Glaucoma NZ Case 2:

Learning outcomes

- To recognise the features of manifest primary open angle glaucoma,
- To understand the basic and advanced principles of Visual field testing.
- To understand and interpret OCT in the context of glaucoma
- To understand the artefacts associated with visual field and OCT

Case:

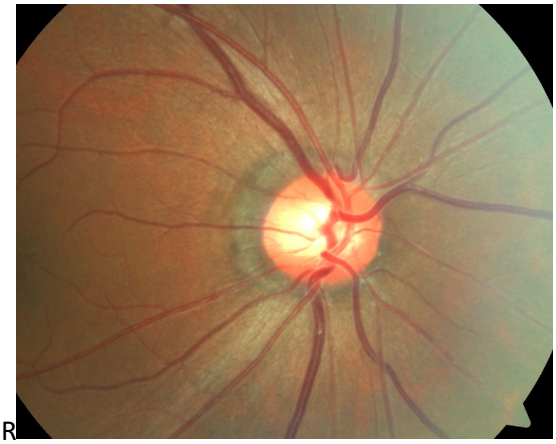
A 59 year-old Caucasian woman presented for a routine optometry examination. She is emmetropic but has developed presbyopia. She has been wearing over the counter readers until now.

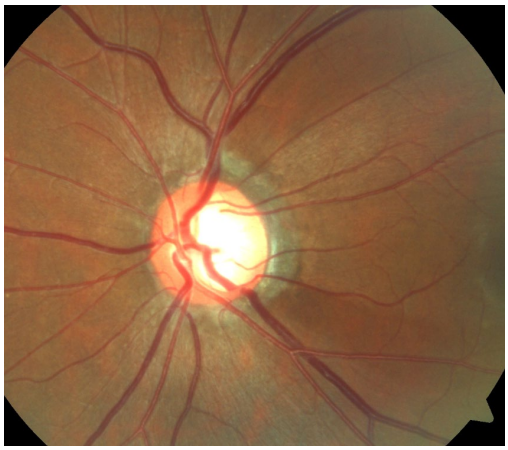
She is not aware of a family history for glaucoma. She reports good general health, and mentioned that he takes Lipitor for high cholesterol, and that this is now well-controlled with medication.

Clinical examination:

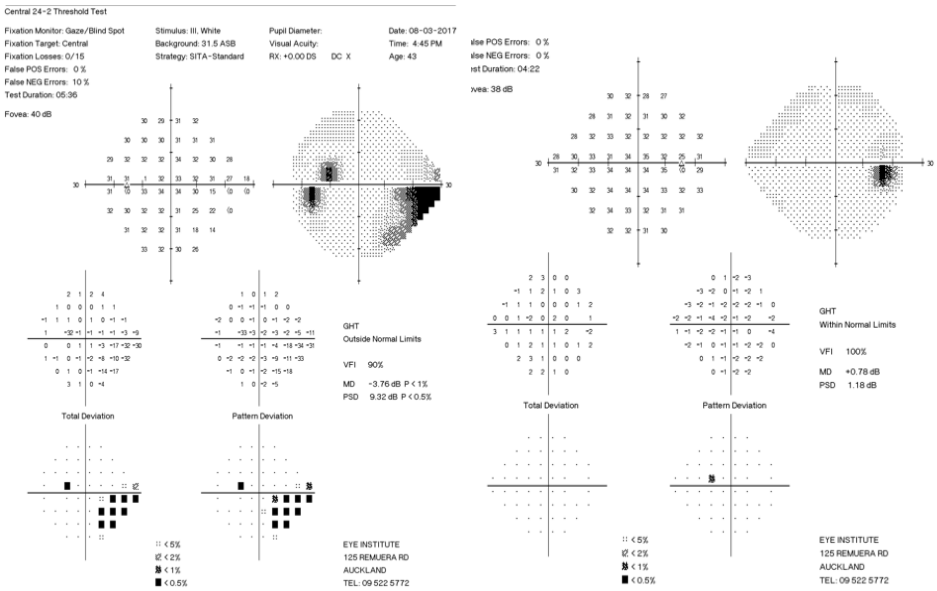
	Right Eye	Left Eye
VA	6/5 unaided	6/15 unaided, 6/6 with pinhole
Pupils	Small L RAPD	
Colour Vision	15/15	15/15
IOP	16 mmHg	20 mmHg
Gonioscopy	C-D30r	C-D30r

