

Clinical utility of new visual field modalities in Glaucoma

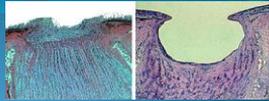
Pinakin Davey OD, PhD, FAAO
Professor
Western University of Health Sciences
College of Optometry

Disclosure

Has a relevant financial relationship with Haag Streit, Genzyme, Optovue and Bausch and Lomb as a speaker and ZeaVision, Vector Vision, Topcon as a consultant

The content and format of this course is presented without commercial bias and does not claim superiority and commercial product or service.

Glaucoma



Definitions

- “Ocular tissue damage at least partially related to intraocular pressure”

Goals

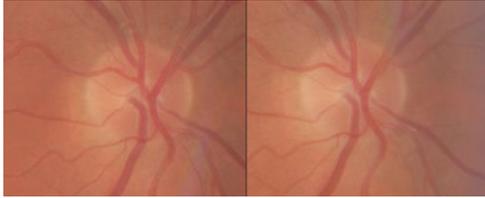
- Document status of optic nerve structure and function
- Target pressure- so damage is unlikely to happen
- Maintain IOP below target pressure
- Monitor status of the optic nerve and reset target pressure if deterioration occurs.
- Monitor Visual fields

Goals cont...

- Minimize side effects of management and impact on vision and general health and quality of life.
- Educate and engage the patient in management

Gold standard

- Simultaneous stereo photography!
- Problems?

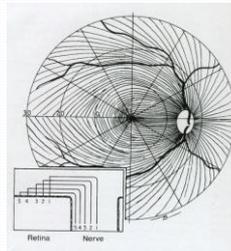


If damage occurs throughout the retina, how does visual acuity remain stable?

What about other visual tasks?

Axonal facts

- 700,000 to 1.2 million
- Large variation
- Count of axons increase with increase in area.
- Large number of axons central macula



Visual fields



Which test shall I select?

Threshold tests -standard of care in glaucoma

- Central threshold tests are standard of care in glaucoma
- Central 30 degrees
- Tests like 24-2, 30-2, G- Protocol, 32



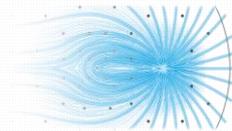
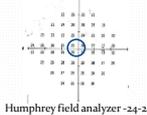
Is Glaucoma a peripheral disease ?

- Yes
- So why don't we measure visual fields from 30-60 degrees from center ?



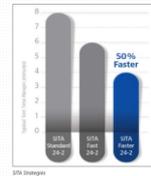
Is central retina and visual field more protected?

- Yes there is some truth to that
- But not as much as once considered...
- Lots of OCT studies identify macular damage early in glaucoma!



Octopus-G protocol

What strategy should I use?

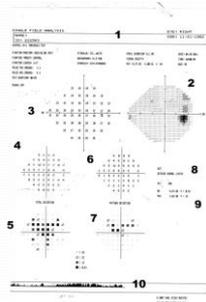


New strategies in Humphrey

- SITA Faster
- No Fixation losses measured
- No False negatives measured
- No False positives measured (SITA Standard did not measure as well.
- The thresholds are begun at much more difficult levels
- Saves time...
- But whats the cost ...?

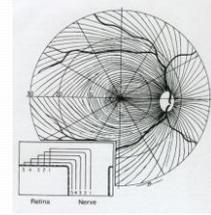
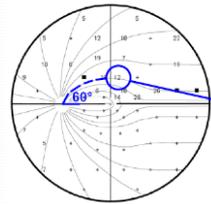
Visual fields – don't like them; cant live without them.

Humphrey "Gold standard" ?



