Adapting New Testing Methods to the Tangent Screen

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Abstract

Tangent screen examination has remained a popular method for detecting visual field defects in spite of the recent availability of more sophisticated perimetric instrumentation. Many techniques used with these newer instruments can be adapted for use with the tangent screen in order to enhance its sensitivity in detecting early field problems. Some of these techniques, including the glaucoma screening method of Armaly and Drance, are discussed with this emphasis.

Abrégé

Le campimètre demeure un instrument de choix pour le dépistage des défauts du champ visuel et cela malgré l'avènement des périmètres électroniques. Plusieurs techniques utilisées avec ses nouveaux instruments peuvent s'adapter au campimètre pour accroître la sensibilité de ce dernier dans le dépistage précoce des défauts du champ visuel. En marge de ces adaptations, l'autre décrit certaines techniques, entre autres, la technique d'Armaly et Drance pour déceler le glaucome.

Although projection perimeters such as the Goldmann or Tübinger are considered to be the standard field testing instruments and, more recently, automated or semi-automated instruments such as the Fieldmaster or Friedmann Visual Field Analyser have gained recognition, it remains that the tangent screen is the most commonly used field testing device in the private practice setting.[1] Since 90% of field defects are potentially detectable using the tangent screen,[2a] it seems to be a logical choice for a field testing instrument. Its attraction becomes even greater when its simplicity and low cost are considered. Unfortunately, these advantages tend to be offset by the degree of skill required by the examiner as the detection of most, if not all, field defects is highly dependent upon technique.

Traditional methods of field examination with the tangent screen involve plotting the blindspot, followed by mapping the limits of the central field in the vertical, horizontal and oblique meridians.[2b] Scotomata within this isopter can be sought by having the patient report the disappearance of the test object as it is moved through the central field in a zig-zag[3] or rosette[4] pattern. The experienced perimetrist will acknowledge the difficulty in detecting an early, subtle field defect using these methods, and should seek to improve the sensitivity of the tangent screen by means of alternate techniques.

When developing a field testing procedure one must be familiar with the anatomy of the visual pathways and the corresponding parameters of anticipated field defects. Since a detailed discussion of these topics is beyond the scope of this paper, the reader is referred to any standard text on visual fields should this information be required. It suffices to state that the field of vision is functionally centred about the fixation point and is split vertically due to decussation of the nasal nerve fibres in the chiasm, and horizontally by the distribution of the retinal nerve fibres and the retinal vasculature.[2c,5a] For this reason, chiasmal and post-chiasmal lesions usually result in bilateral field defects with vertical steps or hemianopsias, and lesions of the retinal nerve fibre layer or retinal vasculature will result in unilateral defects with horizontal steps. When examining the horizontal or vertical meridian it is therefore necessary to test on each side of the meridian rather than directly along it in order to detect a step-like defect. If the target were moved directly along the meridian, responses could be haphazard depending upon the exact nature of the defect and accuracy of fixation, possibly labelling the patient as a poor observer, and probably missing the abnormal field.

For the central 30 degrees of the field, a static testing technique is superior to a kinetic procedure;[6a] a stationary target is exposed in the desired location and the patient reports whether it has been seen or not. By varying the target size or relative contrast, it is possible to determine a threshold sensitivity for any test location. When a target is used such that it should be above threshold for the chosen test location, the procedure is termed a supra threshold spot check. This method of supra threshold static spot checking can be used to search within a given isopter for an area where the target should be seen, but is not, representing a scotoma. The equivalent kinetic technique, which is considerably more difficult, requires the patient to report the disappearance of the moving target. Fixation control using the static technique is not compromised since the patient is able to see the target for only a brief period and is less likely to alter fixation toward a briefly exposed immobilized target. The accepted