Optic nerve photos

R 

L 

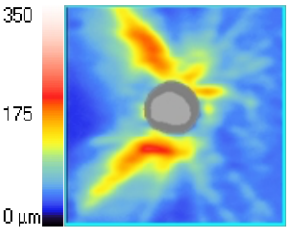
Visual Fields



Optical Coherence Tomograph

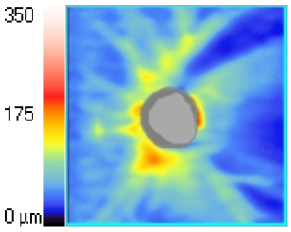
ONH and RNFL OU Analysis:Optic Disc Cube 200x200 OD ● ● OS

RNFL Thickness Map

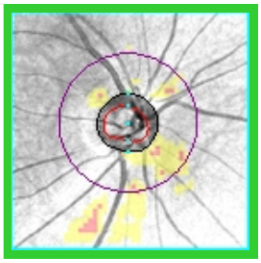


	OD	OS
Average RNFL Thickness	88 µm	77 µm
RNFL Symmetry	1%	
Rim Area	0.94 mm²	0.80 mm²
Disc Area	1.74 mm²	2.16 mm²
Average C/D Ratio	0.67	0.79
Vertical C/D Ratio	0.59	0.82
Cup Volume	0.293 mm³	0.619 mm³

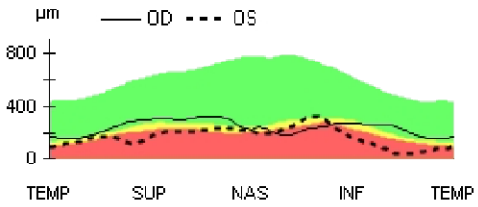
RNFL Thickness Map



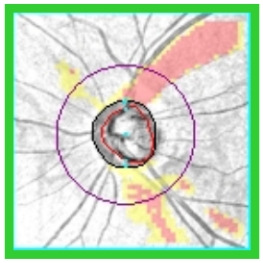
RNFL Deviation Map



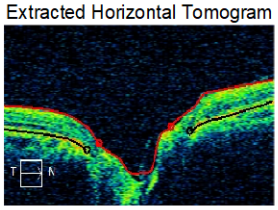
Neuro-retinal Rim Thickness



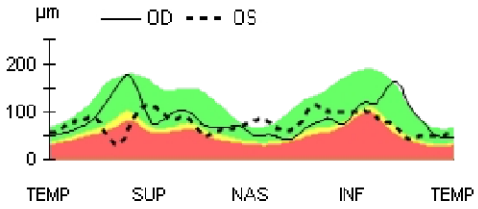
RNFL Deviation Map



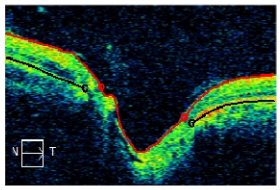
Disc Center(-0.09,0.24)mm
Extracted Horizontal Tomogram



