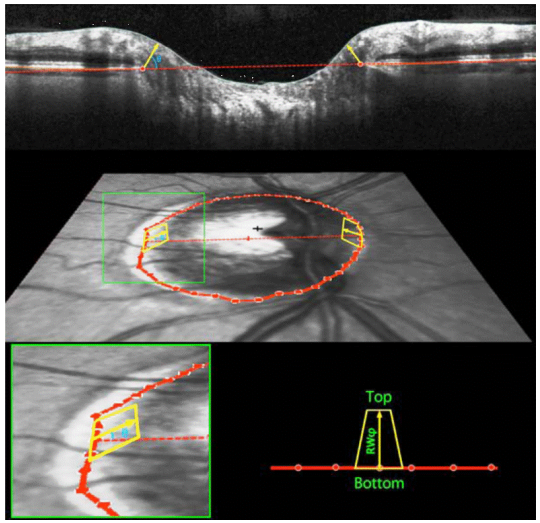
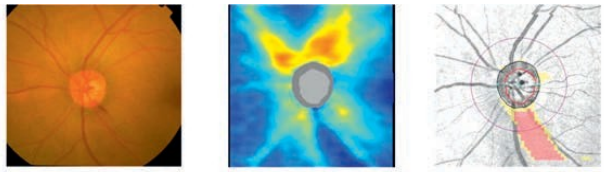
Commercial Disclosure:

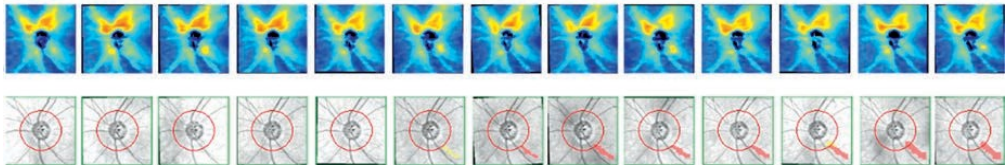
Optovue, Inc., Fremont, CA

Structures damaged in glaucoma

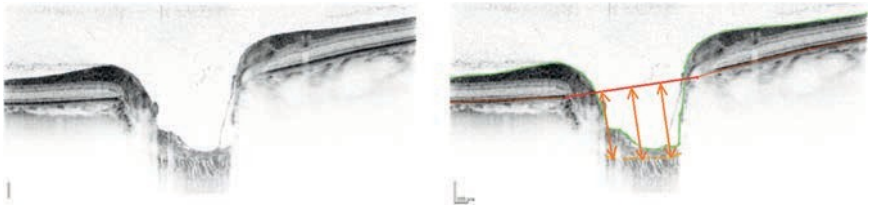


Chauhan et al., 2014

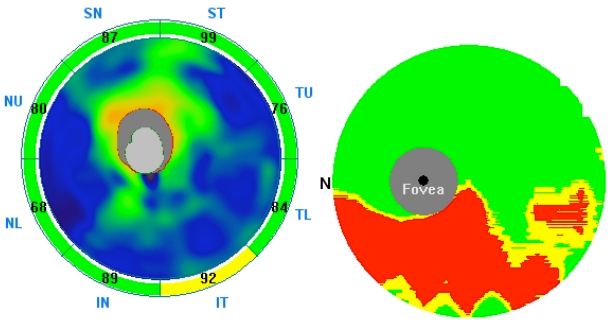




Leung et al., 2012



Wu Z. et al., 2015



Kurysheva et al., 2015

Macular damage and macular vulnerability zone in glaucoma

Published in final edited form as:
Prog Retin Eye Res. 2013 January ; 32C: 1–21. doi:10.1016/j.preteyeres.2012.08.003.

Glaucomatous damage of the macula

Donald C. Hood[a,b,*,1], **Ali S. Raza**[a,c,1], **Carlos Gustavo V. de Moraes**[d,e,1], **Jeffrey M. Liebmann**[d,e,1], and **Robert Ritch**[d,f,1]

[a]Department of Psychology, Columbia University, New York, NY 10027-7004, USA

[b]Department of Ophthalmology, Columbia University, New York, NY 10027-7004, USA

[c]Department of Neurobiology and Behavior, Columbia University, New York, NY, USA

[d]Einhorn Clinical Research Center, New York Eye and Ear Infirmary, New York, NY, USA

[e]Department of Ophthalmology, New York University, New York, NY, USA

[f]Department of Ophthalmology and Visual Science, New York Medical College, Valhalla, NY, USA

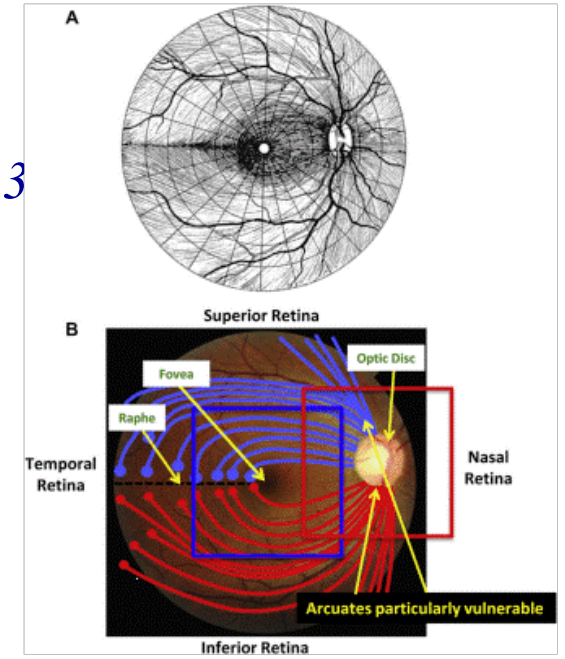
Abstract

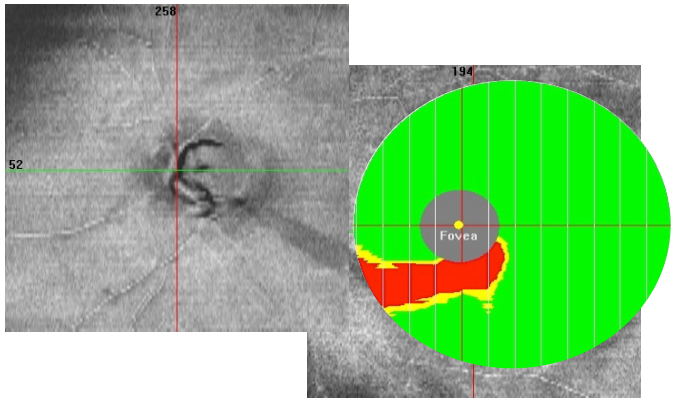
There is a growing body of evidence that early glaucomatous damage involves the macula. The anatomical basis of this damage can be studied using frequency domain optical coherence tomography (fdOCT), by which the local thickness of the retinal nerve fiber layer (RNFL) and local retinal ganglion cell plus inner plexiform (RGC+) layer can be measured. Based upon averaged fdOCT results from healthy controls and patients, we show that: 1. For healthy controls, the average RGC+ layer thickness closely matches human histological data; 2. For glaucoma patients and suspects, the average RGC+ layer shows greater glaucomatous thinning in the inferior retina (superior visual field (VF)); and 3. The central test points of the 6° VF grid (24-2 test pattern) miss the region of greatest RGC+ thinning. Based upon fdOCT results from individual patients, we have learned that: 1. Local RGC+ loss is associated with local VF sensitivity loss as long as the displacement of RGCs from the foveal center is taken into consideration; and 2. Macular damage is typically arcuate in nature and often associated with local RNFL thinning in a narrow region of the disc, which we call the macular vulnerability zone (MVZ). According to our schematic model of macular damage, most of the inferior region of the macula projects to the MVZ, which is located largely in the inferior quadrant of the disc, a region that is particularly susceptible to glaucomatous damage. A small (cecocentral) region of the inferior macula, and all of the superior macula (inferior VF), project to the temporal quadrant, a region that is less susceptible to damage. The overall message is clear; clinicians need to be aware that glaucomatous damage to the macula is common, can occur early in the disease, and can be missed and/or underestimated with standard VF tests that use a 6° grid, such as the 24-2 VF test.

Keywords

Glaucoma; OCT; Macula; Retinal ganglion cell; Visual field

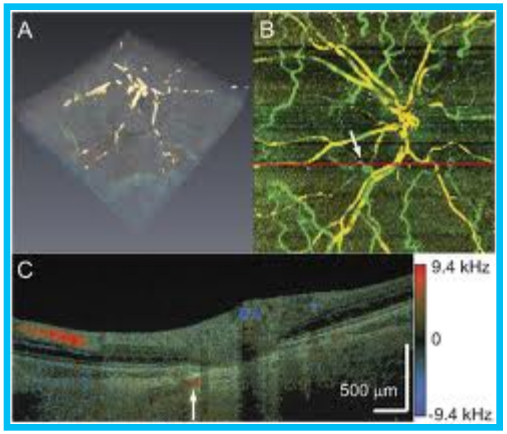
D.Hood et al., 2013

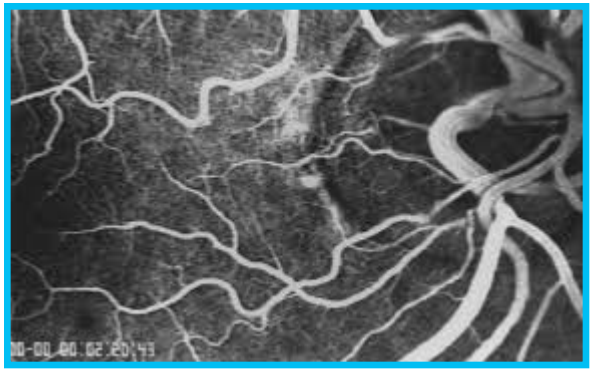


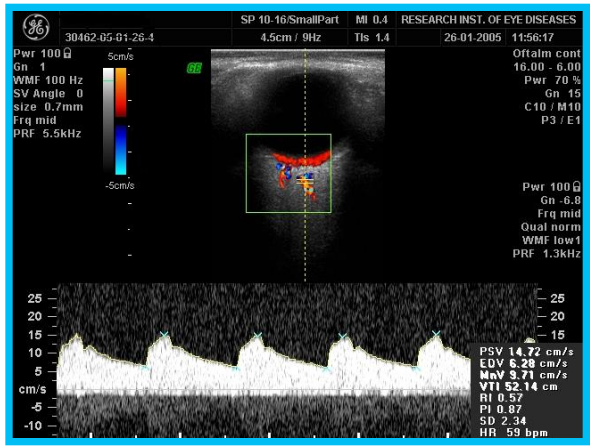


What is a role of ocular blood flow in glaucoma pathogenesis?

- Retinal blood flow in glaucoma has been measured by different methods.
- It is still unclear whether vascular changes are a primary or secondary consequence in glaucoma ???







….. a new technology for measuring retinal blood flow in glaucoma is needed

Comparative characteristics of the diagnostic value of structural and ocular blood flow parameters in the early detection of glaucoma

Parameter	z-value	p-value	AUC	AUC LCL*	AUC UCL**
VortexVein,Vmean, cm/s	5.35	<0.0001	1.000	1.000	1.000
CRV, Vmean, cm/s	3.74	0.0001	0.849	0.715	0.983
CRA, EDV, cm/s 1	2.74	0.006	0.730	0.582	0.878
TPCA, EDV, cm/s	2.53	0.011	0.711	0.566	0.857
CH, mm Hg.	2.24	0.025	0.686	0.539	0.833
pCT, pm	-2.28	0.022	0.689	0.545	0.833
avg.GCC, pm	2.05	0.041	0.670	0.513	0.837
Focal Loss Volume, %	-1.86	0.064	0.655	0.493	0.816

- * lower confidence limit of of 95% confidence interval for AUC
- ** upper confidence limit of 95% confidence interval for AUC

Avg.GCC- the average thickness of the ganglion cell complex, CH - corneal hysteresis, CRA - central retinal artery, CRV - central retinal vein, TPCA - temporal short posterior ciliary arteries; PSV- peak systolic velocity, EDV- end diastolic velocity Vmean- mean velocity, pCT - choroidal thickness at a point located 3 mm nasal from the fovea.

