Visual Fields-Is There still a need in 2023?

EYECARE EDUCATION

Learning Objectives

Delegates will learn how to recognise non-glaucomatous Visual Field Defects and their likely causes (s.5)

Delegates will be skilled in how to be able to select an appropriate VF test for an individual patient and make appropriate referral based on the VF defect (s.7)

ARE Visual Fields being Overshadowed?

Earlier generations of practitioners did not diagnose Glaucoma until there was a VF defect,

Technological changes
Digital Retinal Camera- Colour photos we were able to detect structural deterioration prior to VF changes

OCT- Improved Imaging Option
Better Quantification and earlier detection of structural loss

Practitioners maybe became too reliant on OCT and moved away from VF testing

OCT newer technology with the ‘WOW’ factor for the patient

OCT is still a Game-changer

Now with OCT

RNFL in full Detail- Peripapillary Thickening
Comparison against age based Normative data

Macula Ganglion Cell- Inner Plexiform layer
Hugely beneficial in the early detection of Glaucoma, MS, Parkinson's, Alzheimer's.

OCT-A ONH Radial peripapillary plexus
Retina- Capillary density around the Macula

Fundus Auto-Fluorescence

STRUCTURE VS FUNCTION: Is OCT better?

What goes first Structure of Function?

1) Ocular Hypertension Study (OHTS) in 2002
Structural losses were the 1st to be damaged prior to Functional loss (1)
-Disc Analysis 55% Glaucoma (STRUCTURE)
-Fields Analysis 35% Glaucoma (FUNCTION)
- VF & Discs: 90%

2) OCT is better than stereo photos & Visual Fields at discriminating Glaucoma suspects from Glaucoma (2)

In practice we need to assess BOTH Structure and Function

So which is best OCT or VF?

OCT is better in early Glaucoma

VF is better in more advanced Glaucoma

Sensitivity & Specificity are good with both

Both in combination with each other are exceptional

White on White, SAP & SITA

‘White on White’- White stimulus on a white background

SAP- Standard Automated Perimetry
Determines the threshold with age based data

SITA- optimises the determination of the threshold, based on pxs age and neighbouring thresholds.
Reduces the time necessary to detect a VF defect by 50%
Decreases patient fatigue and increases reliability

SITA mode is now routinely used in many automated perimeters

Swedish Interactive Threshold Algorithm- SITA

SITA STANDARD vs SITA FAST vs SITA FASTER

SITA FAST takes 67% of the time taken for SITA STANDARD

Primary difference between the two is the amount of certainty that is required before testing is stopped.
About 1/3 quicker

<u>Conclusion</u>
Standard is more precise
More tolerant of mistakes
Easier test as the stimuli are brighter

SITA FAST- Reliability is not as good

Are you familiar with SITA FASTER?

Sita FASTER

Turns off False Negatives

Turns off Blind Spot Monitor

Leaves on False Positives

Leaves on Gaze Tracking

Faster test with same reliability

testing the 24-30 degrees: 24-2/30-2

Only a small per centage of glaucomatous defects occur in the periphery alone

Testing the central 24-30 degrees is the preferred ‘Gold Standard’

The reason being that the majority of Retinal Ganglion cells are within the central 30 degrees of fixation

If you have a peripheral defect you will more than likely have a central defect also

24-2 vs 30-2 vs 10-2

30-2 tests 76 locations Tests out to 30 degrees Nasal

- Nasal area does tend to be the hunting ground for glaucomatous Nasal Steps
- -Better assessment of Temporal VF Loss
- Only 4 points in central 10 degrees

24-2

-Still tests out to 30 degrees in the nasal step region
-Quicker test time, 5 mins faster
-Only 4 points in temporal field, only 4 central points

10-2 tests 68 points in central 10 degrees

-Why bother: as Glaucoma causes tunnel vision
-Strong evidence of central defects early in disease process

AI & ITS USES in VISUAL FIELDS

Scientists have used AI to predict future VF loss.