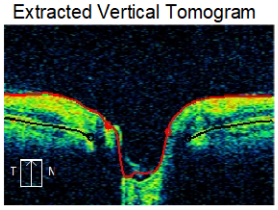
RNFL Thickness

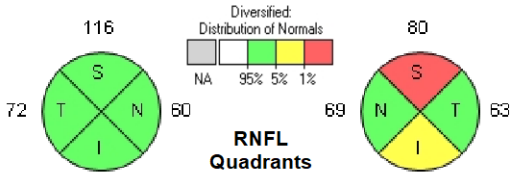


Disc Center(-0.18,-0.06)mm
Extracted Horizontal Tomogram

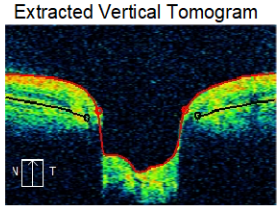


Extracted Vertical Tomogram

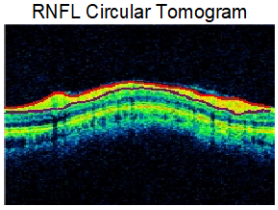


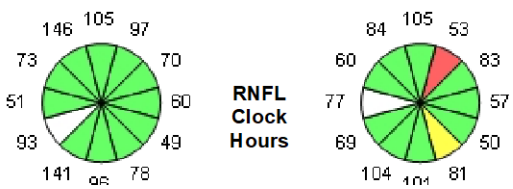


Extracted Vertical Tomogram