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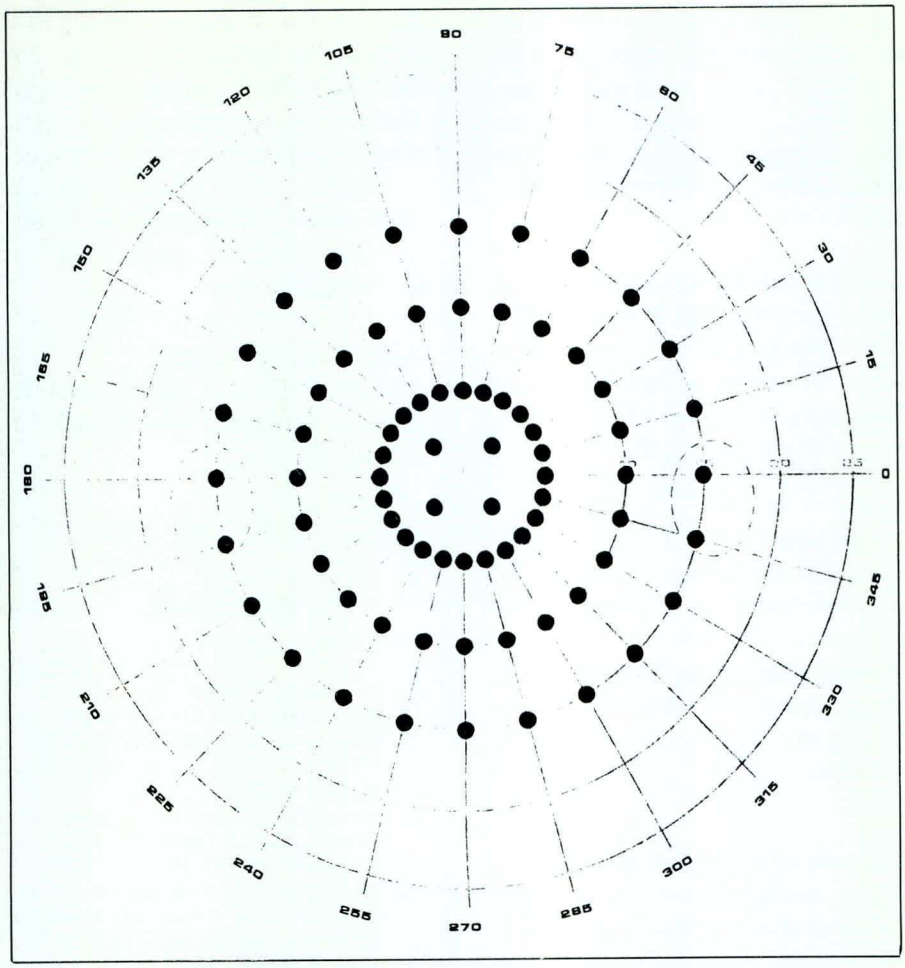


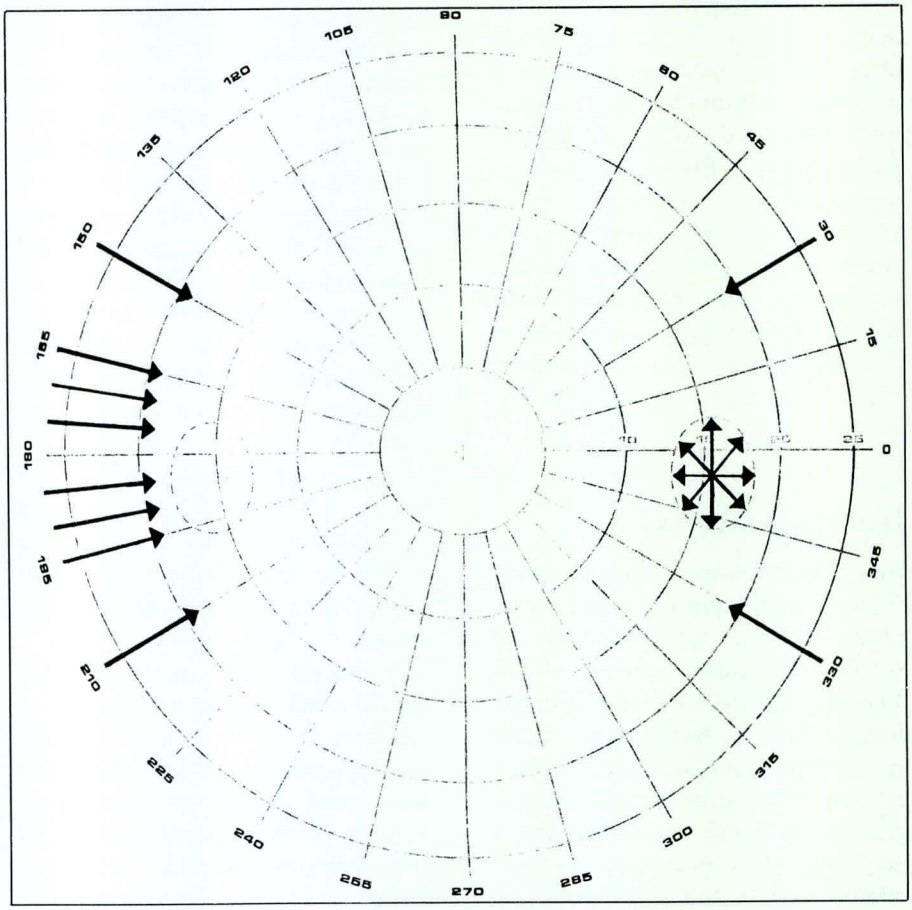
Fig. 1 — Location of 76 supra threshold static spot checks

protocol of testing from non-seeing to seeing is also maintained.