1)Pearse Keane & Moorfields Eye Hospital used 32,000 Humphreys VF Analyser (HFA) taken over 20 years to train a deep learning (DL) algorithm in predicting future changes. Using only a single HFA plot as its input, the DL model is still able to predict, with accuracy, VF results up to 5 yrs. in the future

2) Interpreting OCT scans to predict VF loss
IBM research has collaborated with New York University to develop a DL technique capable of estimating VF index of a patient from a single OCT scan of the ONH

What the future holds

Wearable Technology

Every room is a Visual Field Test Room,
Space is a premium- Small Test rooms nowadays

Wearables

Can be used as an in office screening

Or

At-home monitoring device, similar to measuring your pressure at home with iCare IOP self measurement for Glaucoma sufferers

VIRTUAL REALITY HEADSETS

COMMERCIALLY AVAILABLE VR PERIMETERS

Advanced Vision Analyzer

HERU's Re:vive

PalmScan VF2000 Visual Field Analyzer

VirtualEye Perimeter

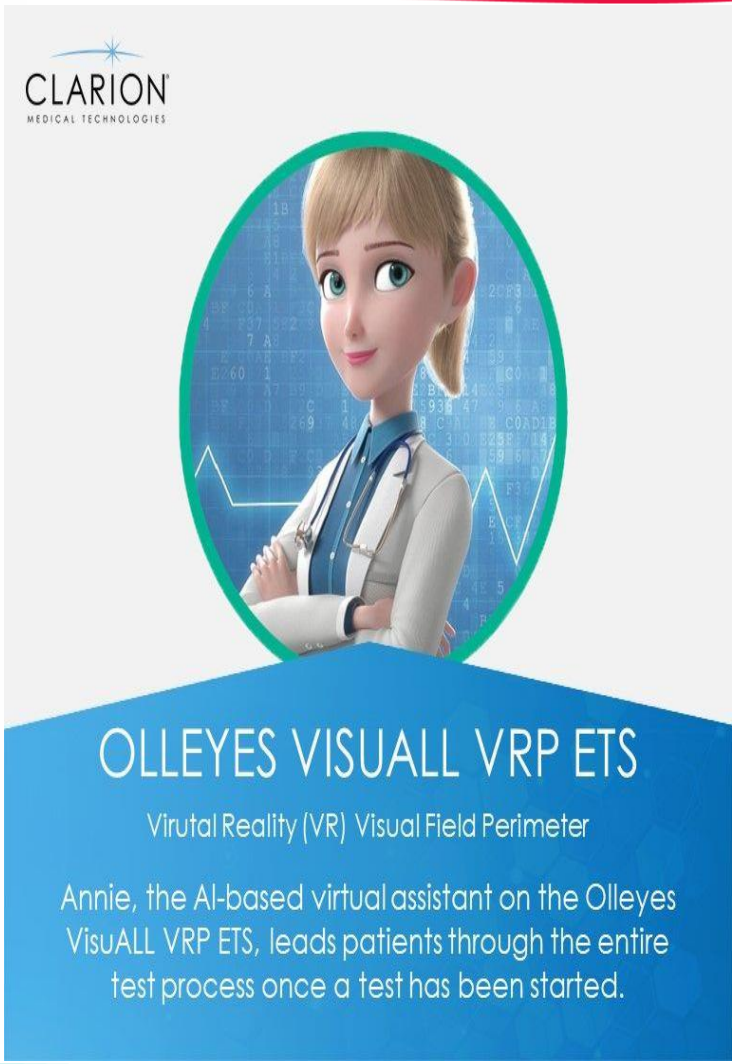
Virtual Field

VisuALL S System perimeter

Vivid Vision Perimeter

- Advanced Vision Analyzer (Elisar)
- Re:vive (Heru)
- PalmScan VF2000 Visual Field Analyzer (Micro Medical Devices)
- VirtualEye Perimeter (BioFormatix)
- Virtual Field (Virtual Field)
- VisuALL S System Perimeter (Keeler/Olleyes)
- Vivid Vision Perimeter (Vivid Vision)