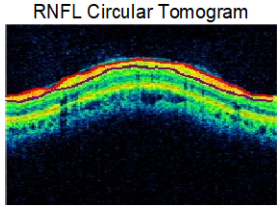


RNFL Circular Tomogram

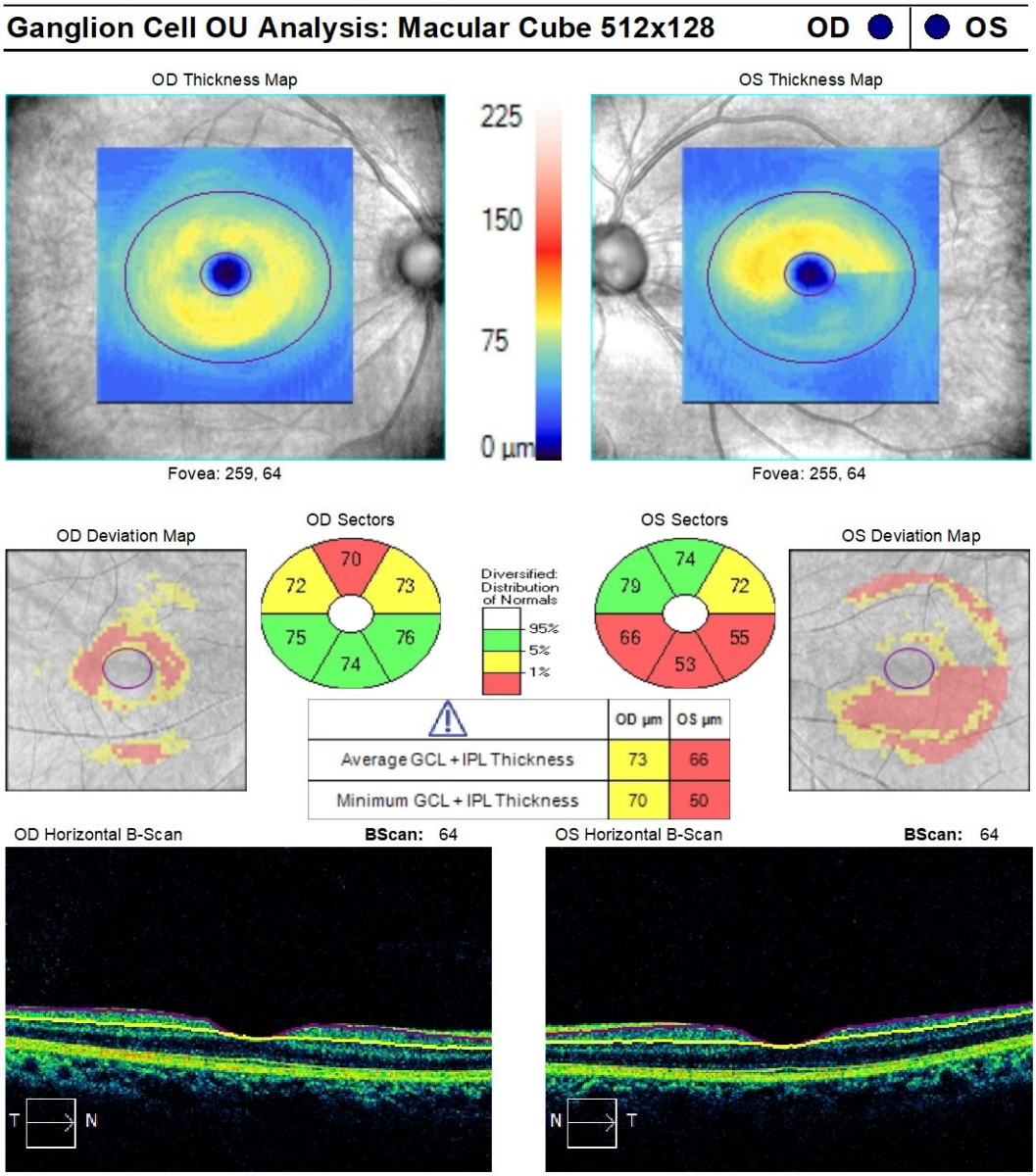




RNFL Circular Tomogram



Optical Coherence Tomography – Ganglion Cell Complex



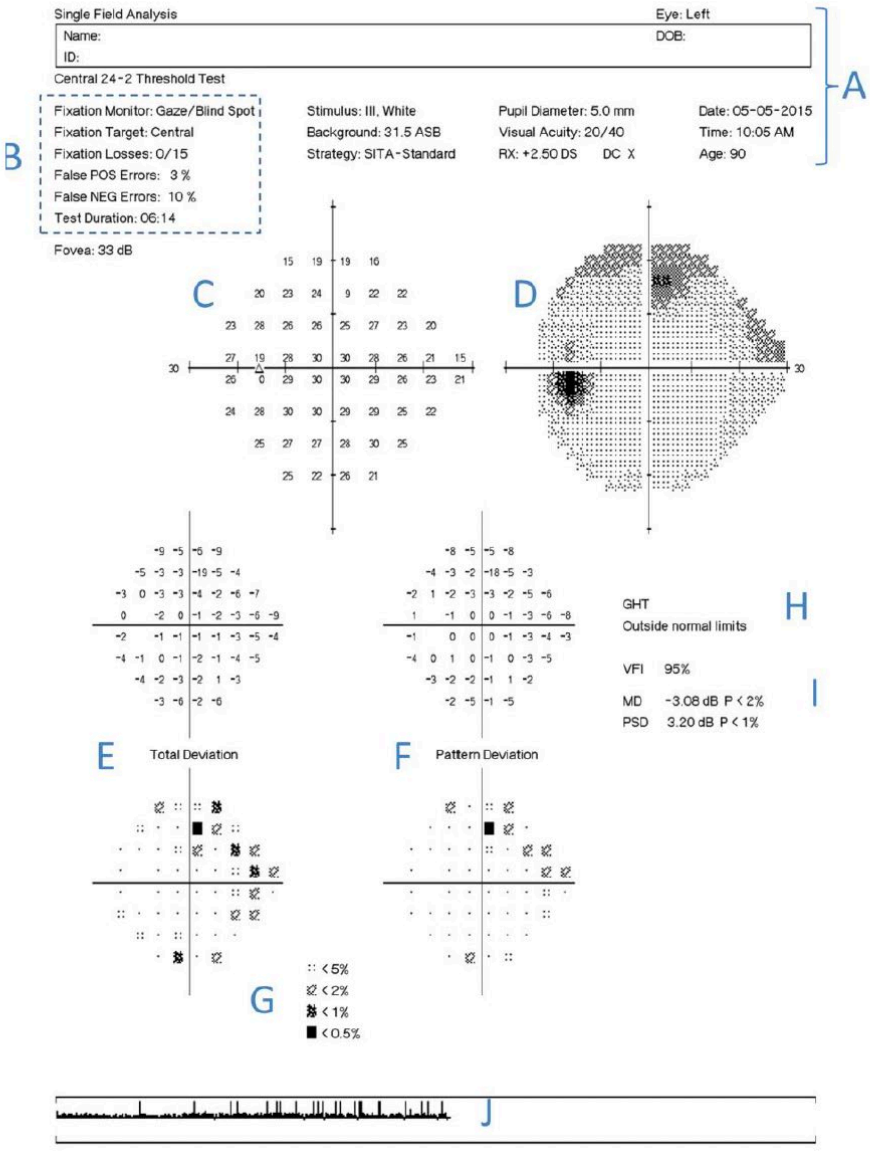
Questions (THE ANSWERS FOR SOME QUESTIONS ARE PROVIDED DIRECTLY IN THE TEXTBOOK REFERENCE, AVAILABLE FREELY ONLINE)