Kurysheva et al, Cur.Eye Res., 2016

OCT angiography – a new method to evaluate blood flow in glaucoma

Does Blood Flow Measurement Have a Role in Glaucoma Care?

Advanced imaging technologies and therapeutic options make blood flow measurement a prime consideration in glaucoma monitoring.

BY AHMAD A. AREF, MD; YALI JIA, PHD; AND DAVID HUANG, MD, PHD

Lowering the IOP remains the only proven method to prevent the development or slow the progression of glaucomatous optic neuropathy.[1] Interestingly, a significant proportion of the treatment groups in the Early Manifest Glaucoma Trial (EMGT),[2] the Collaborative Initial Glaucoma Treatment Study (CIGTS),[3] and the Collaborative Normal-Tension Glaucoma Study (CNTGS)[4] experienced glaucomatous progression despite achieving the targeted decrease in IOP.

Although the cause of disease progression despite seemingly adequate IOP lowering is likely multifactorial, abnormalities in ocular perfusion have become a prime consideration. Vascular risk factors for glaucomatous progression implicate abnormal or insufficient blood flow to the optic nerve as a likely contributor to the disease process.[5,6] This article describes novel diagnostic techniques as well as potential therapies related to ocular blood flow and glaucoma care.

DIAGNOSING ABNORMAL BLOOD FLOW

Low ocular perfusion pressure (OPP) may be used to determine whether abnormal microvascular flow is likely to occur at the level of the optic nerve. OPP is defined as the mean arterial pressure minus the IOP. Epidemiologic studies have identified low OPP as an independent risk factor for the development and progression of glaucoma.[7,8]

Investigators have studied the potential of several advanced imaging modalities to uncover an ocular blood flow abnormality related to glaucomatous disease. Color Doppler imaging uses Doppler ultrasound

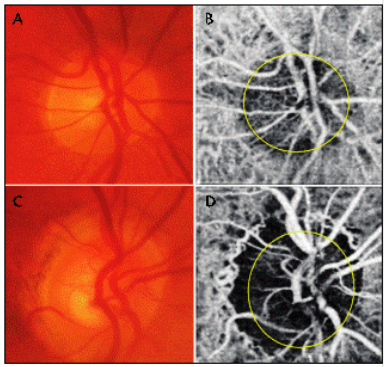
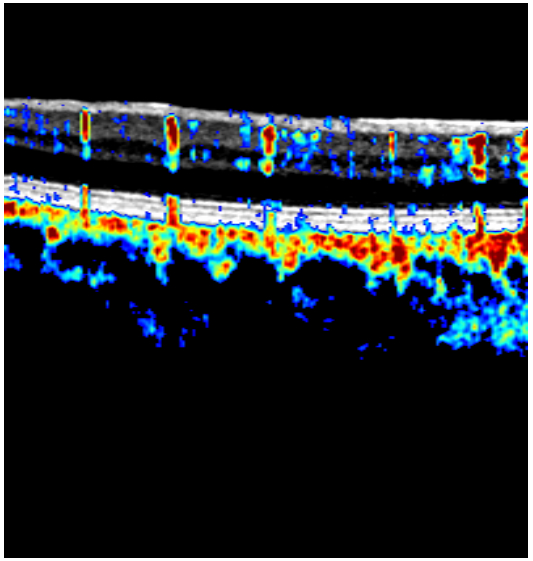


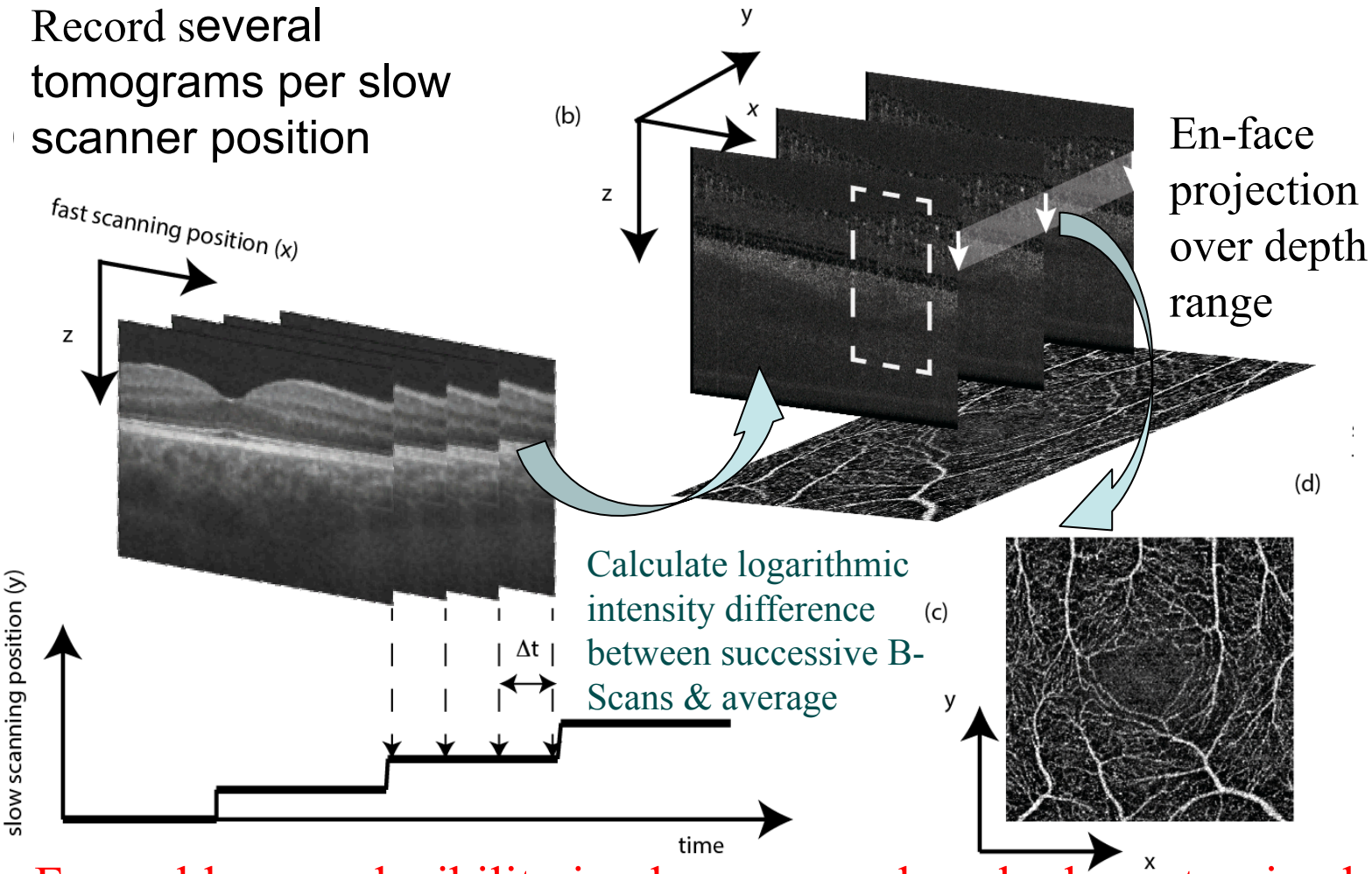
Figure. Disc photographs (A, C) and maximum projection of OCT angiograms (B, D) of the disc region (3 × 3 mm) in representative normal (A, B) and preperimetric glaucoma subjects (C, D). Both examples are from right eyes. The optic disc flow index is 0.178 in the normal subject and 0.150 in the preperimetric glaucoma subject.

to obtain quantitative measurements of the ophthalmic arterial circulation. This relatively noninvasive technique involves placing an ultrasound probe over a patient's closed eyelid. Based on diastolic flow velocities, ophthalmic arterial blood flow is measured in



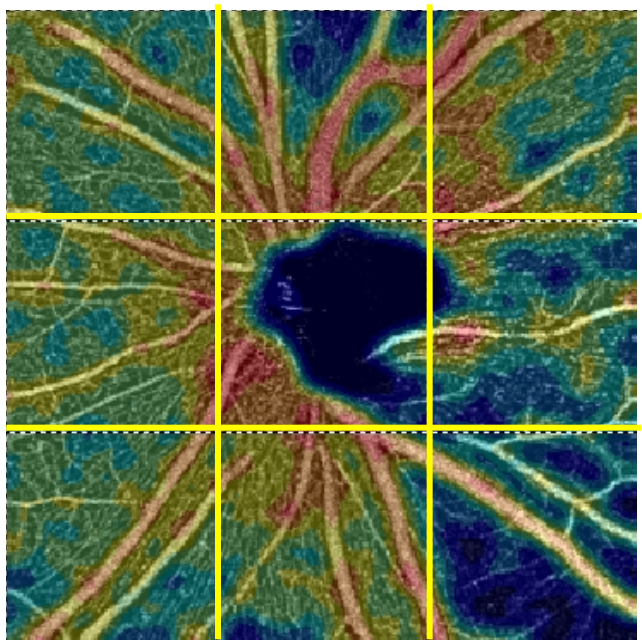
Decorrelation (Flow)

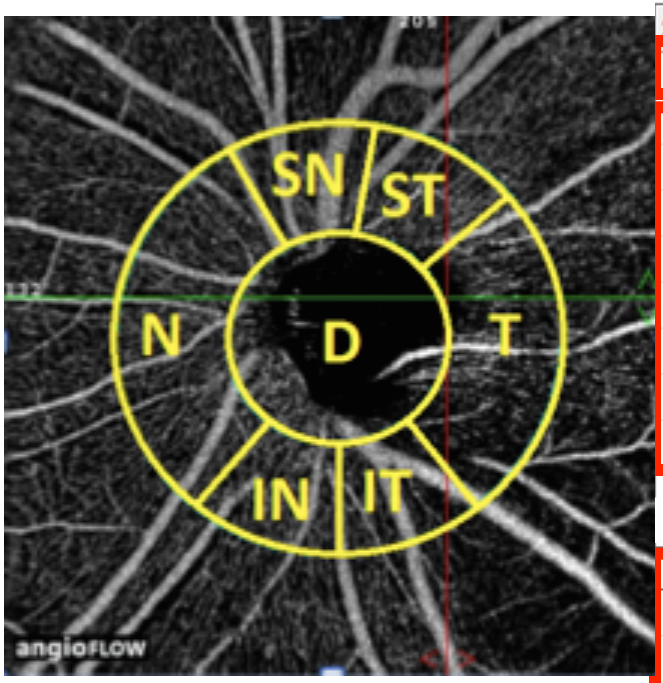
OCT Angiography Steps



Favorable reproducibility in glaucoma and ocular hypertension has been described (test-retest variability: 2.13%)

AngioAnalytics
Optic Nerve Head and the Peripapillary Retina





Angio Flow Density (%)

Section	Density (%)
Whole en face	49.73
Inside Disc	26.31
Peripapillary	59.59
- Nasal	63.85
- Inferior nasal	68.06
- Inferior tempo	61.99
- Superior tempo	64.16
- Superior nasal	68.87
- Tempo	43.56