The most frequently-performed field investigation is that used for the detection of suspected glaucoma,[6b] the earliest defect of which is usually a small, relative scotoma isolated from the blindspot, in the Bjerrum arcuate area of the field, or a depression nasally in the field.[7a] Since kinetic perimetry has been shown to be ineffective in detecting these early scotomata,[8] Armaly[9,10] proposed a screening method subsequently modified by Drance et al,[11a] utilizing supra threshold static spot checking within areas of the visual field commonly affected by glaucoma. A total of 76 supra threshold spot checks are made in the central area, and in addition, the nasal field is investigated for a step defect using two target intensities, one central and one peripheral.

Although originally designed for use with the Goldmann perimeter, the Armaly-Drance screening method can be adapted to the tangent screen in the following manner. The first step is to determine a test stimulus which provides a comparable value to that normally used on the Goldmann perimeter. On a tangent screen this will usually be a 1 mm white target at a 1 m test distance (1/1000/w).[7b] An alternate method would be to select the target which is just detectable at a 25 degree eccentricity from fixation as recommended by Drance,[11b] thus ensuring that all central spot checking is conducted with a supra threshold target without sacrificing sensitivity by using a target size which is too large. Older patients or those with reduced vision may require the use of a larger target. Static spot checks are made at each of the following locations in an orderly sequence: every 15 degree meridian 5, 10 and 15 degrees from fixation, and at 4 locations inside the 5 degree circle, as shown in figure 1. Static spot checking on the tangent screen can be accomplished by concealing the test

Fig. 2 — Kinetic test locations ▼



object while positioning the wand, then by rolling the wand to briefly expose the target spot, or by using a Lumiwand which incorporates a small electric lamp and switch.

If a spot check is not detected, a second presentation is made at the end of the sequence and if it is missed a second time, a scotoma is likely present. The perimetrist can then attempt to plot it using standard kinetic techniques. If the second presentation is detected, the response can be accepted as normal. Following the spot checks, the blindspot is plotted using the same target and the nasal field is investigated kinetically at 5, 10, 15 and 30 degrees above and below the horizontal to detect a nasal step. Finally, two points temporally, 30 degrees above and below fixation, can be plotted to yield a partial isopter (figure 2) or, if desired, the entire isopter can be determined. It is not possible to investigate the peripheral nasal field using the tangent screen, as would be done with the perimeter.

The Armaly-Drance method has been shown to have a sensitivity of 96% for detecting glaucomatous field defects[11c] which means that the chance of missing an abnormality is minimal. Although these studies were conducted using a Goldmann perimeter, it is likely that a similar technique using a tangent screen would be similarly more effective when compared to conventional procedures. Also, since the central field is so thoroughly investigated, it is unlikely that field defects from causes other than glaucoma would be missed.

Other Considerations

Stimulus duration (for static testing)

Spot check exposures should be no longer than 1 sec to reduce the tendency to alter fixation, or influence the level of retinal adaptation achieved by the background illumination;[6c] however, adequate duration is necessary to allow retinal summation effects. Since this is less than 0.1 sec,[6d] it is unlikely that an exposure time which is too short could be obtained using a tangent screen. An interval between exposures should be allowed to permit adequate perception of each presentation. This can be varied depending on individual patient ability, however it should not be less than 2 sec.[6e]

Target speed (for kinetic testing)

The International Perimetric Society does not list an ideal rate of target movement in its standards.[12a] Practically, a rate of 3 to 5 degrees per sec is recommended.[7d]

Target blur

Blur of a test target decreases its stimulus value in the central 30 degrees of the field.[6f,7c] Since the entire tangent screen falls within this limit, appropriate refractive correction is required for the 1 m test distance.

Background illumination

The recommended illumination for tangent screen examination is 7 foot-candles (fc).[2c,5b,13] Portney and Rubenzer[14] have shown that the tangent screen compared favorably to the Goldmann perimeter in detecting glaucomatous defects when the illumination was at this level, but sensitivity was reduced dramatically when the illumination was increased to 12 fc superiorly and 8 fc inferiorly by using the ceiling lamps in the examination room. It is important, therefore, to perform the test with the background illumination reduced to 7 fc. This can be obtained practically using a 40 watt frosted light bulb in a standard Luxo lamp, directing the lamp centrally from a distance of about 1.5 m to provide even illumination on the screen. It is preferable, however, to confirm that proper illumination is obtained by means of a light meter.

Although many perimeters are available which may be superior to the tangent screen, it is difficult for most practitioners to justify the large investment needed to obtain and operate such instrumentation. It therefore is important for the practitioner to use tangent screen procedures which maximize the capabilities of the instrument in order to detect field defects at an early stage. The use of supra threshold static spot checking, specifically the technique of Armaly and Drance, correct illumination and appropriate target size can aid the perimetrist in achieving this result.

Acknowledgements

I thank Drs. G. Strong and J. Brisson for their many helpful suggestions.

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