Question 1: Describe the patient's optic nerve.

The right disc appears to be of normal size with a normal vascular pattern. The vertical cup:disc ratio is 0.55 to 0.6. The cup depth appears to be average depth. The neuroretinal rim is intact 360 degrees with no evidence of neuroretinal rim thinning or notching. There is no retinal nerve fibre layer loss an no retinal nerve fibre haemorrhage.

The left appears to be of normal size with a normal vascular pattern. The vertical cup:disc ratio is 0.8. The cup depth appears to be average depth but the photograph is over-exposed. The neuroretinal rim shows thinning superotemporally and inferotemporally with evidence of neuroretinal rim thinning superotemporal and inferotemporally. The retinal nerve fibre layer thinning is evidence with RNFL defect superotemporally and inferotemporally. There is retinal nerve fibre haemorrhage.

Question 2 : Describe this visual field and what each letter refers for the letters A-E:



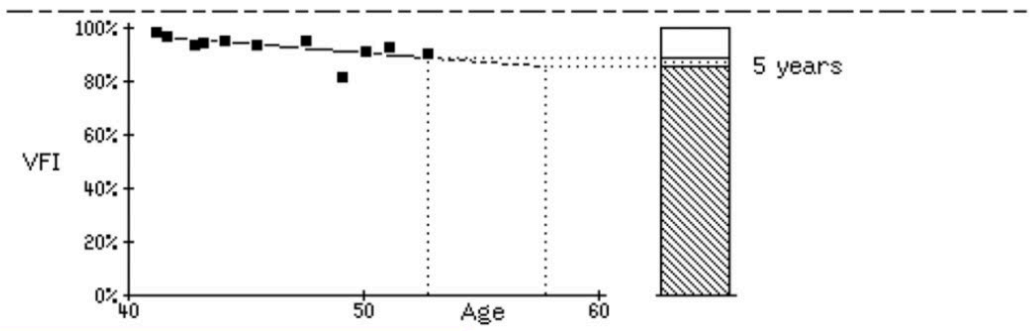
Answer:

- **A.** Patient information and test conditions.
- **B.** Reliability parameters (*dash-line box*). Fixation losses, false-positive errors, and false-negative errors are discussed in the text.
- **C.** Test result in dB. The higher the number, the greater the visual sensitivity.
- **D.** Gray scale.
- **E.** Total deviation: the difference from normal in dB (*top*) and the likelihood that the results occurred by chance (*bottom*).