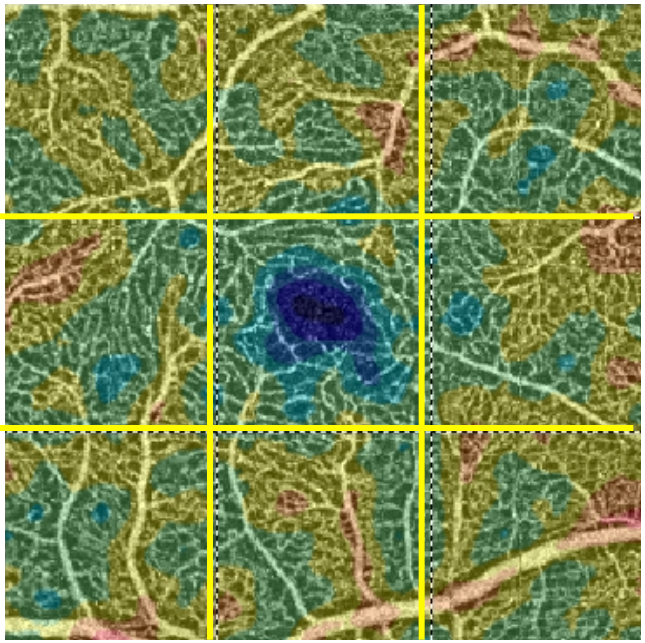
Grid-based Flow Density (%)

52.03	57.47	57.07
56.56	34.36	43.63
51.99	58.80	34.78

Angio Flow Density (AFD)

AngioAnalytics

Macula in normal eye



OCT Thickness ILM-IPL

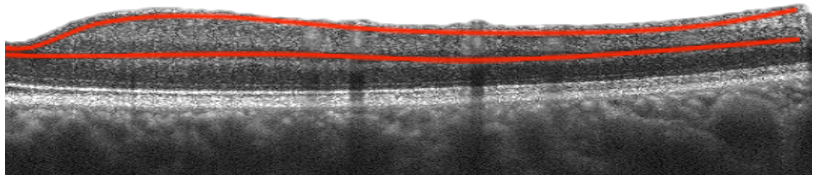
Section	Thickness (µm)
ParaFovea	124
- Superior-Hemi	125
- Inferior-Hemi	123

OCT Thickness ILM-RPE & Flow Density

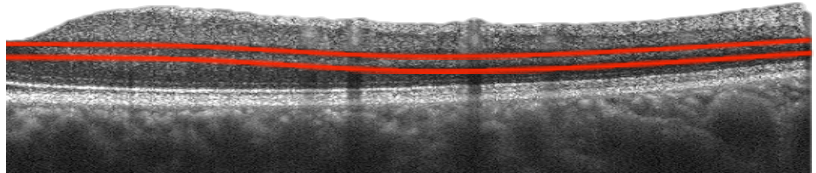
Section	Thickness (µm)	Density (%)
Whole en face	N/A	55.64
Fovea	277	40.34
ParaFovea	316	55.90
- Tempo	308	55.71
- Superior	321	57.10
- Nasal	317	54.88
- Inferior	317	55.91

Grid-based Flow Density (%)		
57.16	58.06	56.39
55.64	42.06	57.78
56.46	56.98	60.09

Parafovea
is divided into four sectors



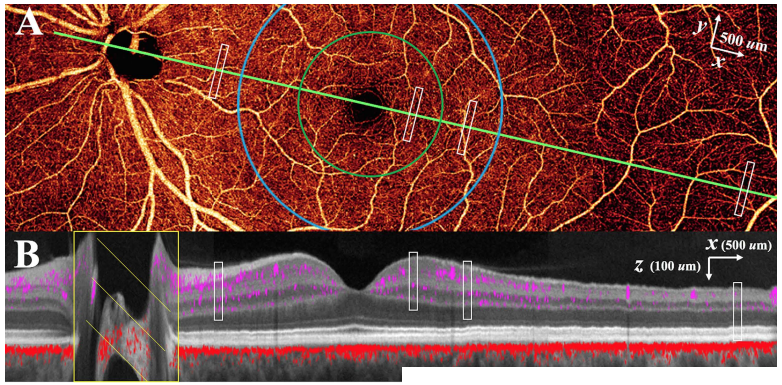
Superficial plexus

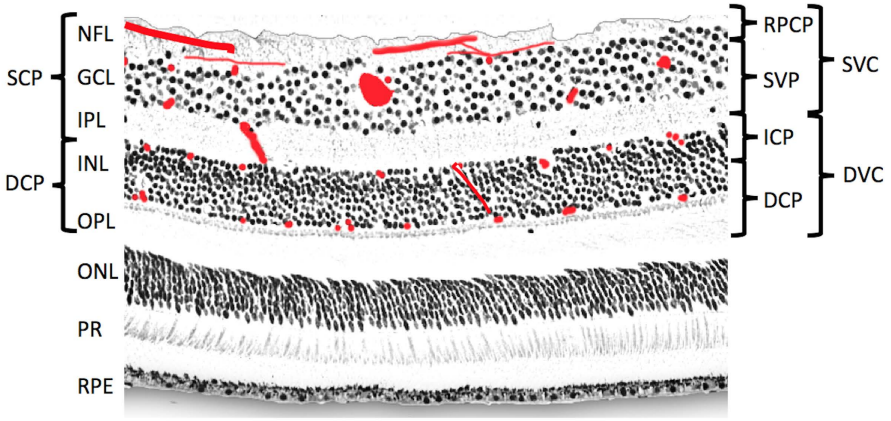


Deep plexus

Detailed Vascular Anatomy of the Human Retina by Projection-Resolved Optical Coherence Tomography Angiography

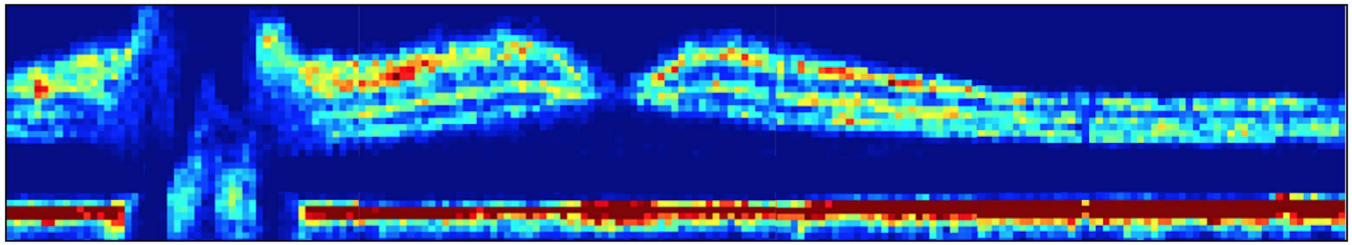
J. P. Campbell*, M. Zhang*, T. S. Hwang, S. T. Bailey, D. J. Wilson, Y. Jia & D. Huang

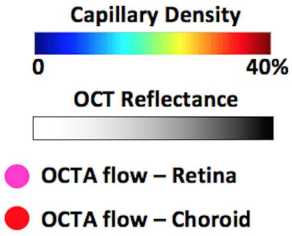




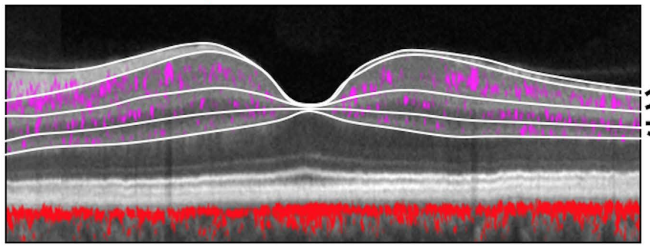
Current OCTA Nomenclature	Anatomic Layers	Proposed OCTA Nomenclature	
SCP	NFL	RPCP	SVC
	GCL	SVP	
	IPL	ICP	DVC
DCP	INL	DCP	
	OPL		

Capillary Density Cross Section





Composite Cross Sectional OCTA



Campbell, J. P. et al., Sci. Rep., 2017

OCT-A in Glaucoma

List of publications

Table 1. Summary of the articles evaluated optical coherence tomography angiography of the optic nerve head

Author and year	Design	Study subjects	Instrument type	Findings
Jia et al,[12] 2012	Prospective case series	4 pre-perimetric glaucoma and 4 normal eyes	Swept-source	Whole image: flow index was reduced by 35% and vessel area was reduced by 34% in the pre-perimetric glaucoma group Temporal ellipse of the disc: both flow index and vessel density reduced by 57% in the pre-perimetric glaucoma group
Spaide et al,[17] 2015	Prospective case series	12 normal eyes	Spectral-domain	Peripapillary capillary network was visible completely around the nerve head by OCTA but not with fluorescein angiography
Falavarjani et al,[18] 2016	Cross-sectional observational	3 eyes with optic disc edema, 2 eyes with pseudo-edema, 16 eyes with optic atrophy, and 12 healthy eyes	Swept-source	Increased or decreased visibility of peripapillary capillaries in disc edema, decreased visibility in optic atrophy Significant correlation of the vessel density and nerve fiber layer thickness
Mase et al,[19] 2014	Prospective case study	Twenty eyes of 20 healthy subjects	Spectral-domain	OCTA can visualize the expansion of the radial peripapillary capillary network, which is distributed to the superficial peripapillary retina relative to the RNFL thickness and this vascular network may be primarily responsible for RNFL nourishment
Chen et al,[20] 2016	Prospective case series	Ten eyes from 10 healthy volunteers	Spectral-domain	OCTA provides a noninvasive method to visualize and quantify disc perfusion in human eyes with excellent repeatability and reproducibility, which may add additional insight into ONH perfusion in clinical practice
Jia et al,[21] 2014	Observational, cross-sectional	24 normal subjects and 11 patients with glaucoma	Swept- source	The disc flow index was reduced by 25% in the glaucoma group Sensitivity and specificity were both 100% using an optimized cutoff The flow index was highly correlated with pattern standard deviation
Akagi et al,[22] 2016	Prospective observational case series	60 eyes with primary open angle glaucoma and 21 normal eyes	Spectral-domain	Reduce peripapillary vessel densities at the corresponding location of the visual field defect
Lévêque et al,[23] 2016	Cross-sectional observational	50 glaucoma patients and 30 normal subjects	Spectral-domain	Total and temporal disc vessel density reduced by 24.7% and 22.88% compared with the control group Significant correlation between rim area, nerve fiber layer thickness, ganglion cell layer thickness, visual field mean deviation, and visual field index and the temporal vessel density and total vessel density

Contd...

Table 1. Contd...