OLLEYES AI Assisted VR HEADEST VF



Oculera VR Visual Field Analyser

Testing: At home & in the office

iCARE HOME TONOMETER

PEER REVIEW
CASE STUDY 1

Case Study 1

A 69YO WF presents for a routine eye examination. No visual symptoms reported. Hasn't been feeling very well recently, had 'a bit of a turn' 2 months ago. Feels her self that her vision is OK and her glasses are working well. Retired. Driver

General Health: Fair

Meds: Atorvastatin, Bisoprolol

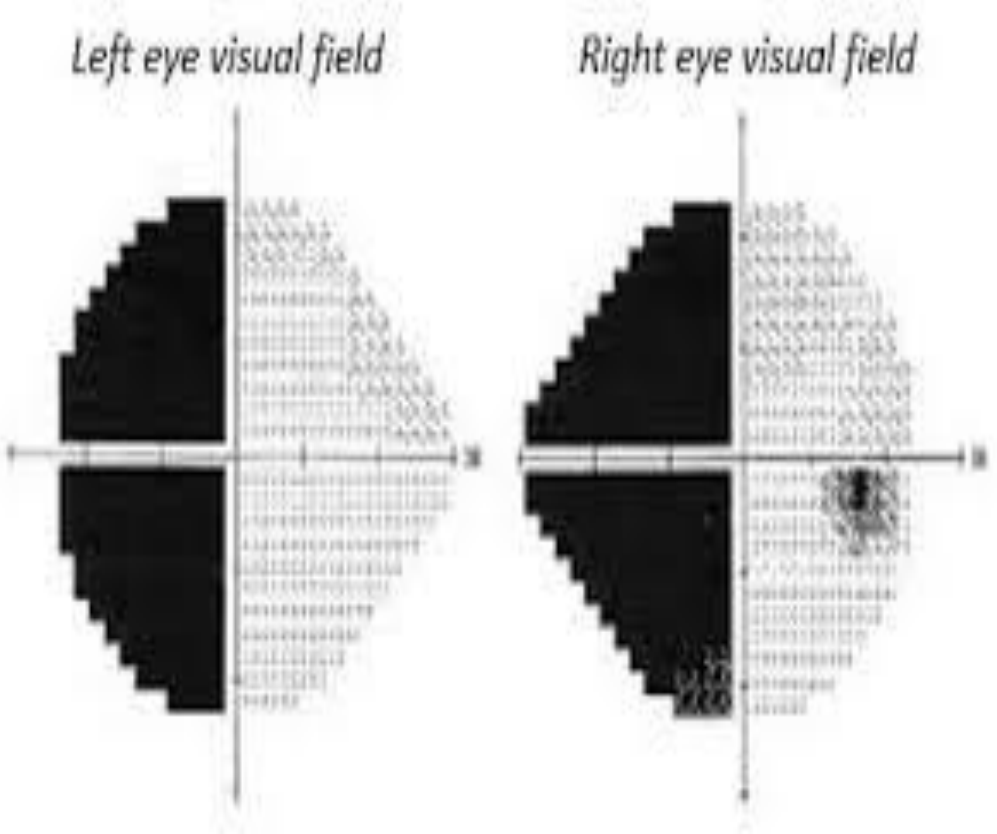
Ocular Hx: None

Family Ocular HX: Good

Visual Acuity: 6/7.5 Monoc, no change in Refraction

Visual Fields plot attached

CASE STUDY 1 VISUAL FIELD PLOT



CASE STUDY 2- MANAGEMENT OPTIONS

1) Refer to GP

2) Refer same day to Ophthalmologist

3) Refer within 2 week to Ophthalmologist

4) Refer routinely to Ophthalmologist

5) Refer to Stroke Clinic

What other recommendations could you suggest?
Optical Therapy options?

VF Defect after a stroke

VF Defect is not going to progress, the stroke has already happened. Unfortunately there is nothing that can be done to restore that area of the Visual Field.