Question 3 : Describe this visual field and what each letter refers for the letters F-J:

F. Pattern deviation: the total deviation, corrected for the overall height of the hill of vision to minimize the effect of media opacity, in dB (*top*) and the likelihood that the results occurred by chance (*bottom*).
G. Key to probability symbols.
H. Glaucoma Hemifield Test (see page 51).
I. Global indices. The Visual Field Index (VFI), mean deviation (MD), and Pattern Standard Deviation (PSD) are discussed in the text.
J. Gaze tracker. A gaze deviation is recorded as a line extending upward, while inability to track gaze (e.g. a blink) is recorded as a line extending downward.

Question: Regarding Guided Progression Analysis (GPA)in visual field, describe the results:



Answer:

The GPA shows rate of progression in the visual field over time. It displays a rate of progression over time along with confidence intervals. This displays the **trend analysis.** This regression line determines the rate of change for all of the data collected over time. It is shown as a slope with a percentage rate of change per year.

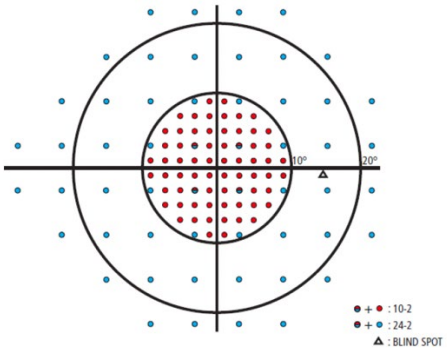
GPA requires two baseline scans before it can begin to interpret changes over time. It plotting a regression line for the Visual Field Index . The VFI percentage is calculated by the HFA to quantify the patient's visual function. A slow rate of progression is considered less than 0.5 dB/year, while a very fast rate of progression is considered 1.5 dB/year or higher. However, even slower rates in younger patients are still at risk of progressive field loss due to longer life expectancy with glaucoma.
The slope for the trend analysis also gives a prediction of future progression over the next five years if the patient continues the current treatment plan to slow down progression.

The benefits of trend analysis include:

- Identifying fast progressors
- Identifying generalized, large areas of structural or functional loss

Question 4: Describe the difference between the points tested for in 24-2 and 10-2 visual field test.

Answer:
While the 24-2 tests (*blue dots*) point are separated by 6 degrees, 10-2 test points (*red dots*) are separated by only 2 degrees. Note that the 24-2 and 10-2 programs only overlap at one test point in each quadrant (*half-red, half-blue dots,*