Author and year	Design	Study subjects	Instrument type	Findings
Liu et al,[24] 2015	Prospective observational	12 glaucomatous and 12 normal eyes	Spectral-domain	Peripapillary flow index and vessel density were significantly lower in glaucomatous eyes. Peripapillary flow index and vessel density were highly correlated with visual field pattern standard deviation in glaucomatous eyes.
Wang et al,[25] 2015	Prospective cross-sectional observational	62 eyes with glaucoma, and 20 normal eyes	Spectral- domain	Disc flow index and vessel density were significantly lower in the glaucoma eyes and were significantly correlated with the severity of glaucoma.
Yarmohammadi et al,[26] 2016	Observational cohort	261 eyes from 37 glaucoma suspect, 104 glaucoma, 23 healthy patients	Spectral-domain	Age-adjusted mean vessel density was significantly lower in glaucoma eyes compared with glaucoma suspects and healthy eyes. Age-adjusted area under curve was highest for whole image vessel density (0.94), followed by nerve fiber layer thickness (0.92) and circumpapillary vessel density (0.83) for differentiating glaucoma from normal eyes.
Yarmohammadi et al,[27] 2016	Observational, cross-sectional study	153 eyes from 31 healthy participants, 48 glaucoma suspects, and 74 glaucoma patients	Spectral-domain	Compared with glaucoma eyes, normal eyes demonstrated a denser microvascular network within the RNFL.
Suh et al,[28] 2016	Cross-sectional, case-control study	82 patients with primary open-angle glaucoma with and without focal lamina cribrosa defects (41 eyes in each group)	Spectral-domain	In eyes with similar severity of glaucoma, OCTA-measured vessel density was significantly lower in POAG eyes with focal lamina cribrosa defects than in eyes without a defect.
Rao et al,[29] 2016	Cross-sectional study	48 eyes of 33 healthy control subjects, 63 eyes of 39 patients with POAG and 49 eyes of 32 patients with PACG underwent OCTA	Spectral-domain	Diagnostic ability of peripapillary vessel density parameters of OCTA, especially the inferotemporal sector measurement, was good in POAG and PACG.
Lee et al,[30] 2016	Cross-sectional study	98 POAG eyes having a localized RNFL defect and 45 healthy control eyes	Spectral-domain	Decreased parapapillary microvasculature of the retina determined by OCTA was found at the location of retinal nerve fiber layer defect in POAG patients.

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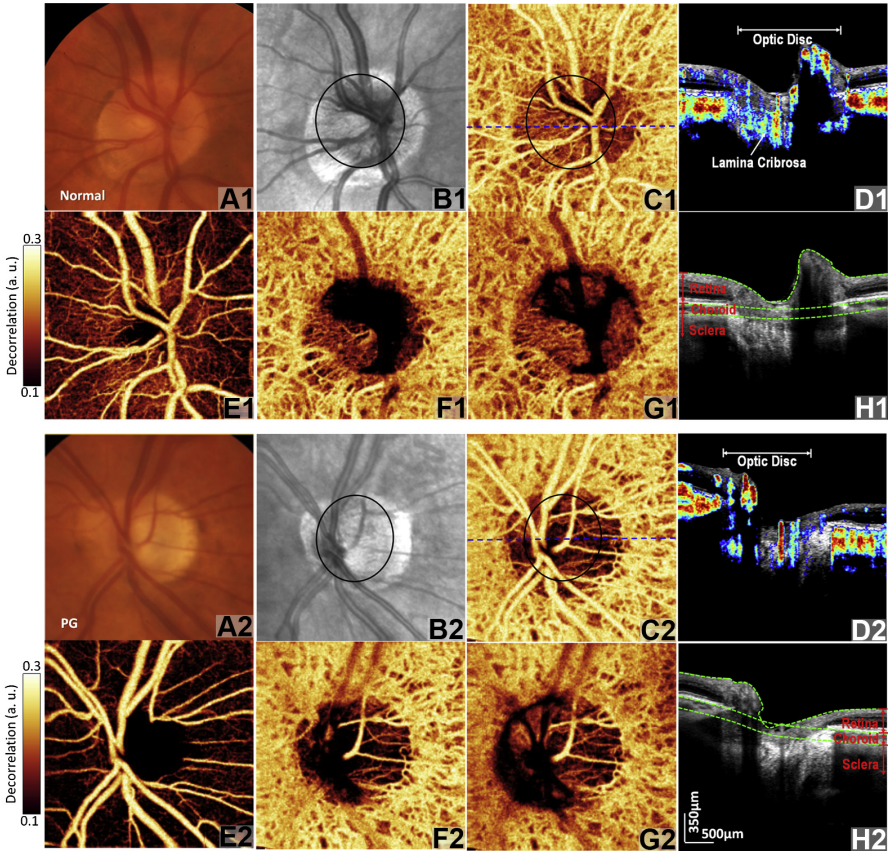
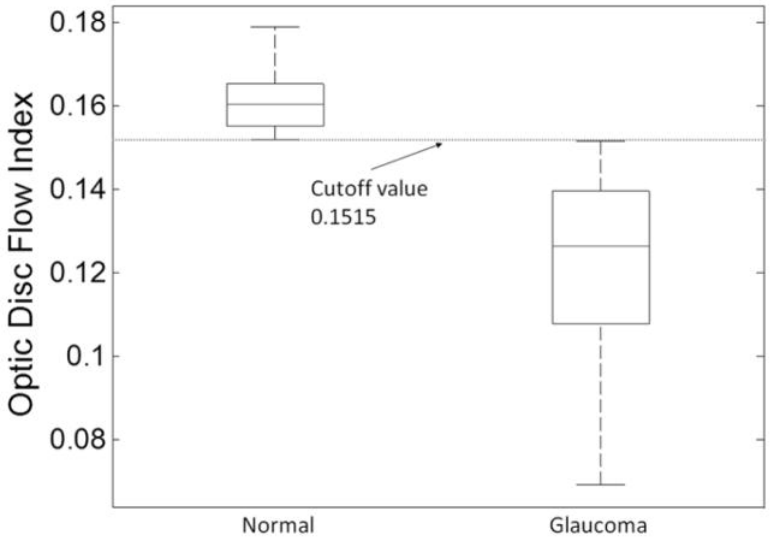
Akil H.,et al., J Ophthalmic Vis Res 2017

Literature Review





Jia et al. Ophthalmology 2014

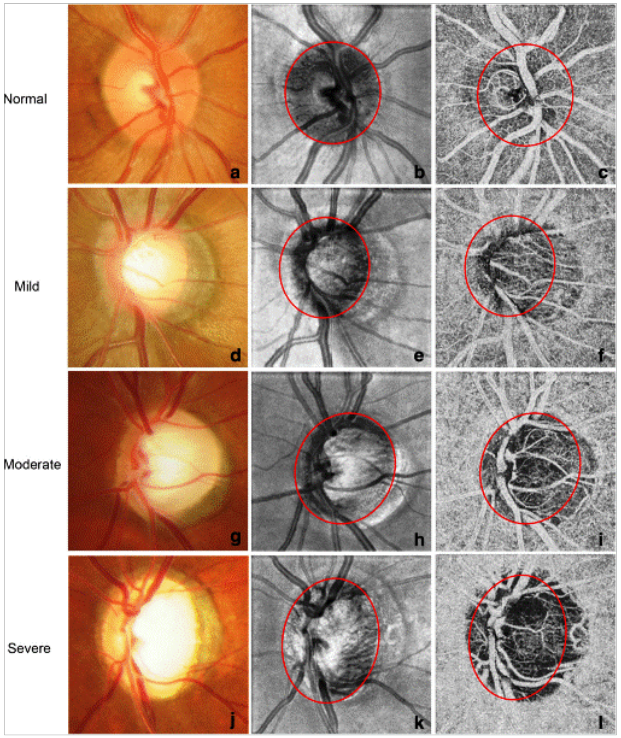
Literature Review

Graefes Arch Clin Exp Ophthalmol (2015) 253:1557–1564
DOI 10.1007/s00417-015-3095-y

GLAUCOMA

Correlation between optic disc perfusion and glaucomatous severity in patients with open-angle glaucoma: an optical coherence tomography angiography study

Xiaolei Wang[1] · Chunhui Jiang[1,3] · Tony Ko[3] · Xiangmei Kong[1,2] · Xiaobo Yu[1,2] · Wang Min[1,2] · Guohua Shi[4] · Xinghuai Sun[1,2,5,6]



… the entire optic disc blood flow was significantly lower in the glaucoma group than in the control eyes.

The more sever glaucoma stage- the lower the entire optic disc blood flow.

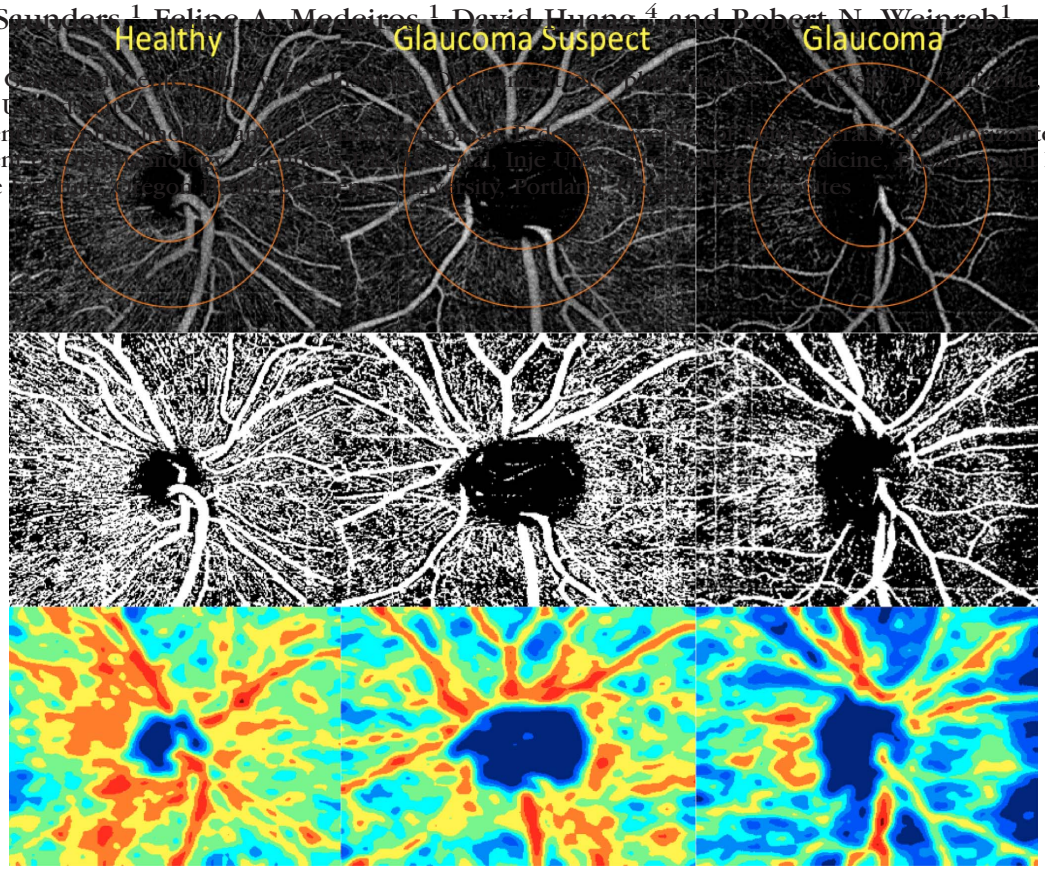
Literature Review

Special Issue

Optical Coherence Tomography Angiography Vessel Density in Healthy, Glaucoma Suspect, and Glaucoma Eyes

Adeleh Yarmohammadi,[1] Linda M. Zangwill,[1] Alberto Diniz-Filho,[1,2] Min Hee Suh,[1,3] Patricia Isabel Manalastas,[1] Naeem Fatehee,[1] Siamak Yousefi,[1] Akram Belghith,[1] Luke J. Saunders,[1] Felipe A. Medeiros,[1] David Huang,[4] and Robert N. Weinreb[1]