So therefore a referral to an Ophthalmologist is not going to be the best option. It is not going to become worse. Ophthalmologist wont be able to do anything. So therefore referral to an ophthalmologist is not going to be of any benefit to the patient in this case

Option 1 & 5 are going to be the best options, to minimise the risks of another stoke occurring

VF DEFECT AFTER A STROKE- RECOMMENDATIONS

Other options to discuss:

1) Informing the DVLA

2) Visual Rehabilitation/Optical Therapies

3) Spectacle Lens Options

4) Modifiable Risk Factors- Speak to GP to minimise Vasculopathic risk factors. Bincocular Esterman

CLINICAL PEARL

In conditions such as Stroke, which affects the brain, the VF is affected (mostly equally) in both eyes.
In such cases a defect would be seen on the same side of the VF, respecting the Vertical Midline.

Sometime it tends to be a mirror image of each other if the defect is **Absolute** or very close to being exactly the same if a **Relative** defect

VF DEFECTS ASSOCIATED WITH STROKES

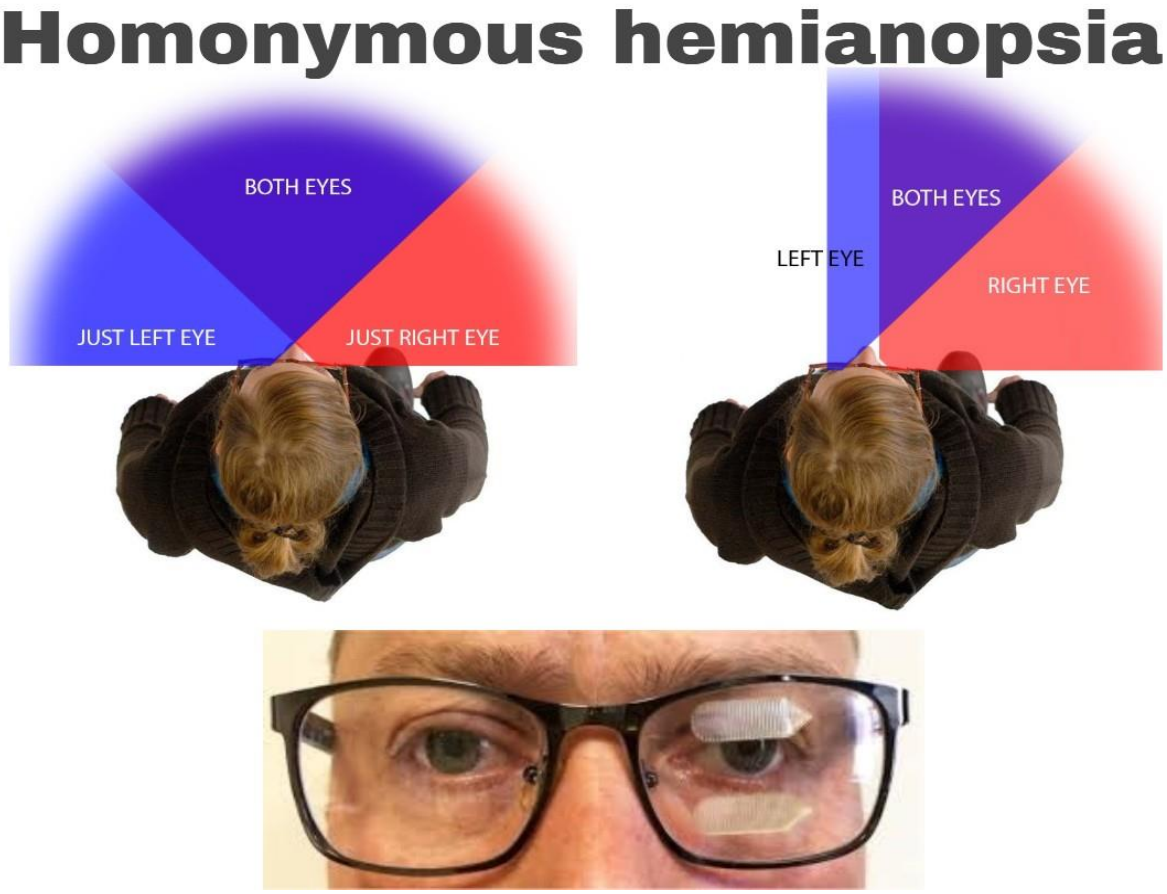
The most common type of visual field loss was found to be complete (54%) and partial (19.5%) homonymous hemianopia and occurring significantly more frequently to the left side than to the right side or bilaterally.

