# PURPOSEFUL PERIMETRY

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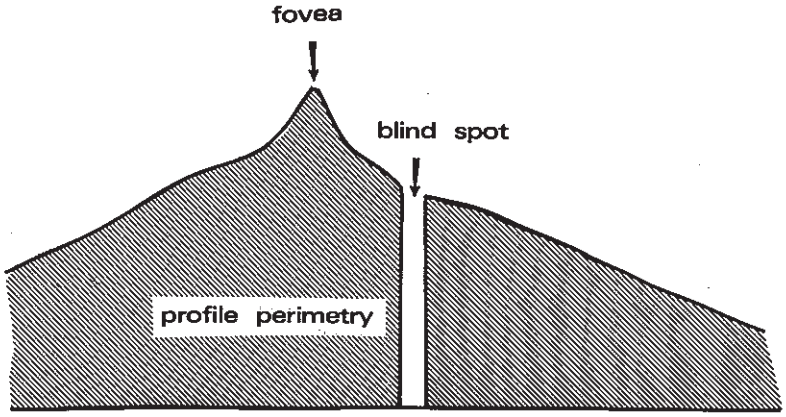
The plotting of visual fields has now become part of the routine work of many Orthoptists. This paper will outline the method currently in use at The Prince of Wales Hospital Eye Clinic, using the Goldmann Perimeter which we feel provides the most accurate, reproduceable visual field in glaucoma management.

Harrington describes the visual field as "that portion in space in which objects are simultaneously visible to the steadily fixating eye". "Objects act to stimulate the various portions of the retina and, through the conducting nerve fibre bundles of the visual pathway, the visual cortex in the calcarine areas of the occipital lobes."

The cortical response to the patient's awareness of these stimuli depend upon

1. their proximity to the visual axis
2. their size
3. their brightness
4. movement
5. the integrity of the receptor of the stimulus and the visual pathway.

"Retinal sensitivity is greatest in the foveal area and decreases in proportion to the distance of the rods and cones from the macula" and so does the visual acuity within the visual field. One is thus able to imagine Traquair's comparison of the visual field to "an island of vision surrounded by a sea of blindness' (figure 1). The peak is the fovea and the coastline the periphery. Objects near the fovea are easily seen but only become visible near the periphery if they increase in size and intensity, becoming larger, brighter or moving.




Characteristic changes in the visual field make it possible to localise within the visual pathway the site of the lesion that has produced the changes, and thus determine diagnosis, prognosis and possible therapy.

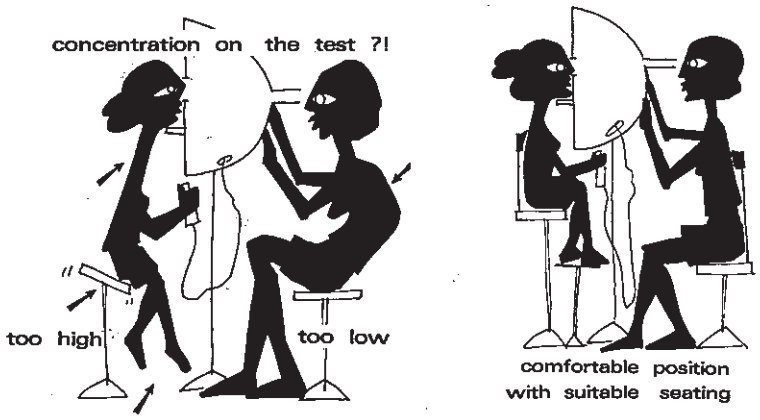
Harrington states the purpose of perimetry is "to detect these revealing defects in the visual field, to measure them quantitatively in terms of visual acuity, and to chart them as normal or abnormal contour lines or isopters".

A patient's neurological or ocular future may rest in our hands and we need to approach perimetry with due responsibility, and with enthusiasm. As we are trained to obtain detailed subjective and objective data, at times from very uncooperative patients this training should enable us to become well equipped to perform perimetry.

