Open angle glaucoma and advanced technologies

Pinakin G Davey OD, PhD, FAAO
Professor

Western University of Health Sciences
College of Optometry

Disclosure

- Principal investigator for FDA iVue OCT trial
- Principal investigator Topcon FDA trials
  - FDA Topcon NDB Maestro and OCT 2000
  - FDA Topcon OD and Retina study
  - FDA NDB II study
  - FDA Maestro AP II study
- Principal investigator FDA Zeiss GDx PRO NDB study
- Consultant for Optovue and Topcon
- Speakers bureau Sanofi- Genzyme and Allergan

Objectives

- 1) Compare and contrast the differences between the new tonometer devices like the Pascal Dynamic contour tonometer and Ocular Response Analyzer with the gold standard in tonometry Goldmann applanation tonometer.
- 2) Understand and interpret and use of imaging technology and visual fields in management of primary open angle glaucoma
- 3) Cases

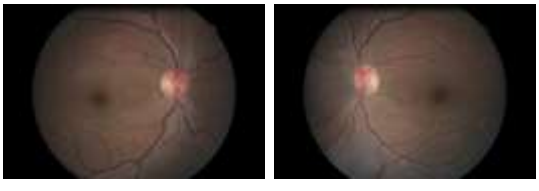
Case-1

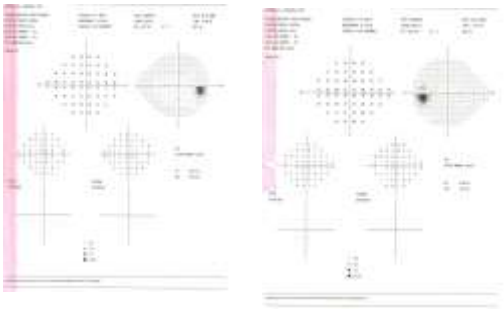
66 B/F

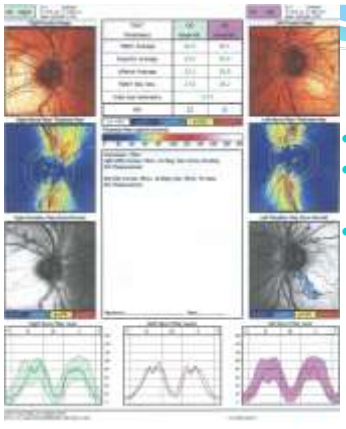
- VA 20/40 OD, OS 20/30 OU
- Blur past few months, constant

Previous history elevated IOPs (3 annual visits)
Range OD 20-24
OS 19-23

IOP today 22, 20 (OD, OS)







- Ocular hypertension
- Pre-perimetric glaucoma

- Any thoughts?

Intraocular pressure

- Diagnosis- not helpful
- Treatment- only proven method
- Progression- very closely associated with IOP
- Risk factor- without a doubt most important risk factor

- In fact only alterable risk factor!

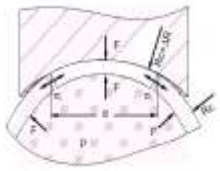
Various tonometers

- Indentation-Schiötz tonometry – only theoretical interest
- Applanation –
  - Goldmann, Perkins
  - Mackay-Marg-Tonopen
  - Pneumotonometer
  - Non-contact
- Others
  - Dynamic Contour Tonometer
  - Ocular Response Analyzer
  - 7CR
  - Diaton
  - Rebound tonometer

Inherent differences in types of tonometers

- Contact area and region
- Anesthetic required/not required
- Non-contact or contact
- portable or hand held
- disinfection required
- observer dependence/independent

Dynamic contour tonometer

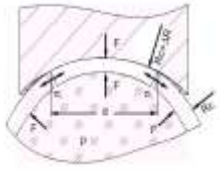


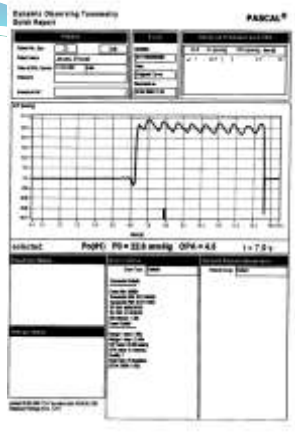
Dynamic contour tonometer (cont 2)

- Digital output
- Continuous recording of IOP waveform

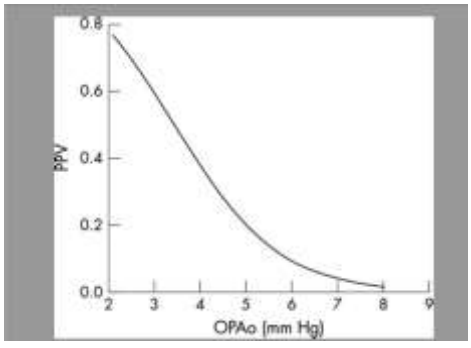
Dynamic contour tonometer (cont 3)

- The corneal biomechanical contribution to IOP measurement is largely removed when the cornea takes up the shape of the tip.
- Tip radius of curvature is 10.5mm.
- Pressure sensor is 1.5 mm.