Some problems with HFA

- Points spread evenly
- Data not representative of RNFL



Opportunities for Improvement in Central 10 Degrees

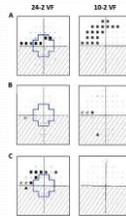
Glaucomatous damage of the macula Prog Retin Eye Res. 2013 Jan; 32C: 1-21.
 Donald C. Hood, A.B.^{1,2} Ali S. Raza, A.C.^{1,3} Carlos Gustavo V. de Moraes, D.M.^{4,5} Jeffrey M. Liebmann, D.M.^{6,7} and Robert Ritch, D.M.^{8,9}

- glaucomatous damage of the macula is common and can occur early in the disease
- can be missed and/or underestimated with standard 24-2 VF tests that use a 6° grid

The Prevalence and Nature of Early Glaucomatous Defects in the Central 10° of the Visual Field JAMA Ophthalmol. 2014 Nov; 132(11):1207.
 Jane Trajcia, B.S.^{1,2} Carlos G. De Moraes, M.D.^{3,4,5} Ali S. Raza, B.A.¹ Jeffrey M. Liebmann, M.D.^{6,7} Robert Ritch, M.D.^{8,9} and Donald C. Hood, Ph.D.^{1,2}

24-2 and 10-2 VF Examples

- Blue cross region on the 24-2 VF = central 10-2 VF.
- (A) Both are abnormal.
 - (B) 24-2 VF normal; 10-2 VF abnormal
 - (C) 24-2 VF abnormal; 10-2 VF normal



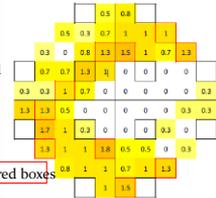
Highest Importance Locations Chosen from 10-2 Pattern

Selecting additional test locations to enhance the 24-2 pattern using a scoring system

Mathias Mollnes¹, Cato Lin², Alf Henrich³, John Flaxman⁴, Carl Otto Johansson, Hildebrandt, Carl Otto Mollnes, Debbie CA, United States, Tapan Sengco Eye Clinic, Tapan, Japan, University of California Berkeley Berkeley, United States.

WOC08-1942 / P-WF-009

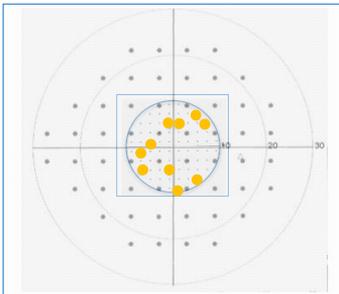
- Expert group selected specific 10-2 test point locations
- Prevalence and depth of glaucomatous macular defects were systematically evaluated to select optimum test points
- Pattern covers areas known to be susceptible to glaucomatous defects both from structural and functional studies



Selected test locations are shown in red boxes

The expert group: Donald C. Hood, Stuart K. Gardiner, Allison M. McKendrick and William H. Swanson.

Resulting SITA Faster 24-2C Pattern on HFA3

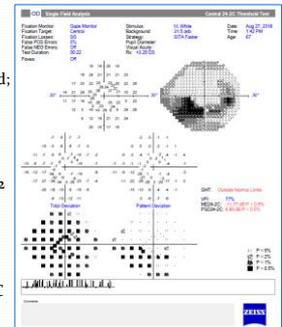


The 24-2C test pattern combines all 24-2 points + ten selected 10-2 points (shown in OD orientation)

Large Gray	24-2 pattern
Large Orange	Ten additional 24-2C points
Small Gray	10-2 pattern

Minimize Time and Maximize Information in VF Testing with HFA3

- SITA Faster 24-2**
- test in 2 minutes or less
 - ~50% faster than SITA Standard;
 - ~30% faster than SITA Fast
- SITA Faster 24-2C**
- more information in central field
 - ~20% faster than SITA Fast 24-2
- Add new tests to patient progression**
- Mixed SITA GPA
 - Includes SITA Faster, Fast, Standard, 24-2, 30-2, and 24-2C in progression analysis