A Prospective Profile of Visual Field Loss following Stroke: Prevalence, Type, Rehabilitation, and Outcom

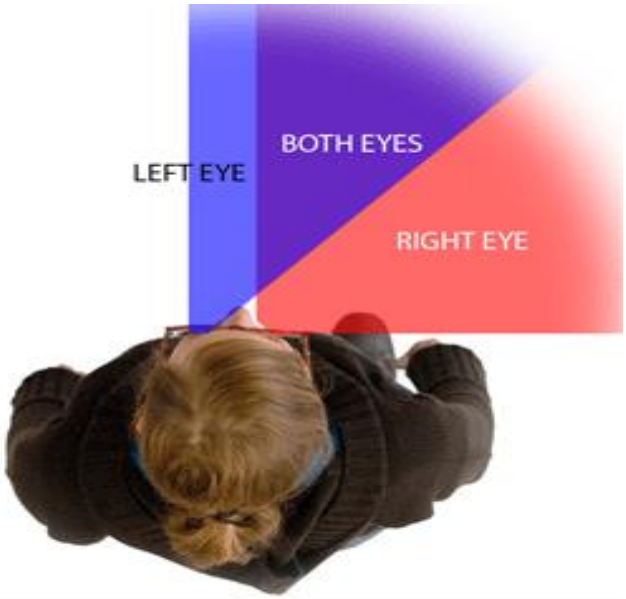
OPTICAL THERAPIES

Optical therapy: Optical therapies aim to expand the VF using prisms, mirror lens or telescopes. Prisms are often used,either one or both eyes, causing distortion and displacing images from the hemianopic field across into the seeing side.
Patients use head turning and eye movements to view the objects of interest on the affected side. Acceptance rate is variable with some patients due to inadaptability to distortion and image jump. On the other hand some patients report an improvement in their visual fields, with a potential to expand the visual field by up to 20 degrees.