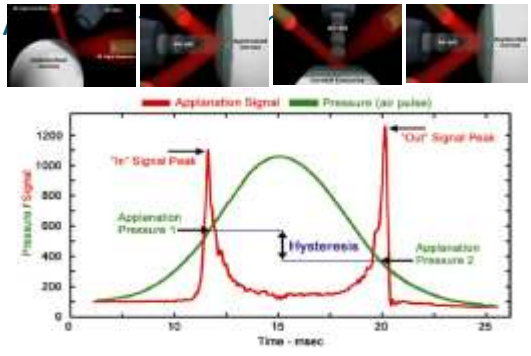


OPA and NTG

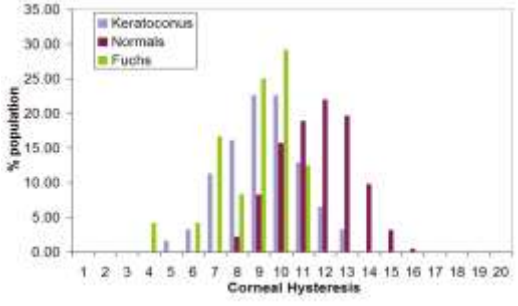


Ocular Response Analyzer

- **IOPG** - Goldmann Correlated IOP
- **IOPCC** - Corneal Compensated IOP
- **CH** - Corneal Hysteresis
- **CRF** - Corneal Resistance Factor
- **CCT** - Central Corneal Thickness



Classifying Corneal Pathologies

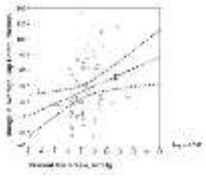


Data courtesy Shah, Brandt, Pepose, Castellano

Corneal Hysteresis but Not Corneal Thickness Correlates with Optic Nerve Surface Compliance in Glaucoma Patients

Anthony P. Wells,[1,2] David F. Garway-Heath,[3] Ali Poostchi,[1] Tracey Wong,[2] Kenneth C. Y. Chan,[2] and Nisha Sachdev[2]

Low corneal hysteresis may be an independent indicator of glaucoma

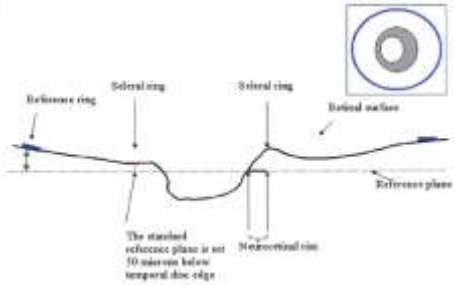


Heidelberg Retina Tomograph

- First
- Relatively unchanged
- Confocal scanning laser ophthalmoscopy

SLO video

Reference plane of HRT



RJ Watkins, L Panchaal, J Uddin, **P Gunvant**: Vertical cup-to-disc ratio - Agreement between direct ophthalmoscopic estimation, fundus biomicroscopic estimation and scanning laser ophthalmoscopic measurement. ***Optometry and Vision Science***, 2003: 80: 454-459.

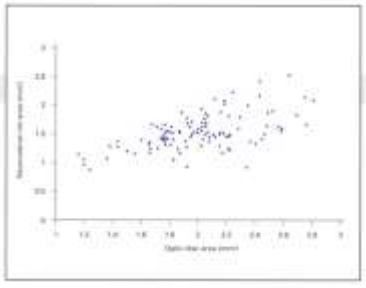
HRT-3

Best diagnostic parameter in identifying individuals at risk of conversion to glaucoma using HRT is- Moorfields Regression Analysis

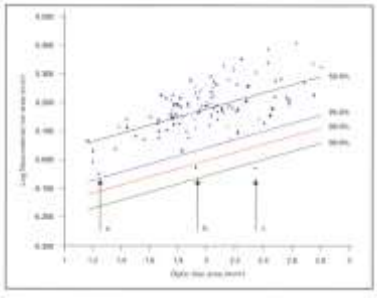
Moorfields Regression Analysis

- Prior knowledge that NRR is related to optic disc size.
- NRR may possibly decline with age.
- Knowledge of glaucomatous disease process.