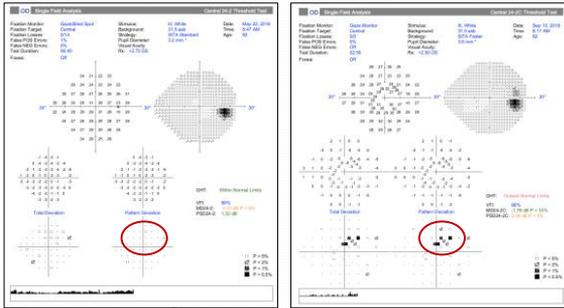


24-2C SITA Faster

Flagged points detected centrally in OD

24-2 SITA Standard

24-2C SITA Faster

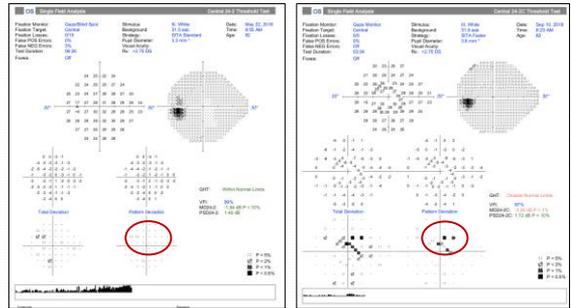


24-2C SITA Faster

Flagged points detected centrally in OS

24-2 SITA Standard

24-2C SITA Faster



New 24-2C SITA Faster protocol

- Free upgrade if you have HFA III
- Gives more macula points.
- Results comparable to 24-2 SITA FAST
- Thresholds are ± 3 dB
- Gives you some macula information
- You may need 10-2 if damage is noticed in macula region

Problems continued

- No real blind spot monitoring



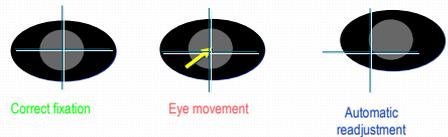
Octopus Features: Fixation Control

True Fixation Control



- No stimuli during fixation loss
- Automatic repetition of stimuli after blinking or darting
- Most accurate test possible

Octopus Features: Auto Eye Tracking



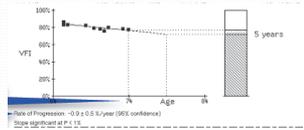
- ❖ The perimeter centers the patient automatically to the optical axis
- ❖ Less interrupts, less time to finish

HFA II versus HFA 3

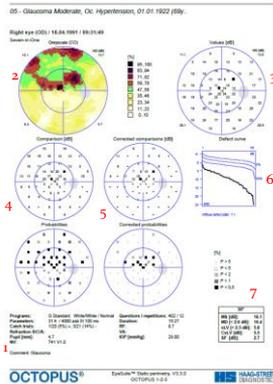
- Larger touch screen
- Liquid crystal lens -8 to +8 only sph correction

Visual Field Index

- Percentage of normal age adjusted field
- Greater the number more normal
- Trend over time is given with a probability values as well
- Should work in theory; in reality does not!



Octopus



Unique features of Octopus

Octopus Features: Fixation Control

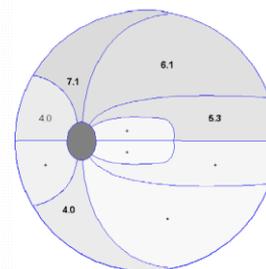
True Fixation Control



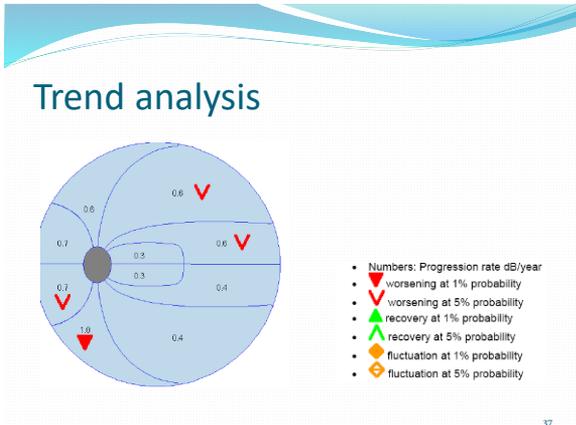
- No stimuli during fixation loss
- Automatic repetition of stimuli after blinking or darting
- Most accurate test possible

Cluster analysis

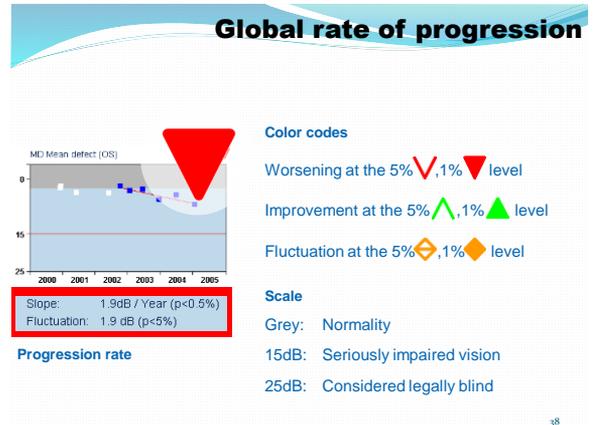
Why cluster analysis?