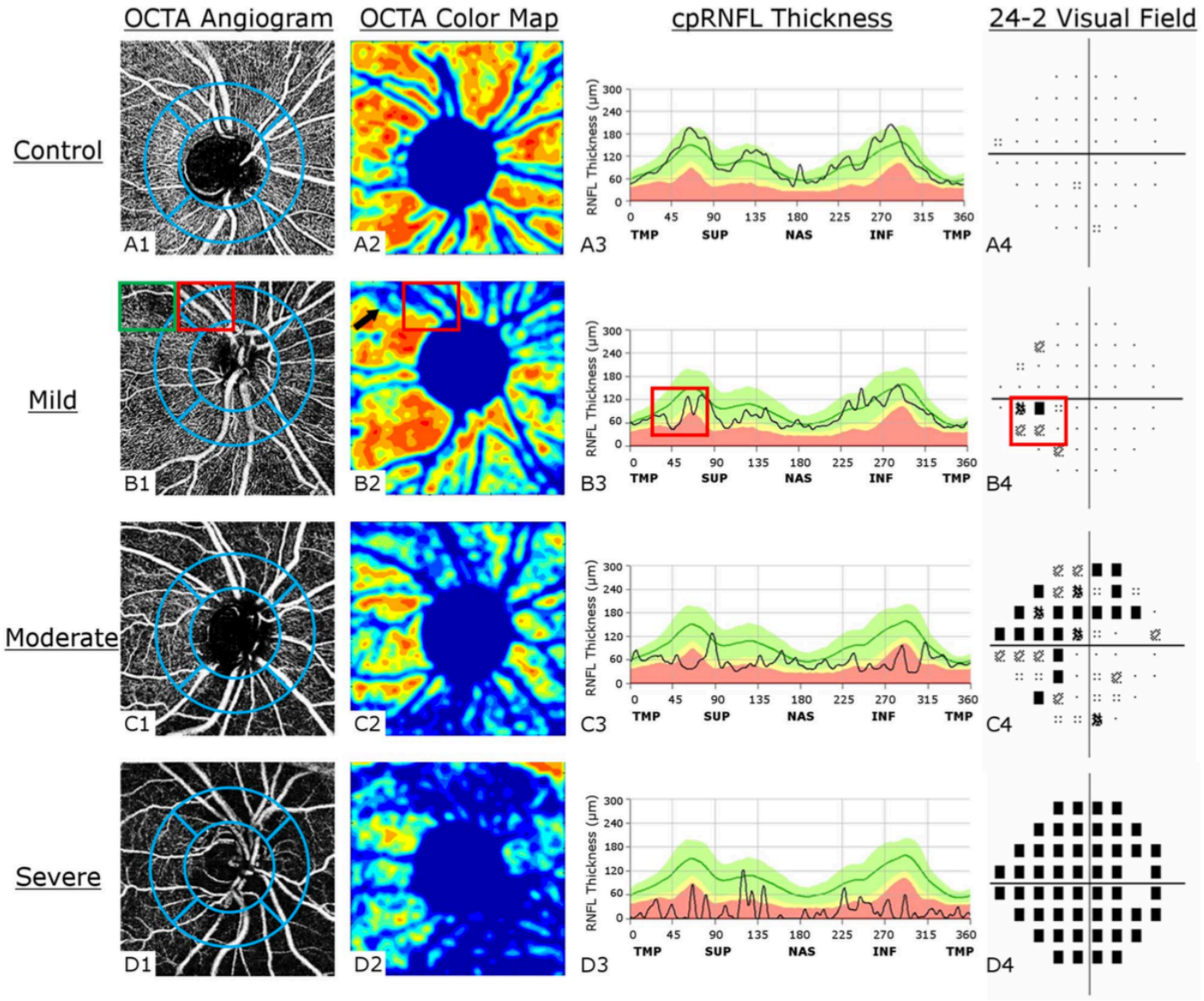
[1]Hamilton [illegible] San Diego, La Jolla, California, [illegible]
[2]Departmen[illegible]e, Brazil
[3]Departmen[illegible] Korea
[4]Casey Eye [illegible]



Yarmohammadi A., et al.

IOVS 2016 Special Issue Vol. 57 No. 9

Literature Review



Geyman S., BJO, 2017

PLOS ONE

RESEARCH ARTICLE

Retinal vessel density from optical coherence tomography angiography to differentiate early glaucoma, pre-perimetric glaucoma and normal eyes

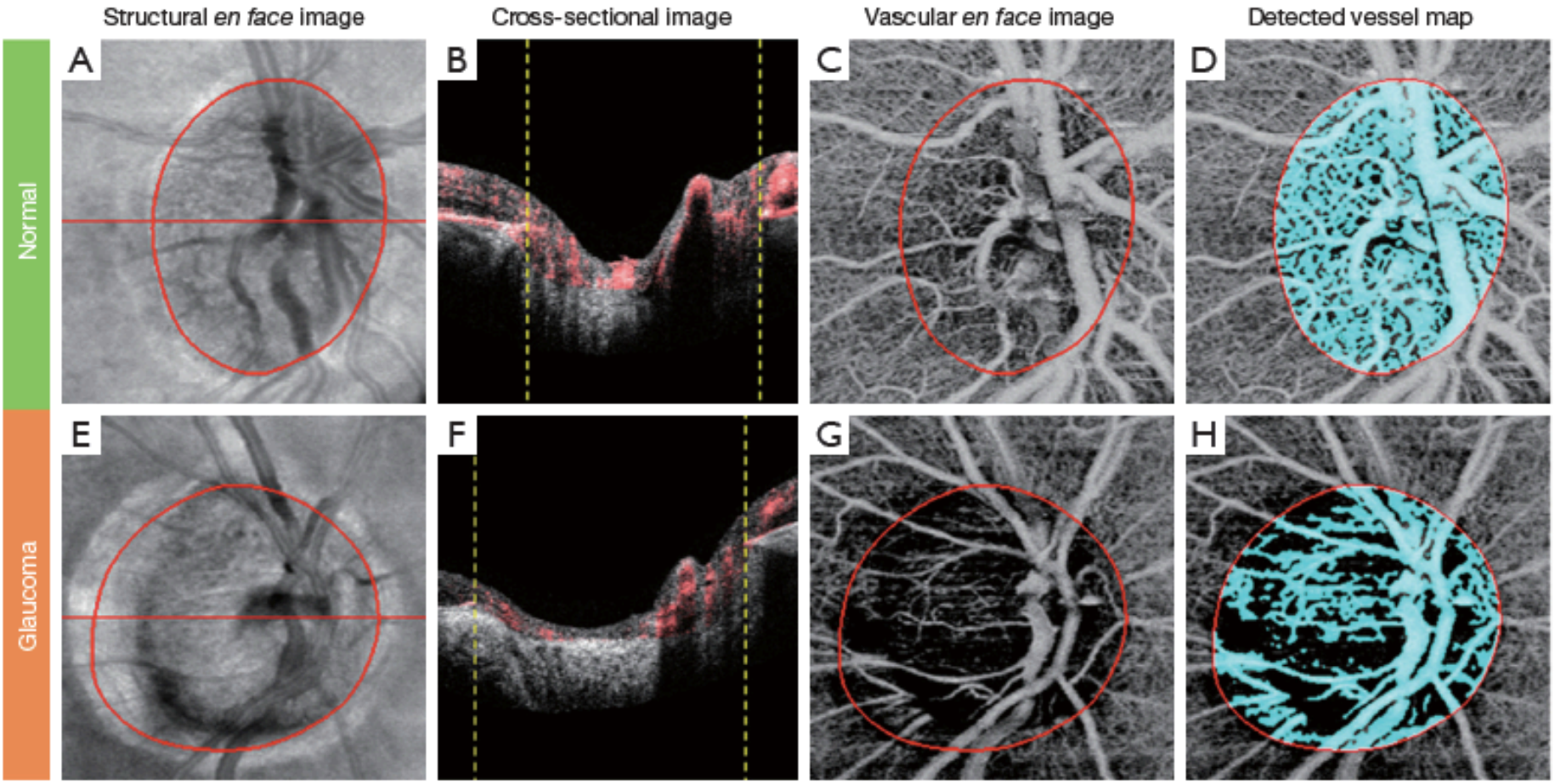
Handan Akil[1,2], Alex S. Huang[1,2], Brian A. Francis[1,2], Sirinivas R. Sadda[1,2], Vikas Chopra[1,2]*

1 Doheny Eye Institute, Doheny Image Reading Center, Los Angeles, CA, United States, **2** Department of Ophthalmology, David Geffen School of Medicine at UCLA, Los Angeles, CA, United States

	Control vs POAG	**Control vs Pre-perimetric Glaucoma**
Peripapillary area vessel density	0.956 (0.883–1.000) $p<0.001$	0.756 (0.566–0.946) $P = 0.03$
Optic nerve head vessel density	0.931 (0.838–1.000) $p<0.001$	0.863 (0.720–1.000) $P = 0.02$
Papillary area vessel density	0.956 (0.883–1.000) $p<0.001$	0.956 (0.887–1.000) $P = 0.001$
Superior papillary area vessel density	1.000 (1.000–1.000) $p<0.001$	0.981 (0.938–1.000) $p<0.001$
Inferior papillary area vessel density	0.9 (0.762–1.000) $P = 0.001$	0.819 (0.659–0.979) $P = 0.007$

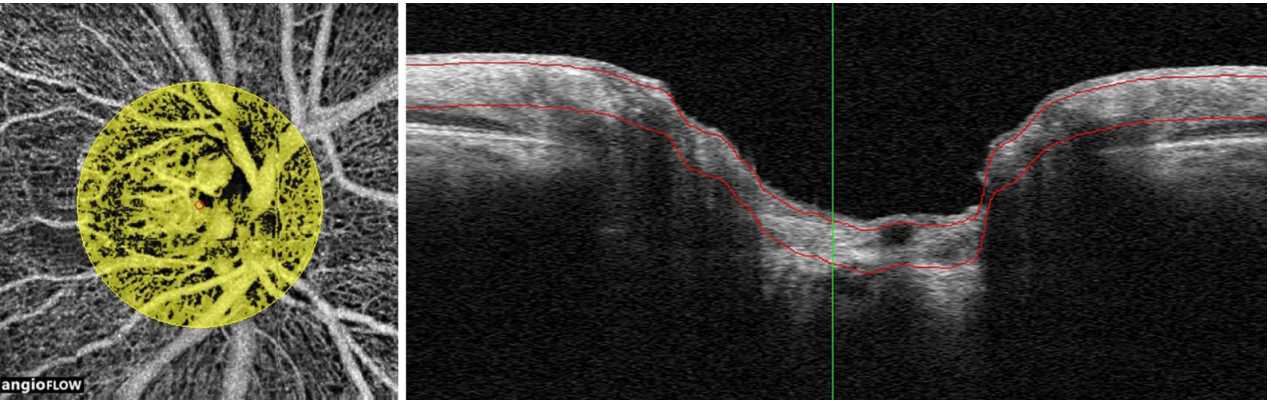
Data are area under the curve (95% confidence interval). Null hypothesis: true area = 0.5