Relationship between NRR and optic disc



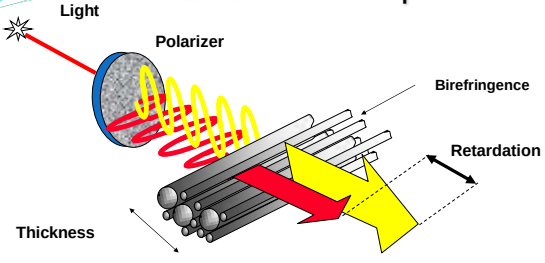
Log NRR and optic disc



Optic disc and statistical limits

GDx-VCC and GDx Pro

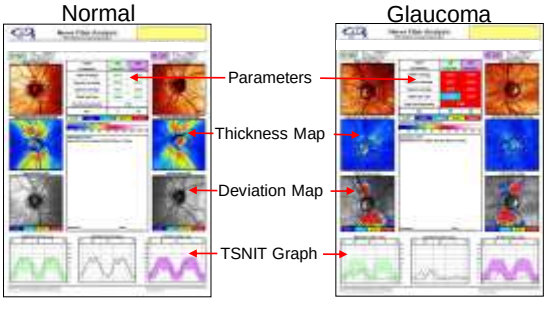
SLP Basic Principles



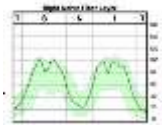
The amount of retardation from the RNFL is directly proportional to the RNFL thickness[1].
Retardation =Birefringence* thickness

[1] Weinreb et al. *Arch Ophthalmology* 1990; 108: 557-560.

GDx-VCC Printout



TSNIT Map and Table of parameters

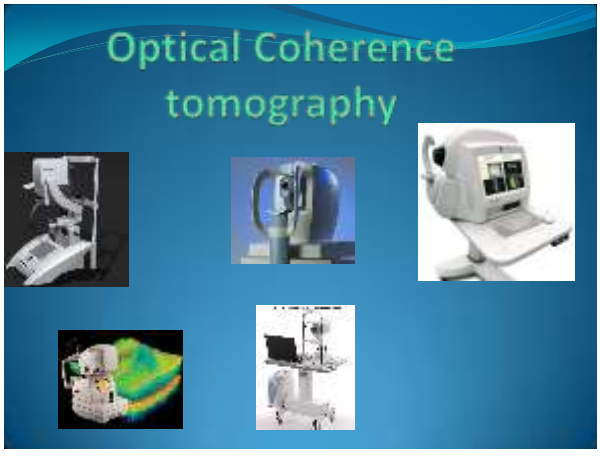


TSNIT Parameters	OD	OS
TSNIT Average	64.13	65.62
Superior Average	88.34	91.91
Inferior Average	79.37	73.95
TSNIT Std. Dev.	29.54	26.13
Inter-Eye Symmetry	0.96	
NFI	4	18

Best diagnostic parameter in identifying glaucoma using GDx is- NFI

NFI: Nerve fiber indicator

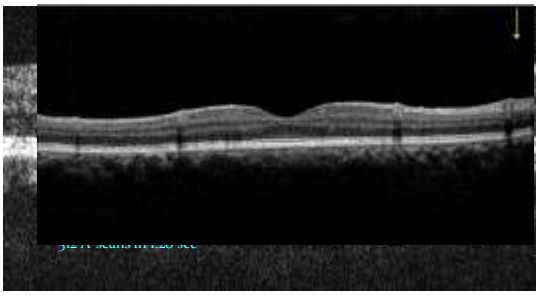
<30 low likelihood of glaucoma
30-50 glaucoma suspect
>50 high likelihood of glaucoma



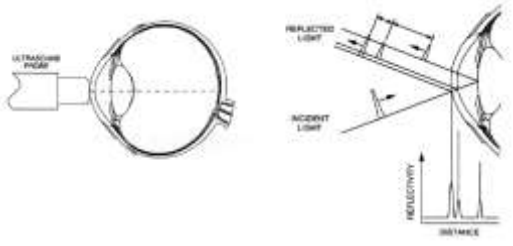
Optical coherence tomography

- It has become the mainstay of all the imaging
- It is indeed at a great point now
  - Prior devices were changing rapidly
  - Did not have good software
  - Many imaging errors
  - Numerous unknowns on how to use technology