At the Prince of Wales Hospital Eye Clinic we have found it particularly helpful to follow a visual field screening technique (as adapted from Armaly and Rock, Drance and Morgan), using the Goldmann Perimeter. The Goldmann is constructed from a half shell in which the test object is projected and where the eye is at the centre of rotation of a hemisphere that has a radius of curvature of 33cms. Visual fields must be tested in a quiet area and illumination should also be constant. We have a rheostat which allows us to dim the lights evenly and the walls and floor of our room are black. One should not have a lamp on in the room even though this may be time saving as it is distracting for the patient. The calibration of the Goldmann must be done routinely.

For simplicity I have outlined our technique in ten steps:

1. Explanation is terribly important. Fixation of the central target must be stressed. Some patients require the examiner to remind them to re-fixate after each sighting of the target because they involuntarily fix the target.
2. Relaxation can and should be happening while you are explaining the test. The stressed patient will perform the test poorly as concentration will be reduced. It would be better to perform the test another day if the patient is particularly tense. The rapport between patient and examiner is built at this time and is important to ensure maximum results. Comfort is also necessary for concentration as seen in figures 2 and 3.




3. Refraction should be recent and the lenses used should include a near correction if testing with the Goldmann perimeter. A lens holder is fitted in front of the chin rest and the appropriate correction added using thin rimmed lenses. If the patients refraction is not known an approximate correction can be found by trial and error.

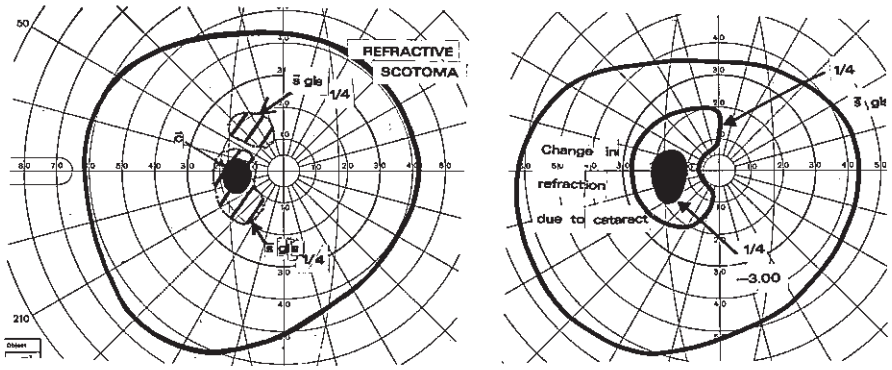



Figure 4 shows a typical refractive scotoma. These can be very similar to relative glaucomatous arcuate scotomata.

Figure 5 shows a refractive scotoma of a patient who became myopic (-6.00 D) in six months because of progressive cataracts. Previously she had been emmetropic. With the appropriate corrections the scotomata could not be reproduced. Any central defects can be refractive and lenses should be checked, cleaned and at the correct distance from the eyes. You should try stronger or weaker lenses if you suspect a refractive scotoma.

4. Threshold (see figure 6 No. 4) is found by presenting the target at 25° from fixation starting with 1/2 (1 = size, 2 = intensity) and increasing intensity and then size until seen by the patient, i.e. 1/2, 1/3, 1/4, 11/4, 111/4, 1V/4, V/4. Obviously a relative scotoma may be missed if the target is greater than threshold.