Literature Review



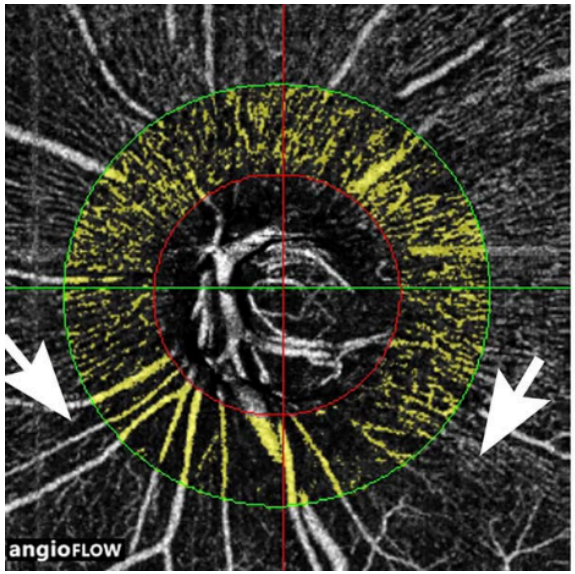
Chen et al. Quant Imaging Med Surg 2016

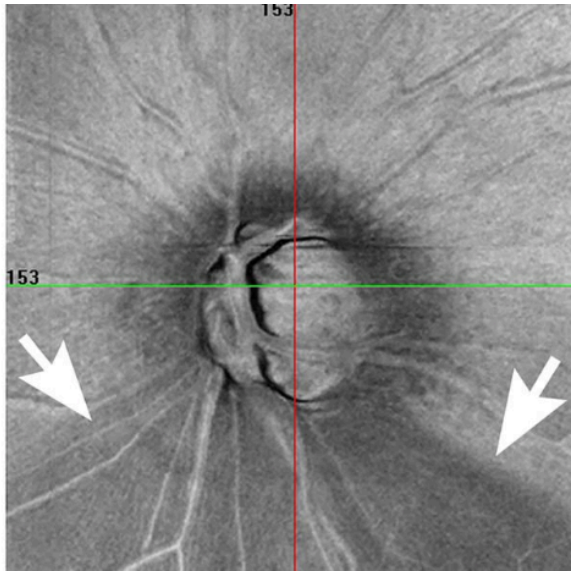
Superficial vessel density and prelaminar vascular flow index in eyes with glaucoma and ocular hypertension



Prelaminar vessels in a normal eye

Defective radial peripapillary capillary and a corresponding RNFL defect *between the arrows*



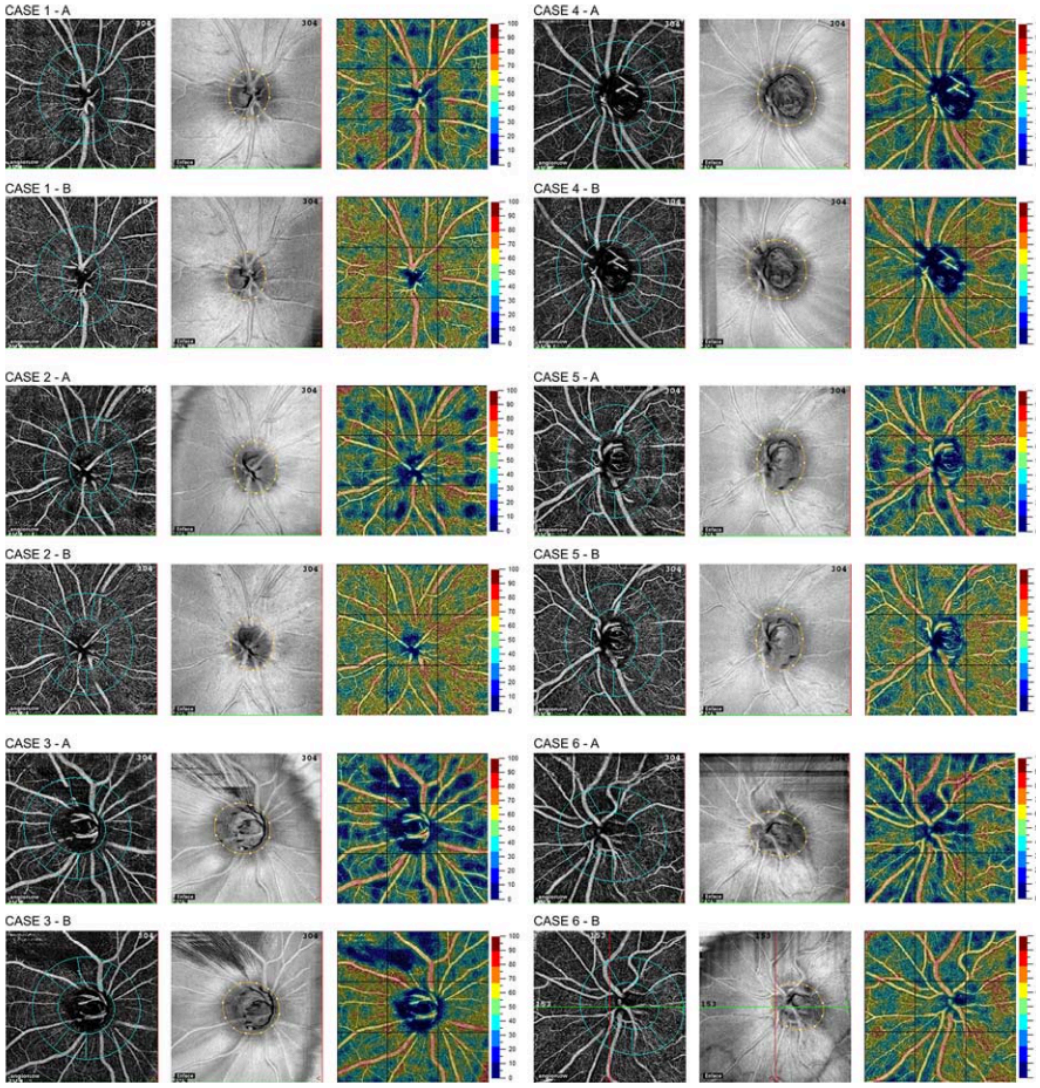


Literature Review

Chihara E,et al., IOVS, 2017

Literature Review

Does vessel density depend on IOP reduction?



IOP decrease >50% in all cases)

Hollo G., J Glaucoma 2016

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Research

Does OCT Angiography of Macula Play a Role in Glaucoma Diagnostics?

Natalia I. Kurysheva, MD*

Ophthalmological Center of the Federal Medical and Biological Agency of Russia, Clinical Hospital No. 86, Gamalei St. 15, Moscow 123098, Russia

Corresponding author
Natalia I. Kurysheva, MD
Professor
Head of the Diagnostic Department
Ophthalmological Center of the Federal Medical and Biological Agency of Russia
Clinical Hospital No. 86
Gamalei St. 15, Moscow 123098
Russian Federation, Russia
E-mail: e-natalia@list.ru

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Macula in Glaucoma: Vascularity Evaluated by OCT Angiography.

Natalia Ivanovna Kurysheva*

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OCT Angiography and Color Doppler Imaging in Glaucoma Diagnostics

N.I. Kurysheva[1], E.V. Maslova[1], A.V. Trubilina[1], V.G. Likhvantseva[1], A.V. Fomin[2] and M.B. Lagutin[3]

[1]Ophthalmological Center of the Federal Medical and Biological Agency of Russia, A.I. Burnazyan Federal Medical Biophysical Center of FMBA 15, Gamalei St., Moscow, 123098, Russian Federation
[2]National Research Institute of Eye Diseases, Russian Academy of Medical Sciences 11, Rossolimo St., 119021, Moscow, Russian Federation
[3]Lomonosov Moscow State University, Faculty of Mechanics and Mathematics, Department of Mathematical Statistics and Stochastic Processes GSP-1, 1 Leninskie Hills St., Moscow, 119991, Russian Federation

Patients' characteristics

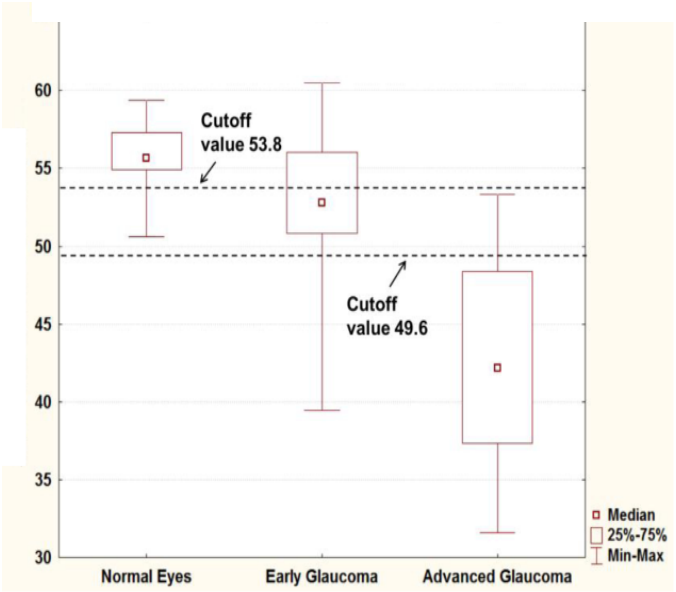
Parameter	Normal eyes (n=48)	p-value*	Early POAG (n=47)	p-value**	Moderate to severe POAG (n=42)	Total p-value***
Age, years	63.5 (5.8)	0.723	62.8 (6.8)	0.465	64.5 (5.8)	0.089
Systolic BP, mm Hg	125.6 (3.6)	0.020	133.4 (16.4)	0.581	129.5 (15.7)	0.015
Diastolic BP, mm Hg	80.3 (6.5)	0.125	83.3 (8.7)	0.625	83.16 (9.1)	0.45
IOPcc, mm Hg	15.7 (3.4)	0.001	19.8 (5.1)	0.639	19.5 (7.1)	<0.001
OPP, mm Hg	50.6 (2.7)	0.231	48.1 (8.8)	0.594	46.5 (8.2)	0.092
Mean deviation, dB	-0.05 (0.24)	<0.001	-1.94 (2.39)	<0.001	-13.23 (5.8)	<0.001
Pattern standard deviation, dB	1.39 (0.15)	0.005	2.20 (1.58)	<0.001	9.85 (4.63)	<0.001
RNFL, µm	103.9 (7.1)	<0.001	91.5 (9.2)	<0.001	71.2 (13.3)	<0.001
GCC, µm	99.3 (8.2)	0.002	90.2 (9.4)	<0.001	69.5 (10.3)	<0.001
Focal Loss Volume of GCC , %	0.18 (0.09)	0.003	2.03 (1.09)	<0.001	9.65 (3.54)	<0.001
Global Loss Volume of GCC, %	1.61 (1.86)	0.001	7.58 (5.10)	<0.001	24.85 (8.36)	<0.001
Amplitude of P100 component of pattern VEP 0,3°, µv	15.3±3.7	0.007	11.01±6.3	0.013	7.8±4.2	<0.001
Amplitude of P100 component of pattern VEP 1°, µv	16.1±4.1	<0.001	11.3±5.3	0.007	7.2±3.3	<0.001
Amplitude of P50 component of tPERG, 1°, µv	5.3±1.3	<0.0001	2.8±1.6	0.932	2.7±1.7	<0.0001
Amplitude of N95 component of tPERG, 1°, µv	7.3±1.9	<0.0001	3.5±1.6	0.338	3.7±2.1	<0.0001
Amplitude of P1 component of ssPERG, µv	3.5±1.7	<0.0001	1.6±0.5	0.423	1.5±0,6	<0.0001
Peripapillary CT, µm	189.4 (49.4)	0.543	176.3 (83.3)	0.586	160.3 (58.9)	0.335

p - values between groups were calculated using Wilcoxon-Mann-Whitney test

MOPP = mean ocular perfusion pressure ([2 / 3 diastolic + 1 / 3 systolic BPs]*2 / 3 - IOP)