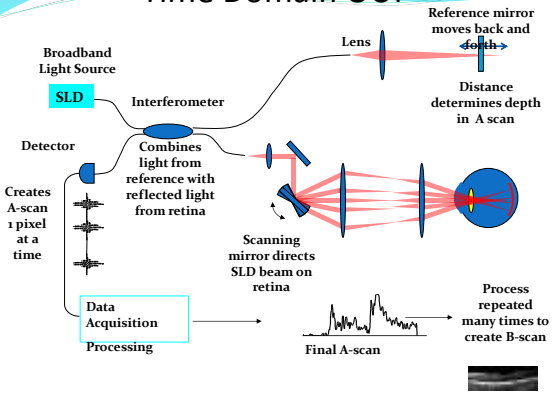
Comparison of Time versus Fourier domain



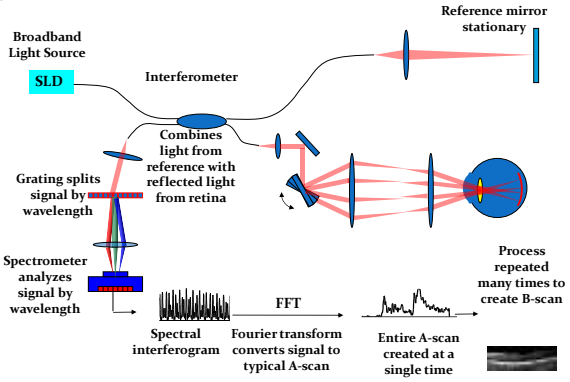
OCT-Principles



Time Domain OCT

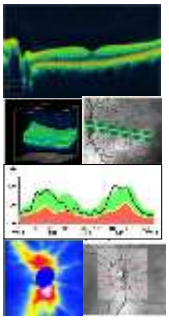


Fourier Domain OCT



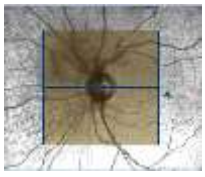
Time Domain OCT	Fourier Domain OCT
• Sequential	• Simultaneous
• 1 pixel at a time	• Entire A-scan at once
• 1024 pixels per A-scan	• 2048 pixels per A scan
• 400 A scans per second	• 26 to 80 K A scans per second
• 512 A-scans in 1.28 sec	• 1024 A-scans in 0.04 sec
• Slower than eye movements	• Faster than eye movements

Cirrus™ HD-OCT Software Version 5.1

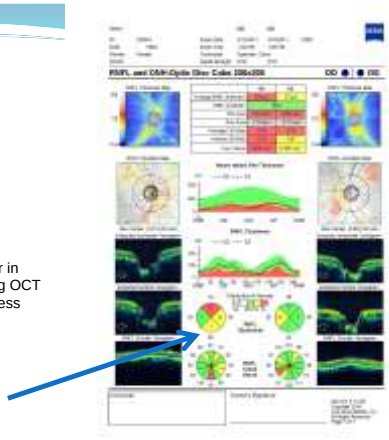


Glaucoma – RNFL Thickness Analysis

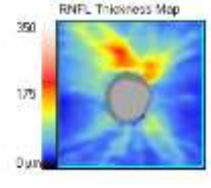
- Optic Disc scan
  - Cube scan with 6mm x 6mm area

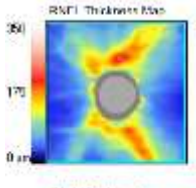


Best diagnostic parameter in identifying glaucoma using OCT is- Inferior average thickness