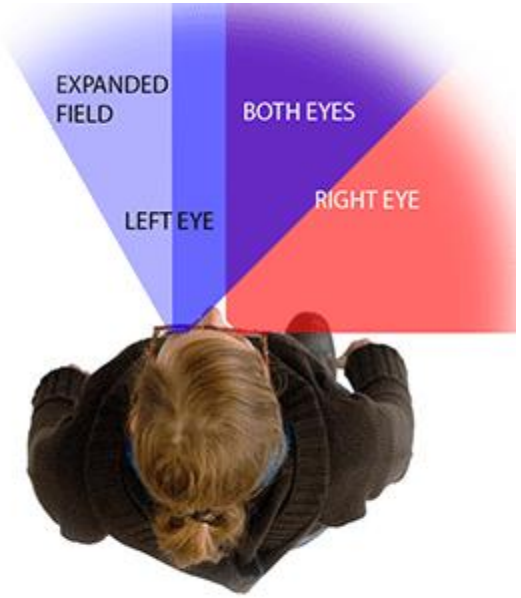
OPTICAL TREATMENT OPTION- STROKE



Peli Lens

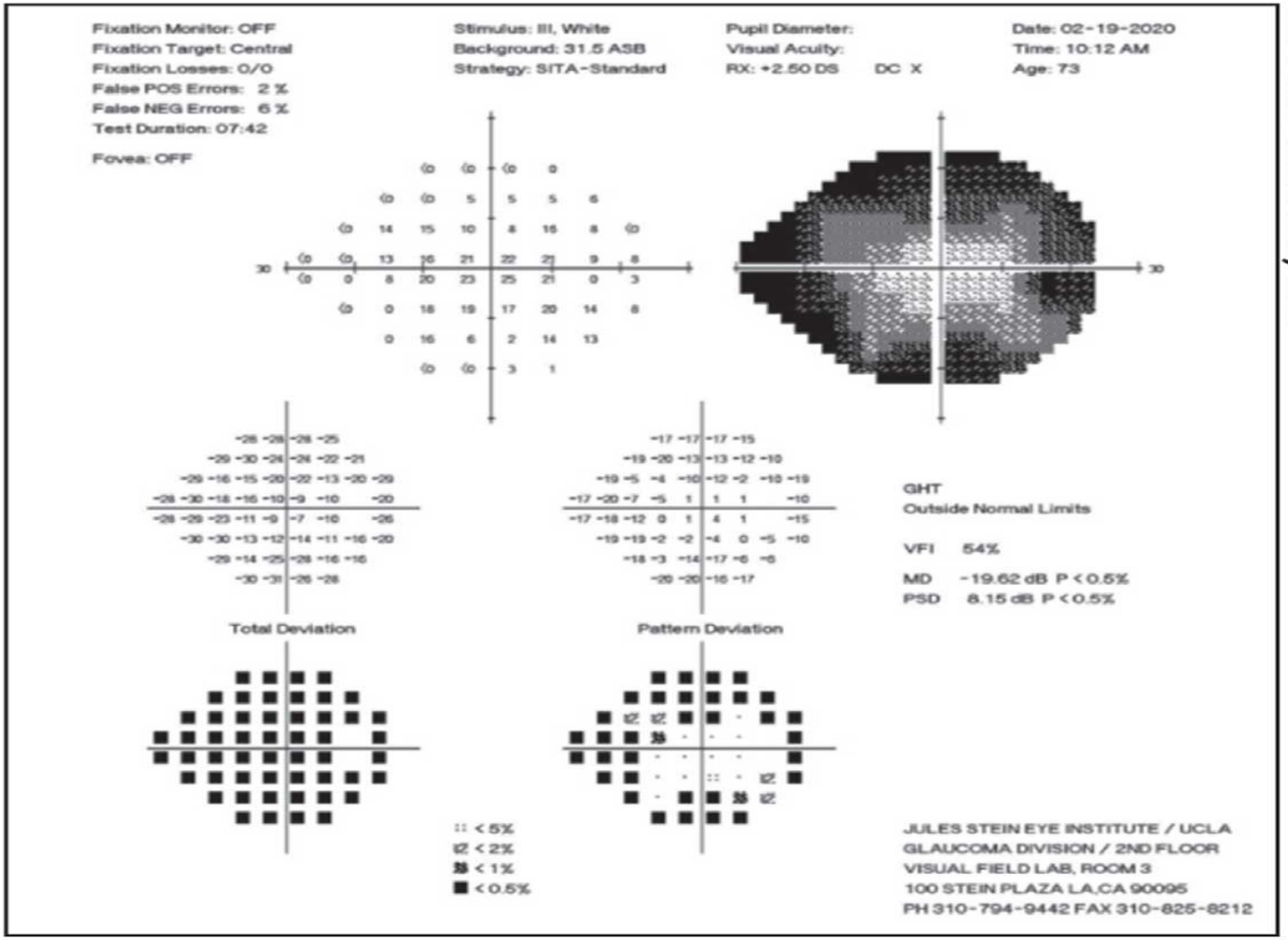


PRIMARY GAZE



PERIPHERAL PRISMS

CASE STUDY 2



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CASE STUDY 2

What Visual Field Defect is observed?

What Reliability Indices are you using for this answer?

What other Clinical Investigative techniques could you use to verify your reason?

What could you do at the next Visual Fields Test?

CASE STUDY 2

• ***The "cloverleaf" pattern.*** This artifact—in which the central points in each quadrant are much lighter than the surrounding points—is a common indication that a test is unreliable. The computer has four primary points that it tests first, near the center of each quadrant. Often the explanation is clear and then the staff member overseeing the test walks away- patient starts loses interest or being distracted. The result is a pattern resembling a four-leaf clover.