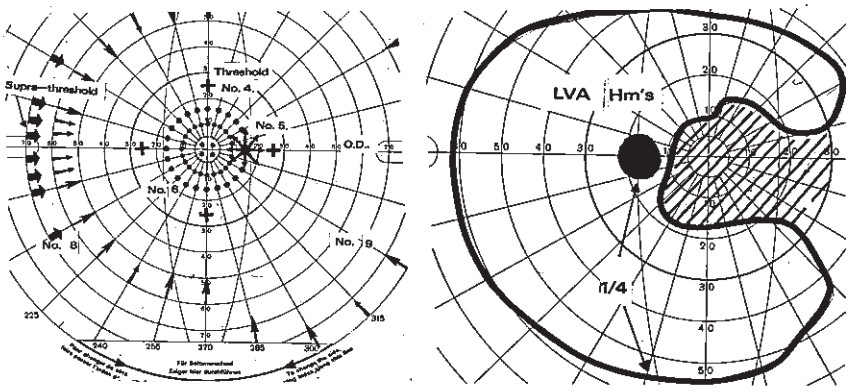



Figure 6 shows our procedure for glaucoma screening. We also check other areas of the visual field randomly. We adapt this procedure for neurological testing eliminating the supra-threshold target and using a red target as well as white. Visual loss to red occurs earlier in the course of neurological

disease than visual loss to white. The usual threshold used is 111/4 red. With glaucoma we are particularly concerned with changes on the horizontal meridian and within the central area, whereas with neurological fields the concern is for changes at the vertical meridian particularly when looking for disease behind the chiasma.

Figure 7 demonstrates how a visual field can be obtained with a low threshold target even with poor central vision. This patient had an anterior ischaemic optic neuropathy of the left eye with hand movements vision. We used the projector (Goldmann) which utilizes the fixation of the other eye to align the pupil of the eye being tested.

5. **The Blind Spot** (see figure 6 No. 5) is tested first starting at 15° temporal to fixation along the horizontal meridian and moving from blind to seeing in at least eight directions. Any defect at this stage can alert the examiner to recheck some of the possible causes. Failure to demonstrate a blind spot is a good indication of error on the part of examiner or patient. I have not only found a blind spot on the nasal field but I have also found one when the occluder was not on! Obviously occlusion and fixation must be checked.

6. **Seventy six Points** (see figure 6 No. 6) are marked in the central area and these should all be "spotted" using static (stationary) perimetry allowing one second for each presentation of the target. It is important to use static perimetry here as it detects relative scotomata whereas kinetic (moving) perimetry may not. It is important not to move (wiggle) the target. A scotoma here may be the keystone in the glaucoma patient's therapy. Roenne's nasal step is usually associated with a small paracentral scotoma and this may be missed if the central area is not thoroughly checked.

7. The refraction correction is removed. This can be a rest and reassurance period for the patient.

8. **The Nasal Isopter** (see figure 6 No. 8) is plotted, paying particular attention to 15° above and below the horizontal meridian. A supra-threshold target (one with increased intensity or size) should be used to check for nasal step in glaucoma screening.

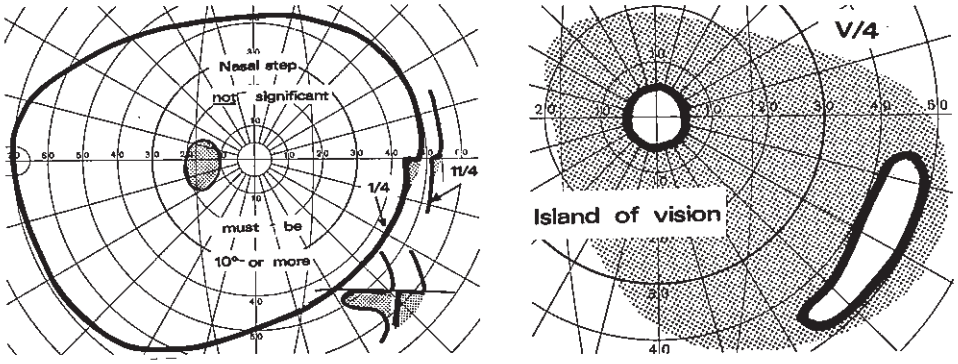



Figure 8 shows a nasal step which is not significant even though both the threshold and supra-threshold targets suggest it. The step must be 10° or more horizontally to be significant and you may find that in testing for nasal steps it is difficult to find a definite scotoma. A nasal step found should precipitate a more extensive search of the central field.

9. **The Temporal Isopter** (see figure 6 No. 8) is tested.