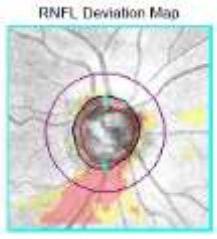


Thickness map

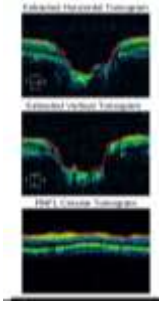




Deviation Map

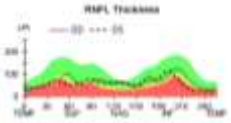


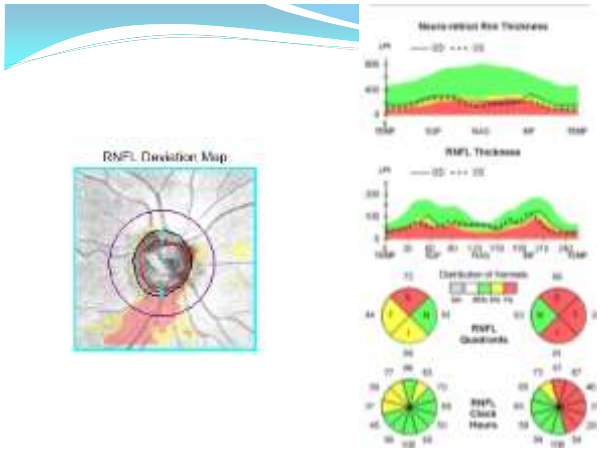
Tomogram



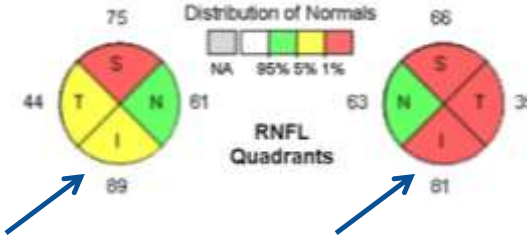
Global parameters

	OD	OS
Average RNFL Thickness	88 µm	87 µm
RNFL Symmetry	613	
Rim Area	0.84 mm²	0.93 mm²
Disc Area	1.55 mm²	1.45 mm²
Average C/D Ratio	0.66	0.72
Vertical C/D Ratio	0.58	0.67
Cup Volume	0.225 mm³	0.230 mm³



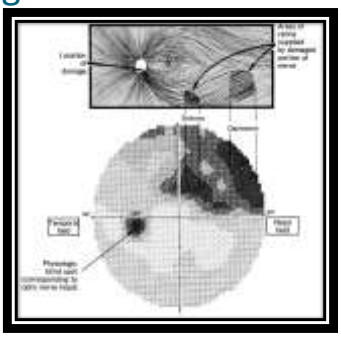


Inferior average thickness



Macula analysis

Arrangement of fibers in retina



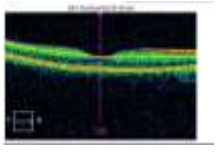
Macula analysis

Ganglion cell complex (Optovue)

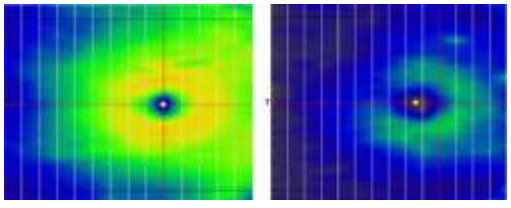
NFL+ GCL+IPL

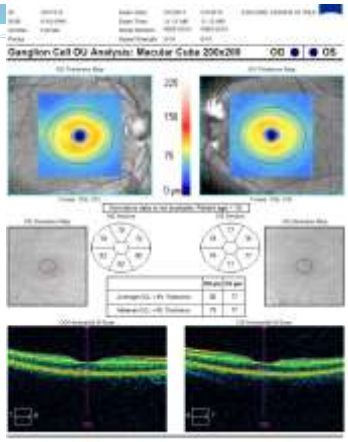
Ganglion cell analysis (Zeiss)