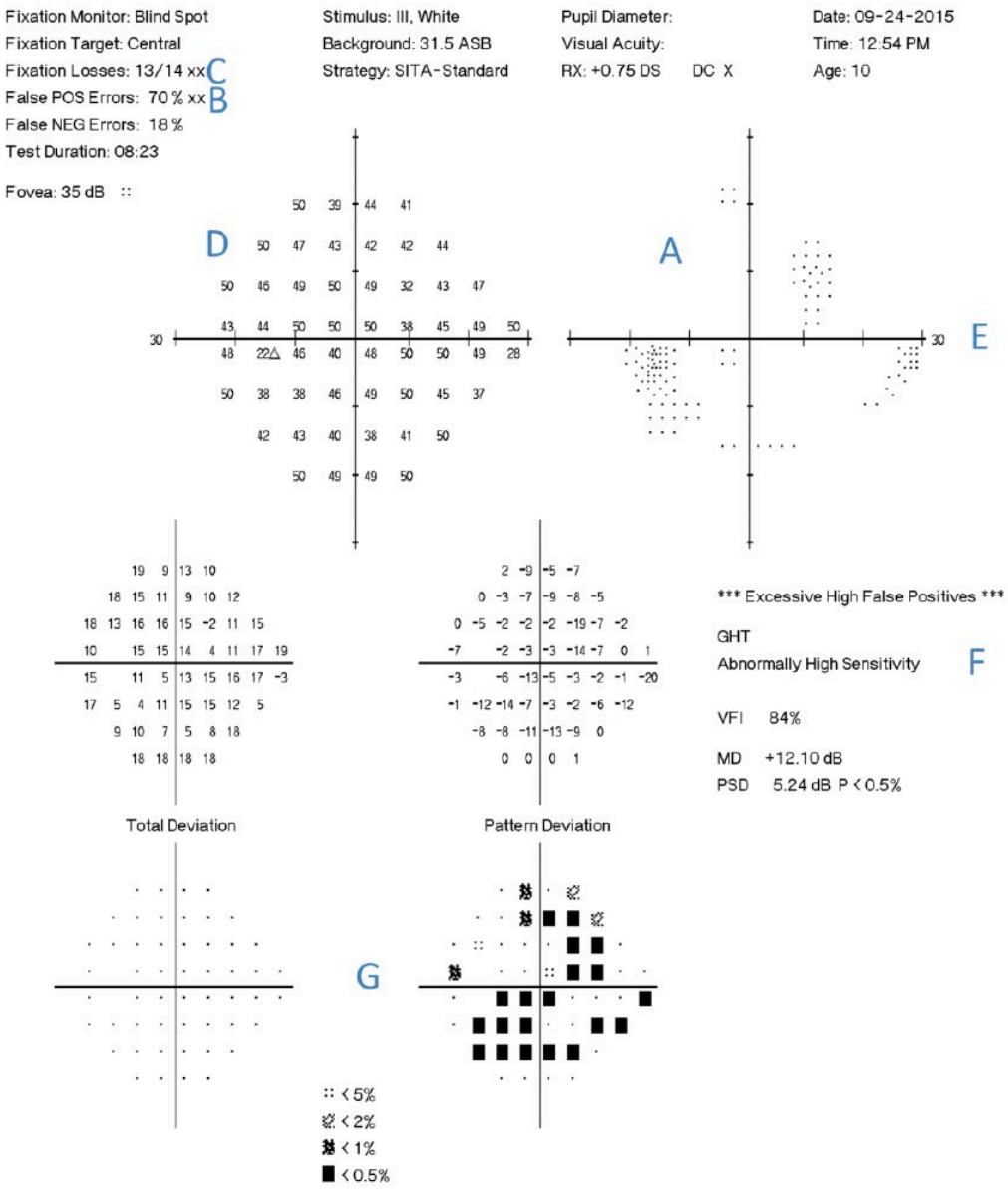


Question 5. Describe what are false positives and how it is determined by automated visual field testing.

Answer:

False positives are recorded when the patient responds without a presented stimulus. False positives up to 33% are acceptable, as per the manufacturer. Excess false positives mask the underlying visual field defects. False positives are generally a mark of unreliable test performance. They are not caused by eye disease or testing artifacts. Rarely, if a patient experiences photopsias it can be cause false positives. Although the perimeter alerts when the false-positive rate is ≥ 33%, fields with a ≥ 5% false-positive rate should be interpreted with caution. Visual fields with ≥ 10% false positives are questionable.

Visual fields can be minimised by patient education. In particular, patients should be informed that it is normal to not seem some of the stimuli. This is a very common reason for false-positives.



There are seven findings related to an excessively high false-positive rate. **A**. White scotoma on gray scale. **B**. High false positives. **C**. High fixation loss rate. The field analyzer records any response to a stimulus projected onto the physiologic blind spot as a fixation loss, which occurs with increased frequency in an examination with a high false-positive rate. **D**. Supra-normal sensitivities (higher than foveal sensitivity, which is 35 dB in this case). **E**. Loss of the physiologic blind spot. **F**. The Glaucoma Hemifield Test message “Abnormally High Sensitivity,” which appears when the overall sensitivity in the best part of the field is higher than that found in 99.5% of the population. **G**. “Reverse cataract” pattern in which generalized depression occurs on the pattern deviation rather than total deviation

Question 6: What are false negatives and what are features on a visual field which suggest the defect is caused by false negatives?
False negatives.

