

BASICS OF AUTOMATED PERIMETRY (HUMPHREY)

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Definition of visual field

Visual field is defined as that part of the environment that is visible to a steadily fixing eye.

"Island of vision surrounded by a sea of blindness".

The measurement of visual fields is done by -

1. Static perimetry
2. Kinetic perimetry

In kinetic perimetry, we outline the border of visual field in which an object is moved from a non-seeing to a seeing area. With the disadvantage that it is supra-threshold and not always reproducible. Early and subtle changes are missed.

Static Perimetry

Main aim is to find threshold of retina at various points.

Combination of computer and visual field testing method.

Major advantage - compares the patient sensitivity to the stored values obtained from normal people for that age.

Definition of threshold

If a particular intensity is shown 100 times and it is appreciated as many times, that particular light is termed as threshold.

The factors affecting the stimulus visibility are -

1. Stimulus size
2. Background illumination
3. Brightness of the stimulus

The stimulus size - Goldmann size III

Background illumination 31.5 ASB

Units used to express light intensity -

1. Apostilbs - absolute unit of light
2. Decibel

When the apostilbs value increases, the intensity of light increases, whereas when the decibel value increases the intensity of light decreases.

Threshold test patterns -

30-2	No. of points tested 76	6 degrees apart
24-2	No. of points tested 54	6 degrees apart
10-2	No. of points tested 68	2 degrees apart

Threshold testing strategy

1. Old strategy - Full threshold strategy - Bracketing - Dimmed by four decibel step crossing seeing zone to non seeing zone and then brightened by 2 decibels from a non seeing zone to a seeing zone.
2. New - **Fast PAC** - Stair case bracketing is used. Stimuli dimmed in a three decibel step and threshold is crossed only once. **SITA** (Sweedish Interactive Threshold Algorithm) takes into account the fact that a response at one location has implication not only for the point tested but also for other points.

Reading a print-out

Zone 1 - Patient data and Test data

Tells about which test is performed and on whom performed.

Target - Central, small diamond, large diamond.

Age - Interpretation of raw data by STATPAC is age dependent, the age of the patient is compared to mean normal threshold of the same age group.

Pupil size - normally the size should be 3-4 mm. *Constricted pupils* may produce edge scotomas.

Correction given - The **near** vision refractive error must be properly corrected. Otherwise generalized depression in the field is seen. Correction should be properly fitted in the frame - *lens rim artifact*.

Zone 2

Information about reliability indices and foveal threshold.

Foveal threshold is compared with the visual acuity.

Reliability indices - include:

1. Fixation losses
2. False positive response rate
3. False negative response rate
4. Short-term fluctuations

Fixation losses - Stimuli presented on the blind spot. The patient responds to this stimulus indicates

shif of fixation. >20% is unreliable.

False positive response - If the patient pushes the button to the non projected stimulus it will be recorded as false positive. A sound is presented without stimulus.

False negative response - In this stimuli are presented much brighter than threshold at a location where sensitivity has already been tested. *Fields should not be considered unreliable solely upon a false negative response rate.*

Zone 3 - Raw Data

The exact retinal sensitivity of the selected point is determined.

Zone 4 - Gray Scale

The diagnosis is not made on the basis of gray scale. Darker area represents lower sensitive zone. Gives information about gross false positive, false negative errors.

Zone 5 - Total Deviation

It is the difference in decibels between the patient's results and age-matched normal results. Draws our attention to any overall sinking of field of vision - cataract, miosis, refractive error, corneal opacity, advanced glaucoma.

It is depicted as total deviation numerical plot and total deviation probability plot.

Zone 6 - Pattern Deviation Plot

In similar to total deviation plot except that it is adjusted for any generalized depression in the overall field which might be caused by factors such as lens opacities or miosis.

Below the pattern deviation numerical plot there is a pattern deviation probability plot.

Zone 7 - Global Indices

In TDNP and PDNP statistical manipulation are provided by point to point calculation.

In global indices all the points are reduced to one.

It includes:

1. Mean deviations (MD)
2. Short-term fluctuations (SF)
3. Pattern standard deviation (PSD)
4. Corrected pattern standard deviation (CPSD)

Mean deviation (MD) - It is elevation or depression of the patient's overall field from normal reference.

Pattern Standard Deviation (PSD) - It is the standard deviation of the difference between the threshold value at each test location and expected value.

Short-term fluctuation (SF) - In this threshold is measured twice at 10 pre-selected points and the standard deviation of these values is SF. Usually between 1 - 2.5 dB in a reliable field.

Corrected Pattern Standard Deviation (CPSD) - The SF is removed from PSD to produce CPSD.

The single field analysis printout with SITA strategies do not calculate short-term fluctuations and hence CPSD cannot be calculated. Only full threshold strategy and FAST PAC calculate SF and hence CPSD.

If the global indices are outside the normal range the P value appears next to it. Any global indices having P value less than 5% - abnormal.

Interpretation of global indices...

Mean deviation	CPSD	Interpretation
1. Normal	1. Normal	1. Normal
2. Abnormal	2 Normal	2. Generalized loss of sensitivity
3. Normal	3. Abnormal	3. Small localized field defect
4. Abnormal	4. Abnormal	4. Large defects + localized component

Zone 8 - Glaucoma Hemifield Test (GHT)

In the glaucoma hemifield test five sectors shown in the upper half of the field are compared to five mirror images in the lower half of the field and the STATPAC analyzes the difference between the sectors and the inference will be labeled as below:

1. **GHT outside normal limits** -If the values between any sector in the upper and lower zone differ to an extent found in the 1% of the general population.
2. **GHT borderline** - The difference between any one of the upper and lower zones is what might be expected in less than 3% of the population.
3. **GHT abnormally low sensitive** - If the best part of the visual field is seen less than 5% of the population.
4. **GHT abnormally high sensitive** - Appears when the overall sensitivity is higher than expected in 99.5% of the normal population.
5. **Within Normal Limits.**

Anderson's Criteria to detect early localized field defect due to glaucoma.

Three minimal criteria (Anderson's) to pick up early abnormality...

1. Three non-edge adjacent scotomas in pattern deviation probability plot - 2 points <P 5%, 1 point <P 1%
2. PSD <P 5%
3. G.H.T. Abnormal