Figure 9 shows typical end stage chronic simple glaucoma using the brightest, largest target (V/4) This is referred to as the island of vision and one can see that the temporal field or island could be missed if this area was not checked thoroughly.

10. **Abnormal Field** is noted and one should note any particular methods used to detect scotomata – whether they are vague suggestions of scotoma, or relative or absolute. A comment on the patient's fixation and status while performing the test should be made especially if you felt this interfered with the results of the field.

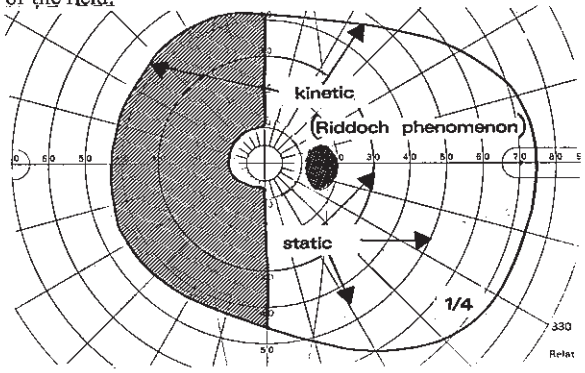



Figure 10 is a field of a patient with a lesion of the striate cortex of the occipital lobe. He had a complete homonymous hemianopia with static testing but showed a normal peripheral isopter with kinetic testing. This man could see only moving objects on his "blind" side.

At our clinic we use the Goldmann perimeter for screening because we feel it is best suited for use by multiple examiners and as several artifacts can be eliminated.

1. The fixation distance is set and the patient's head can be strapped in, whereas our Bjerrum screen relies on positioning of the patient without the help of a chin rest.
2. The patient's fixation can be watched through the telescope.
3. The target can be static or kinetic.
4. The patient cannot anticipate the target or its position.
5. The size and colour of the target can easily be changed without any noise or knowledge of the patient.
6. The diameter of the pupil can be measured through the telescope and recorded routinely. This is important if there is change in contour or size of the visual field and it may be because the pupil has changed in diameter. A miotic pupil produces a smaller field than a dilated pupil.
7. The central and peripheral field is tested routinely.
8. Last but not least the examiner may sit comfortably for the test.

We use the Bjerrum screen when we feel it will best suit the patient or if the patient has a known central scotoma. Confrontation test or any visual field recording is more helpful than the words "could not perform test". Some visual fields recorded have been done solely on the eye movements made to take up fixation and this is also helpful to remember when testing a malingerer. They will involuntarily fix peripheral targets if the examiner persists in "testing", for example, moving from the central area to peripheral area in spotting or changing colour of the target.

Techniques must be varied for each individual patient. The perimetrist must be aware of the limitations of testing and should be ready to adapt techniques to suit each patient. It is easier however if a format is applied initially, particularly as in most cases the patient may be tested the next time by another examiner. There are many subjective and objective artifacts possible so that on the same day the same patient may not respond to the same examiner in the exact same way. Not only should visual fields be reproducible it is our responsibility to perform them purposely. Knowing how a field should look is important. My first field resembled figure 11. Obviously my speed must have varied and I did not know to check any dips in the peripheral contour. If you imagine the outline of the island of vision, one can see that the isopter plotted should be symmetrical unless there is a definite defect.