Reliability Indices: The Glaucoma Hemifield Test, Total Deviation & Pattern Deviation, Visual Field Index.
False Positives & False Negatives less than 15%

CASE STUDY 2

If you believe this pattern is an artifact, examining the optic nerve may confirm that it is, It will look much healthier than a nerve that would actually cause such a poor visual field.

OCT RNFL will be within normotensive levels

At next VF Testing

- Clear Instructions to the patient
- Staying with the patient through the examination offering clear instructions, reassurance and engaging with the px,

Case Study 3

A 44YO WM comes in for routine eye examination, No changes noted in his vision. Occupation: Supermarket worker Driver: No

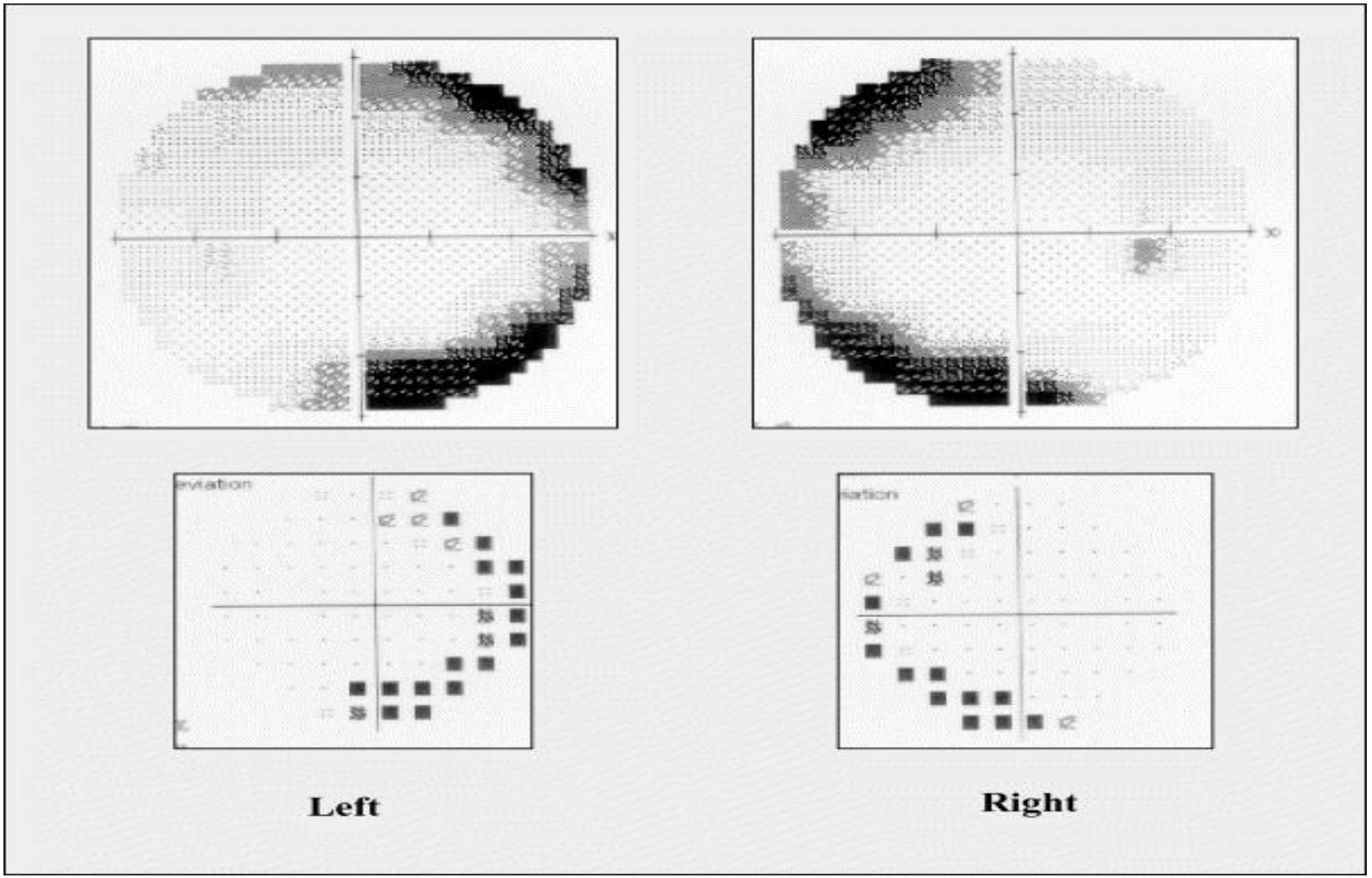
General Health: High BP, Epilepsy, Anxiety