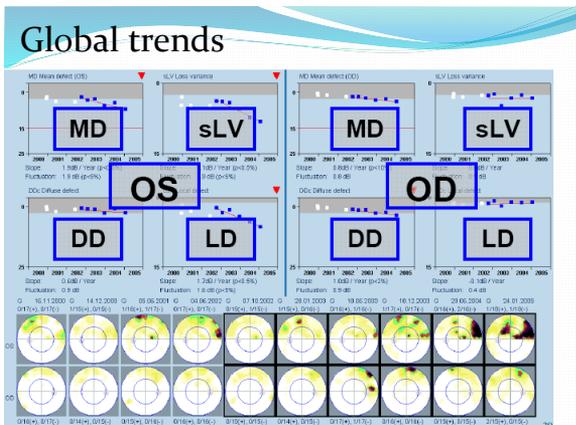
- Individual points may vary
- Overall clusters are more stable
- Also close representation to various bundles of RNFL
- So in some respect better structure function relationship.



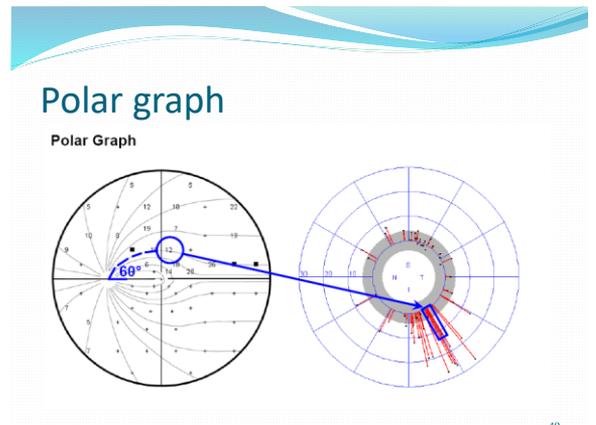
37



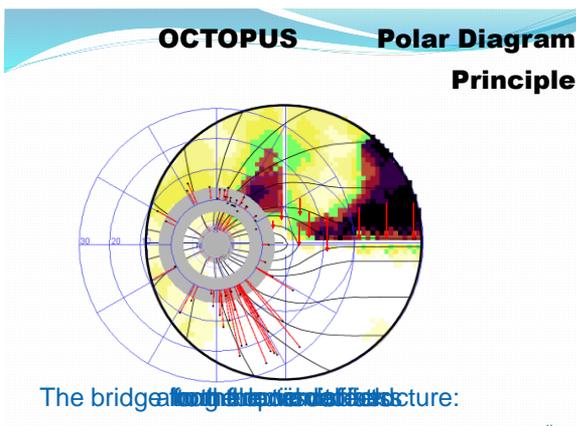
38



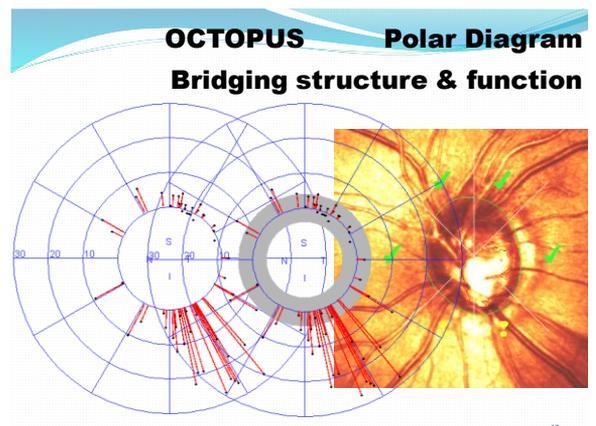
39



40



41



42

Staging of disease



49

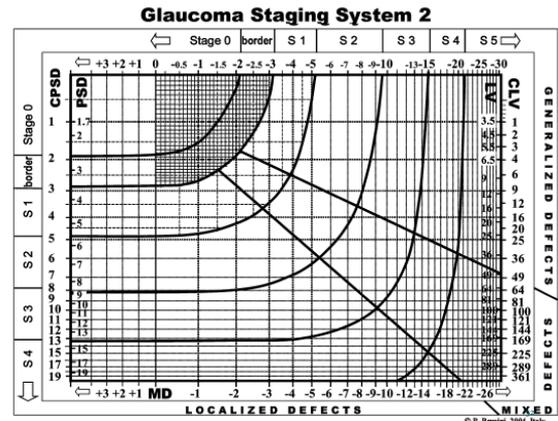
Why is staging important?

- Treatment issues
- Management issues
- Prognosis
- Research

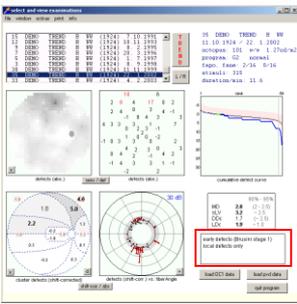
50

Glaucoma staging system- Brusini GSS -2

51



Clear text analysis



Stages

- normal VF
- borderline VF
- early VF defects (Brusini stage 1)
- moderate VF defects (Brusini st. 2)
- advanced VF defects (Brusini st. 3)
- severe VF defects (Brusini stage 4)
- most severe VF defects (Brusini st. 5)

52

Octopus -600



53



Why does it help targeting specific ganglion cells?

ILLUSTRATION OF THE RATIONALE BEHIND FUNCTION-SPECIFIC PERIMETRY

STIMULUS	TYPE OF RETINAL GANGLION CELLS	NORMAL	EARLY PATHOLOGY
SAP 	Parvocellular Koniocellular Magnocellular		
Pulsar 	Magnocellular		

Design of the PULSAR stimulus

DESIGN OF THE PULSAR STIMULUS

PHASE	COUNTER-PHASE
HEALTHY flicker-sensitive cells Seen	DISEASED flicker-sensitive cells Not seen

Sensitivity thresholds with PULSAR perimetry

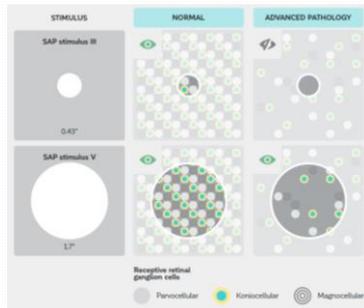