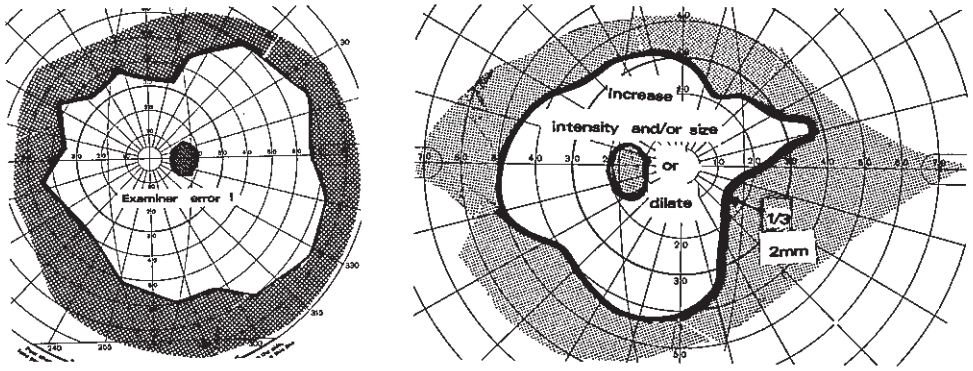



Figure 12 shows another poor field result. Here possibly the speed of the examiner was too fast or the patient's reflexes were poor. The target is only 1/3 and this should have been increased until a normal peripheral isopter could be elicited. The field looks defective but in actual fact would not help in pinpointing any disease.

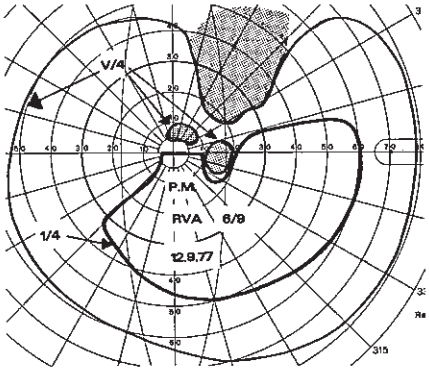
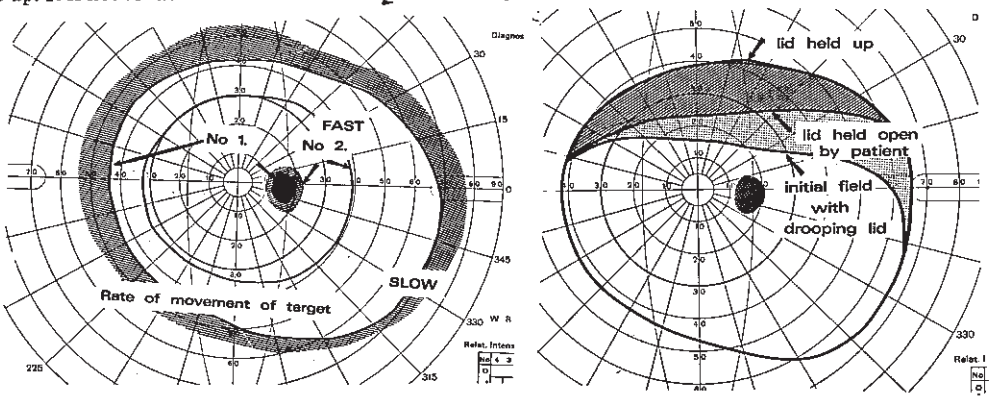



Figure 13 shows that if the field plotted with the 1/4 target was the only isopter plotted, one would not know whether the superior loss was relative or absolute. An increase in target intensity produced an increase in field plotted.

Figure 14 illustrates how speed of the target and reflexes of the patient may affect the result of the visual field. The reflexes of the patient must be known and can be tested using static spotting at the beginning of the test. The examiner should move the target with an even movement relative to the reflexes of the patient. An examiner moving too fast will produce a small visual field. One must also not anticipate seeing areas by slowing down movement or test the same area repeatedly without presenting the target elsewhere.

Figure 15 shows how superior field loss may be due to the lid or brow and this should be held or taped up. It is not alwavs sufficient to ask the patient to "open wide".




It is important to know what you are looking for but it is often expectation of a defect in one area which leads to failure to find another defect. One must be forever reminded that the purpose of perimetry is to determine visual fields accurately and to discover any defect present. Non-existent defects are no help in diagnosis just as overlooked defects can hinder diagnosis and management. Finally, enthusiasm for perimetry should be a must if we are to be responsible professional perimetrists rather than technicians just doing a job.

I would like to thank Dr Ivan Goldberg and Dr Glen Gole for their help and Professor Fred Hollows who introduced me to the pleasures of perimetry.