Meds: Atenolol, Vigabatrin, Citalopram

Visual Acuity: 6/5 & N5 in both eyes

Visual Fields Attached

CASE STUDY 3 VISUAL FIELD PLOT



CASE STUDY 3

Describe the Visual Field Plot?

Would this be a normal finding for Vigabatrin?

What would the Fundus look like?

Would you refer to Ophthalmology, and if so how urgently?

How would you manage these Vigabatrin patients in the future?

What other meds have a retinal toxic effect? What are the main differences seen between them and Vigabtrin?

Case Study 3 Medication Side Effect

Vigabatrin (Sabril) is an anti-epileptic/anti-convulsant drug for both adults & children. Its use seems to increase the risk of a unique and specific Bilateral, mainly asymptomatic VF loss.

It causes VF loss in approx. 30% of users. This is caused by a toxic effect on the retinal cells. The field loss is irreversible even upon cessation of the medication.

The majority of people are usually asymptomatic because the macula is spared

CASE STUDY 3

The appearance of the fundus may be completely normal

Unfortunately the results are irreversible in all cases even after discontinuation- same as Hydroxychlooquine/Plaquenil, the opposite to Tamoxifen,

Managing these patients in the future: Similar to Plaquenil/Hydroxychloroquine patients. Advise them to have an eye exam prior to commencing the medication, then on a 1-2yr review due to the high degree of retinal toxicity.

Difference is even upon cessation the VF defect remains.

INTERPRETATING RELIABILITY INDICES

1) Fixation Losses Counts the time the px looks away, tells if the eye is wandering or not
2) Fixation Monitor ‘Blind Spot’ works out where the natural blind spot is, if px is looking at the fixation target, they shouldn’t see the flash in the BS area
3) False Pos Errors- the px was ‘trigger happy’
4) False Neg errors- the px doesn’t click through brightness they should see. Is a loss of concentration or a genuine VF defect, so a result shouldn’t be disregarded just because of a high False Neg rate
5) GHT: Explanation of how likely, comparing top and bottom half. Result will say OUTSIDE NORMAL LIMITS
6) Visual Field Index: Age related score, a lower % indicates VF loss

VISUAL FIELDS CAN BE A CHALLENGE.

- It is time consuming (it takes four to seven minutes per eye)
- Patients new to the device often fail even if they are healthy (many false positives)[6-10]
- Prevalence of true positives is low (three to five percent of the general population has a visual field loss; that number climbs to 13 percent for patients over age 65)[11]
- There is cost associated with performing the test, and time consuming for both the patient and the practitioner to repeat the test

6. Heijl A, Lindgren G, Olsson J. The effect of perimetric experience in normal subjects. *Arch Ophthalmol*. 1989 Jan;107(1):81-6.
7. Katz J, Sommer A. Screening for glaucomatous visual field loss. The effect of patient reliability. *Ophthalmology*. 1990 Aug;97(8):1032-7.
8. Schimiti RB, Avelino RR, Kara-JosÃ© N, Costa VP Full-threshold versus Swedish Interactive Threshold Algorithm (SITA) in normal individuals undergoing automated perimetry for the first time. *Ophthalmology.* 2002 Nov;109(11):2084-92; discussion 2092.
9. Castro DP, Kawase J, Melo LA Jr. Learning effect of standard automated perimetry in healthy individuals. *Arq Bras Oftalmol*. 2008 Jul-Aug;71(4):523-8.