GCL + IPL

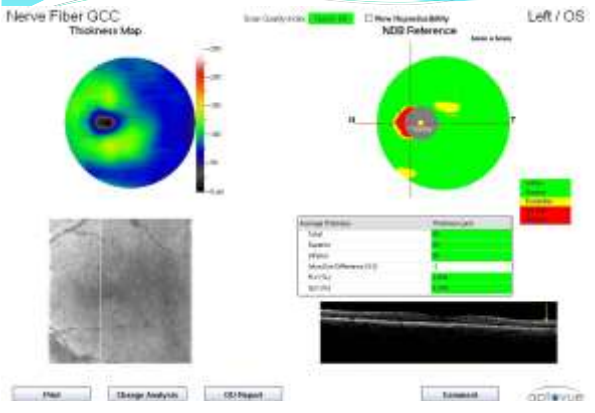


How is GCC measured

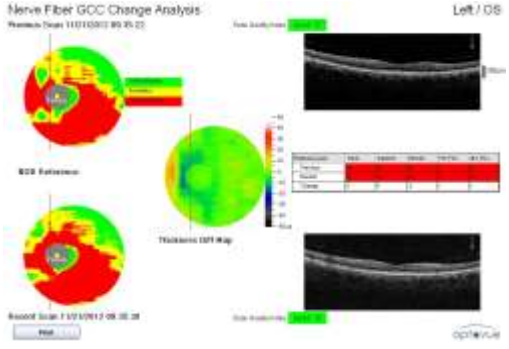




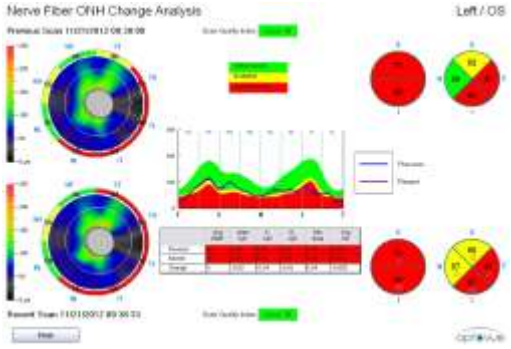
GCC output



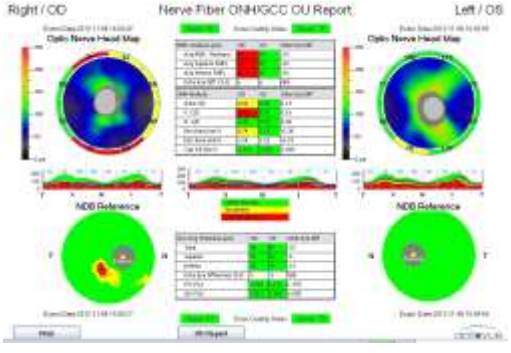
GCC Change

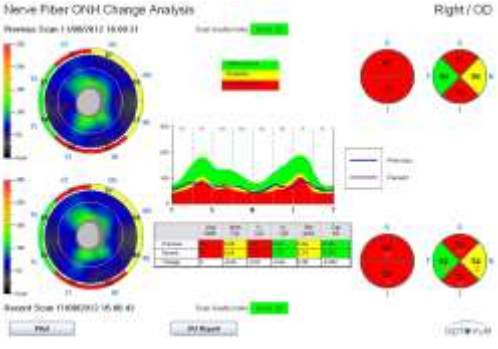


NFL Change Maps



Case





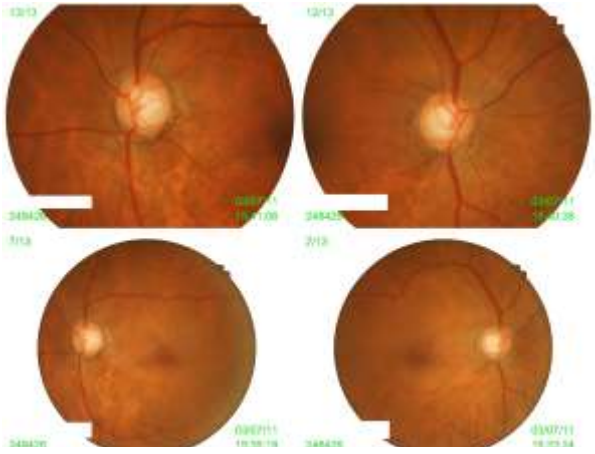
Case 2

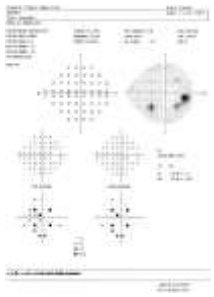
59 BF

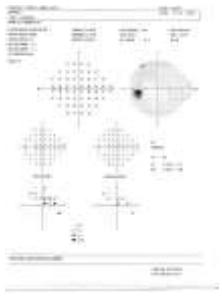
- VA 20/20-3 OD, OS
- Refraction

OD					
OS					

- Systemic history hypertension diagnosed 1 year
- No other complaints
- IOP 15 mmHg OU



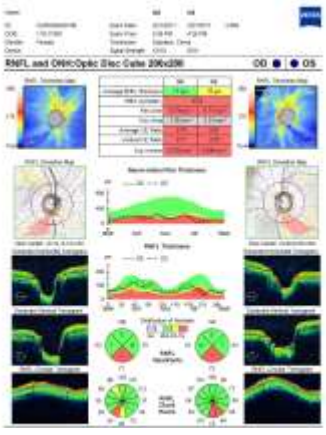




Accutome Pach V
Date: Mon 03/07/2011
Time: 05:26 PM

Patient's Name: _

CCT Reading	OD	OS
1	480	473
2	481	481
3	478	487
4	484	473
5	483	509
8	478	488
9	0	0
Average CCT	480	484
MIOP	15	15
TIOP	18	18



Open angle glaucoma

Your thoughts?