LESS VISIBLE → MORE VISIBLE

	1	2	3
CONTRAST			
SPATIAL RESOLUTION			

Example of SAP and function-specific perimetry in the same eye

	GRAYSCALE (CO)	COMPARISON	PROBABILITIES
SAP			
FUNCTION-SPECIFIC PERIMETRY			

Principle of using stimulus V for low vision patients



Patient has cataract what do I do with Visual fields?

ORIGINAL ARTICLE

Effect of Cataract Opacity Type and Glaucoma Severity on Visual Field Index

Hye Jin Chung^{*}, Jeong Hoon Choi[†], Young-Chun Lee[‡],
and Su-Young Kim[†]

- Visual field parameters improved after cataract surgery
- MD, PSD and VFI- less influenced in nuclear sclerosis
- MD, PSD and VFI – greater effect in cortical cataract, particularly for early glaucoma

1040-5488/16/3306-0575/0 VOL. 33, NO. 6, PP. 575-578
OPTOMETRY AND VISION SCIENCE
Copyright © 2016 American Academy of Optometry

Cataract in glaucoma patient

- Dilate as much as possible
- Depend on PSD plot more than total deviation
- Use imaging modalities more.

Sources of error

- Miosis: decreases threshold peripherally, increases variability centrally
- Lens opacities
- Uncorrected refractive error –decrease in contrast sensitivity
- Spectacles
- Ptosis

65

Summary

- Time for change is here.
- Doing what we have always done is unlikely to yield progress.
- Great programs that make a lot of sense clinically
- New technology may identify glaucoma early and easier to follow