False negatives are recorded when the patient does not respond to a stimulus of higher intensity presented at the same location where previously the patient has responded to a lower intensity stimulus. False negatives of more than 33% suggest poor reliability of the fields. False-negative do not necessarily indicate unreliable fields. Areas of depressed sensitivity, and a brighter stimulus may truly not be visible on second presentation in areas of visual field damage. Visual fields with false-negative responses should be interpreted light of the entire clinical picture.

One characteristic field defect seen in people with high false-negative rates related to fatigue is the "cloverleaf" field in which the patient responds to the early test points but then fails to respond to subsequent stimuli. A variant of this field is the apparently constricted field, a "pseudocentral island," in which the patient failed to respond to the points tested last which were, because of the test logic, the peripheral points.

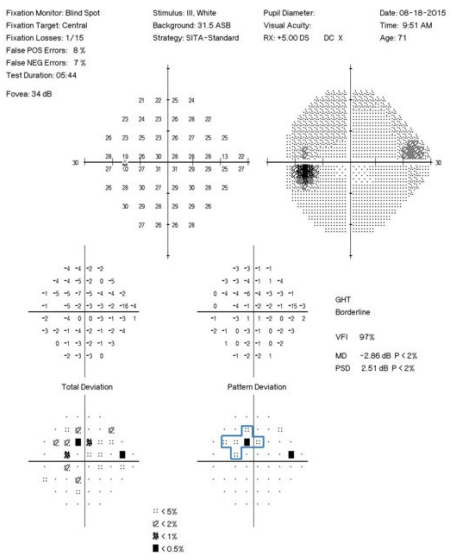
Question 7: How are fixation losses determined and what is the most common reason for high fixation losses?

***Fixation losses*.** Not all fixation losses represent true loss of fixation. The perimeter first quickly locates the blind spot and then projects an occasional maximum stimulus into it. If the patient responds to the stimulus, a shift in the blind spot and fixation has occurred, and the machine records a fixation loss. A high number of fixation losses may thus indicate that the center of the blind spot was slightly mislocated. A high false-positive rate will give a high fixation loss rate as well.

Question 8: What is the Hodapp-Anderson-Parrish criteria for Minimum Criteria for Diagnosing Acquired Glaucomatous Damage in a 24-2 Examination?

Answer:
Any of the following must be reproducible on two consecutive fields –

- A Glaucoma Hemifield Test "Outside normal limits."
- A cluster of three or more points in a location typical for glaucoma, all of which are depressed on the pattern deviation plot at a $p < 5\%$ level and one of which is depressed at a $p < 1\%$ level.
- A pattern standard deviation that occurs in less than 5% of normal fields. For example,



Question 9: What features would suggest conversion from being a Glaucoma Suspect to Manifest Glaucoma?

Answer

1. If a suspect with a visual field defect corresponding to a RNFL defect is noted to have previously undetected, episodic IOP elevation, he/she is diagnosed with glaucoma.

2. A confirmed new defect in a previously normal visual field consistent with glaucomatous damage.
3. A confirmed deepening or expansion of a previously ambiguous visual field defect.
4. Progressive thinning of the circumpapillary RNFL consistent with a glaucomatous process
5. Progressive optic disc cupping, notching or rim thinning documented by serial stereoscopic disc photographs.

Question 10: What features would suggest a non-glaucomatous optic neuropathy rather than glaucoma?

Answer:

Patients should be considered as having a possible non-glaucomatous optic neuropathy if they have the following:

- Age < 50 years
- Best-corrected vision < 20/40 (unless explained by other clear findings on exam)
- Optic disc pallor greater than cupping
- Visual field with borderline vertical midline defect
- Headaches and/or localizing neurologic symptoms

Required reading:

Chang TC, Ramulu P, Hodapp E. Clinical decisions in glaucoma. Miami (FL): Bascom Palmer Eye Institute; 2016. Chapters 1-5 (etext)