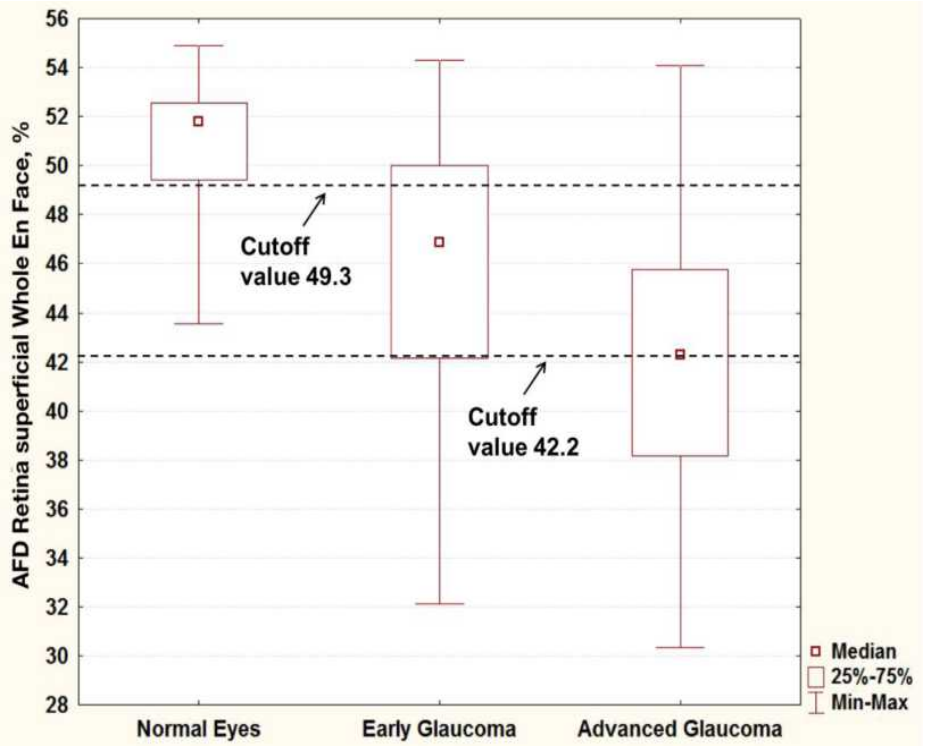
CTp - choroidal thickness at a point located 3 mm nasal from the fovea

OCTA parameters for distinguishing the patients with different stages of glaucoma



ONH and peripapillary angioflow density

Macula angioflow density



Kurysheva et al /Ophthalmology, 2016

Correlation between VEP and OCTA parameters in early glaucoma

Variable	Lat P100 stimul 0,3°	Ampl P100 stimul 0,3°	Lat P100 Stimul 1 °	Ampl P100 Stimul1°
Wi VD Disc		r=0,69 p=0,002		r=0,57 p=0,02
Avg. Peripapillary VD		r=0,74 p=0,001		r=0,51 p=0,04
Inferotemporal Peripapillary VD	***r=-0,45 p=0,02***	r=0,75 p<0,0001		
Superotemporal Peripapillary VD		r=0,65 p=0,004		
Inferior Peripapillary VD		r=0,70 p=0,002	r=-0,59 p=0,01	r=0,56 p=0,02

The Spearman's correlations and corresponding p-values for healthy subjects is given in bold italics.

Correlation between ERG and and macula OCT and OCT-A parameters in early glaucoma and healthy eyes

	Latency ERG Max Response P1(ms)	Latency ERG Flash Color Red P1(ms)	Amplitude Flash Color Red P1(mW)	Amplit. P50 tPERG, 1°	Amplit. N95 tPERG, 1°
wiVD superficial	0.667 0.018		0.783 0.003	0.630 0.028	
Macula thickness ILM-RPE, infer.		-0.648 0.023			**-0.609** **0.007**

The Spearman's correlation for early glaucoma is given in blue color

Correlation between structural and OCT-A parameters in macula in early glaucoma

Variable	VD Superficial parafovea	wiVD superficial	Grid-based VD Superficial in the nasoinferior parafovea
Avg. GCC	r = 0.443 p = 0.005	r = 0.587 p = 0.0001	r = 0,534 p = 0,0001
Inf. GCC	r = 0,448 p = 0,004	r = 0,591 p = 0,0001	r = 0,683 p = 0,0001
GLV	r = -0.431 p = 0.006	r = -0.594 p = 0.0001	r = -0,640 p = 0,0001
FLV	r = -0,371 p = 0,020	r = -0,525 p = 0,001	r = -0,531 p = 0,001

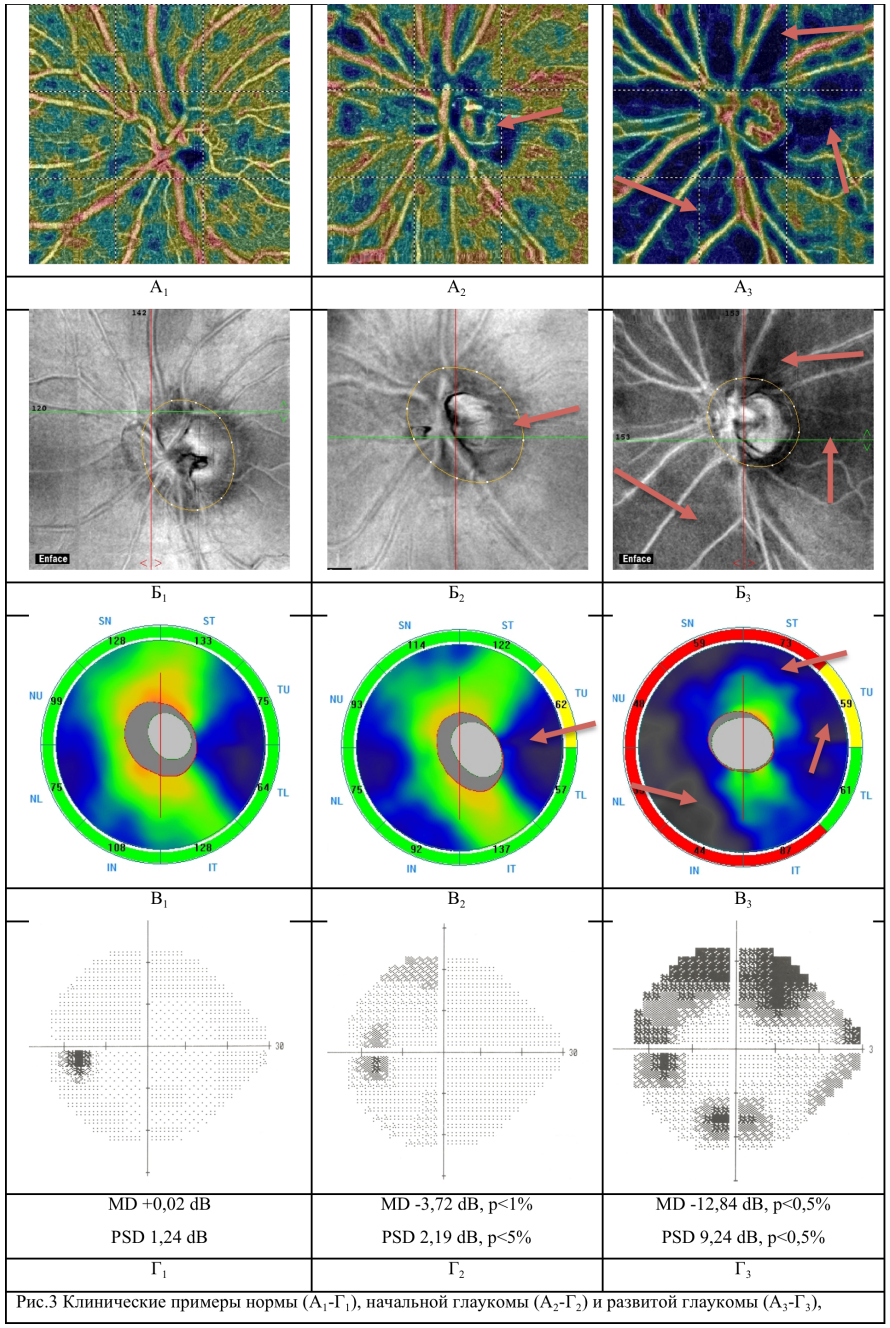


Рис.3 Клинические примеры нормы (A_1-$Г_1$), начальной глаукомы (A_2-$Г_2$) и развитой глаукомы (A_3-$Г_3$),

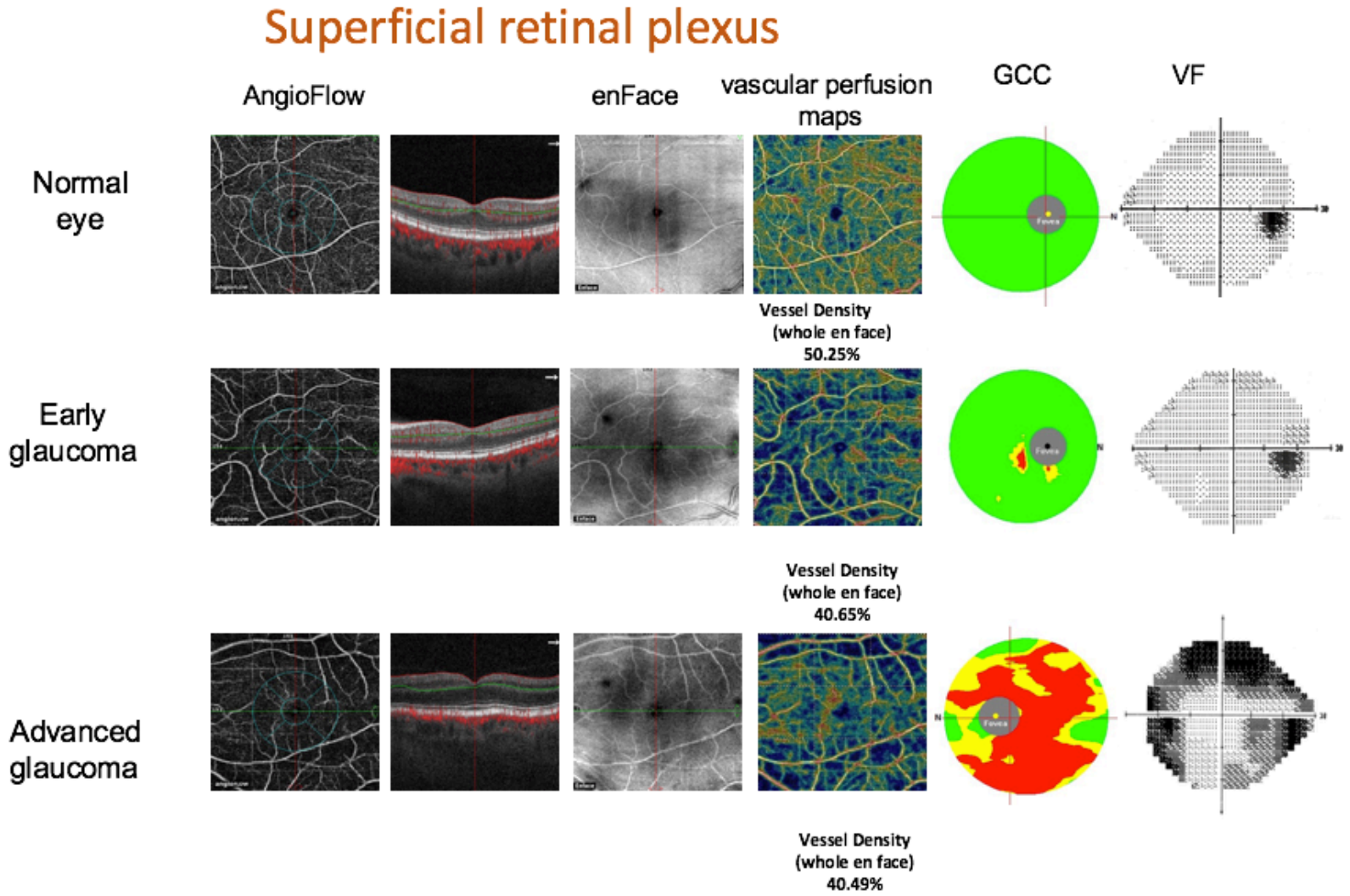
Clinical examples:

OCT-A of ONH and peripapillary area in

- normal eye (A_1, B_1,C_1, D_1),
- early glaucoma (A_2, B_2, C_2, D_2)
- advanced glaucoma (A_3, B_3,C_3, D_3)

Kurysheva et al /Ophthalmology, 2016

Clinical examples: OCT-A of macula



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The AUC analysis of study variables to discriminate early POAG from normal eyes

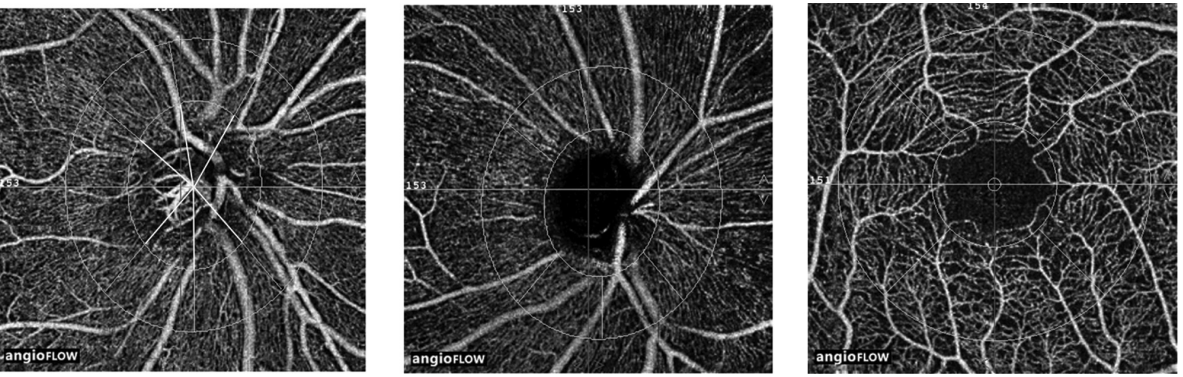
Parameter	z-value	p-value	AUC	CI AUC
Amplitude P50 tPERG, 1°	4.350	<0.0001	0.93	0.853 - 1.000
Amplitude N95 tPERG, 1°	3.98	<0.0001	0.89	0.796 - 0.990
WiVD Retina Superficial	3.86	<0.0001	0.805	0.694 - 0.915
Amplitude P100 pattern VEP, 1°	3.57	<0.0001	0.84	0.72-0.96
WiVD Retina Deep	3.33	0.001	0.76	0.637 - 0.89
Wi VD Disc	3.19	0.002	0.75	0.63-0.87
Avg. GCC	3.097	0.002	0.739	0.606 - 0.87
OA, EDV	3.03	0.002	0.74	0.61-0.86
SPCAtemporal, EDV	2.78	0.005	0.72	0.58-0.86
Avg. RNFL	2.85	0.004	0.72	0.587 - 0.85
Retinal thickness ILM-PE	2.02	0.043	0.67	0.509 - 0.84

wiVDSuperficial (deep)– relative density of blood vessels in fovea and parafovea in the superficial (deep) plexus, GCC –ganglion cell complex, RNFL –retinal nerve fiber layer, tPERG – transient Pattern ERG; Pattern VEP – Pattern Visual Evoked Potentials OA – ophthalmic artery; SPCA temporal –temporal short posterior ciliary arteries, EDV – end diastolic velocity, z-value –absolute value of the adjusted standardized statistic of Mann-Whitney test

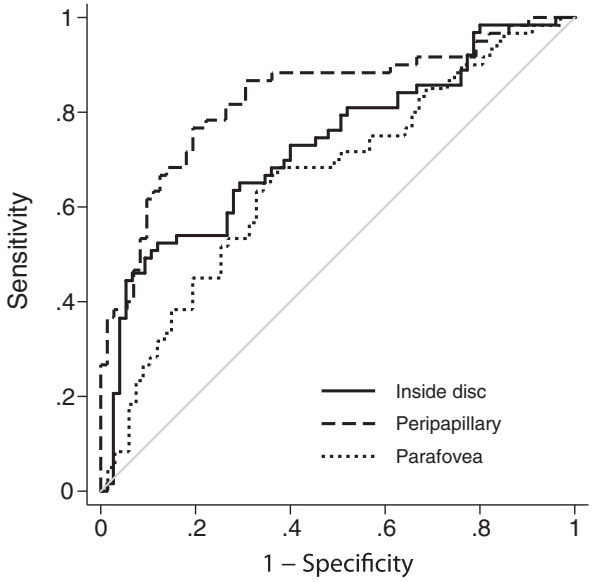
Kurysheva, et al. 2017 In press

Regional Comparisons of Optical Coherence Tomography Angiography Vessel Density in Primary Open-Angle Glaucoma

HARSHA L. RAO, ZIA S. PRADHAN, ROBERT N. WEINREB, HEMANTH B. REDDY, MOHAMMED RIYAZUDDIN, SRILAKSHMI DASARI, MEENA PALAKURTHY, NARENDRA K. PUTTAIAH, DHANARAJ A.S. RAO, AND CARROLL A.B. WEBERS



	Control Group (78 Eyes, 53 Subjects)	POAG Group (64 Eyes, 39 Patients)	*P*
Age (y)	58 (52, 65)	66 (57, 72)	.01
Sex (male:female)	29:24	28:11	.10
Sphere (D)	0.5 (0, 1)	0 (−0.75, 0.5)	.02
Cylinder (D)	−0.5 (−1, −0.5)	−0.75 (−1, −0.25)	.67
Optic disc area (mm^2)	2.30 (2.00, 2.58)	2.33 (1.98, 2.59)	.93
Pretreatment IOP (mm Hg)	16 (14, 18)	19 (16, 24)	<.001
Hypertension (yes:no)	16:37	16:23	.28
Diabetes mellitus (yes:no)	15:38	9:30	.57
Mean deviation (dB)	−1.1 (−3.0, −0.2)	−5.3 (−9.6, −3.1)	<.001
Pattern standard deviation (dB)	1.7 (1.5, 2.5)	4.7 (2.8, 9.2)	<.001
Visual field index (%)	99 (98, 99)	90 (75, 95)	<.001
SSI (optic disc scan)[a]	54.2 ± 9.5	50.4 ± 8.2	.02
Whole en face vessel density (disc scan)	54.4 (51.7, 56.9)	48.0 (42.9, 53.4)	<.001



The AUC analysis of study variables to discriminate early POAG from advanced stages

Parameter	z-value	p-value	AUC	AUC LCL*	AUC UCL**
Peripapillary inferotemporal VD	5.97	<0.0001	0.94	0.97	1.0
Avg.GCC	5.20	<0.0001	0.87	0.79	0.98
Avg.RNFL	5.15	<0.0001	0.88	0.79	0.97
Peripapillary VD	4.88	<0.0001	0.88	0.79	0.97
CRA,Vmean	4.16	<0.0001	0.81	0.69	0.92
Amplitude P100 pattern YEP, 1°	2.85	0.007	0.73	0.59	0.88

z-value – absolute value of the adjusted standardized statistic of Mann-Whitney test;
AUC – area under the ROC-curve;LCL* – lower limit of the 95% CI for AUC,
UCL** – upper limit of the 95% CI for AUC

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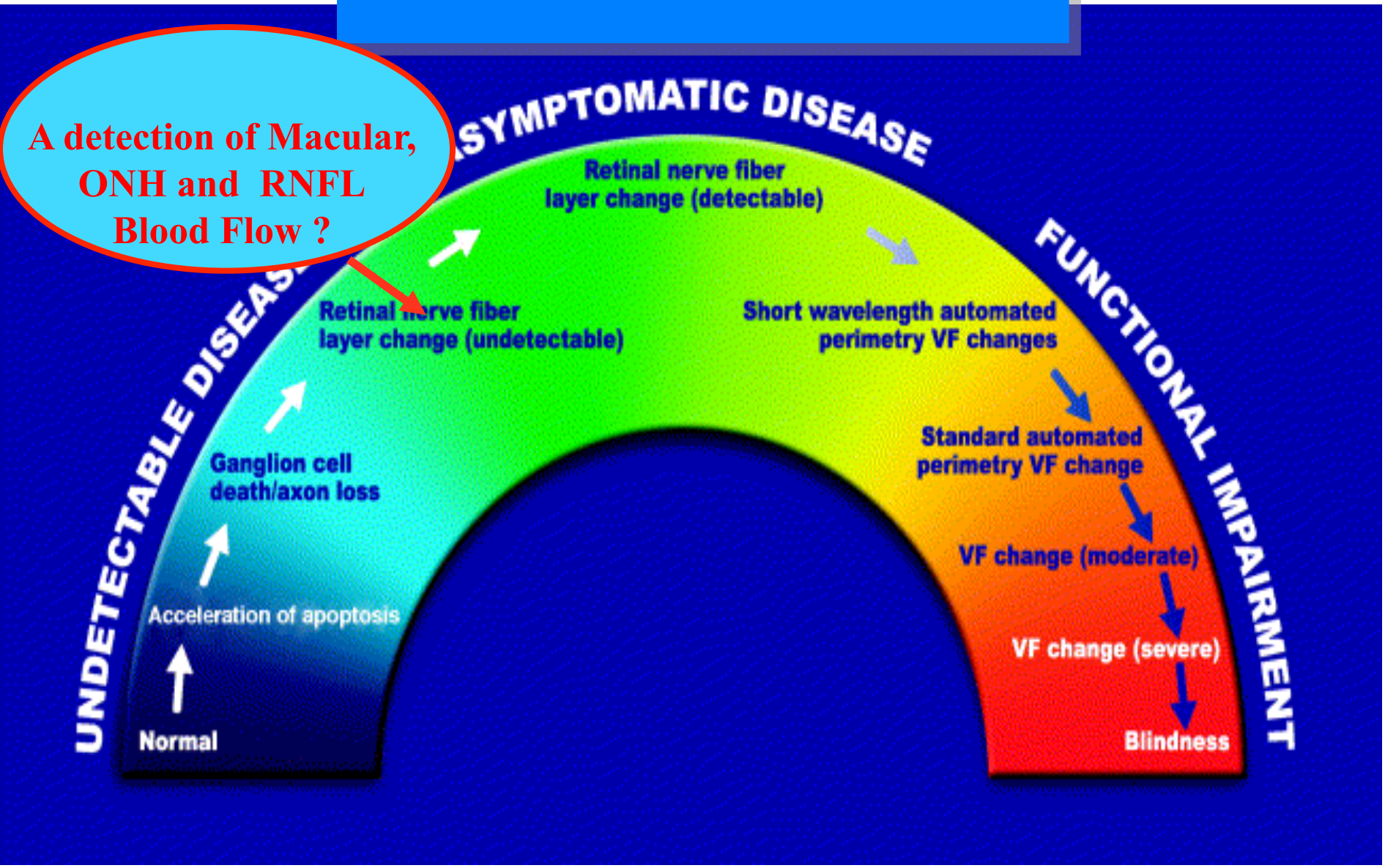
Glaucoma continuum



THANK YOU FOR YOUR ATTENTION!