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A FEW NOTES REGARDING THE DETERMINATION OF THE LIMITS OF THE VISUAL FIELD*

BY

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THE method indicated by Bjerrum in 1889 of determining the limits of and defects in the visual field is rightly used in cases where the object is to trace the more delicate workings of the retina.

The principles indicated by him have been further worked out by his pupils, particularly by Rönne in Copenhagen, and subjected to wide practical tests. Shortly after the publication, oculists, especially in England, adopted this method, as witness the number of apparatus constructed there for the accurate definition of the visual field and scotomata, and the introduction of a quantitative method of accurately arriving at this definition (Traquair).

(1) The fixation point.

Nowadays, the black curtain and the white and coloured discs of different sizes, belong to the usual outfit of every oculist. Still there are some drawbacks connected with this so widely adopted method, which in the determination of the visual field play a certain rôle. This matter demands a great amount of attention on the part of the examiner as well as that of the patient, and of the latter also a power of endurance demanding much of his often already reduced will power. It is, therefore, necessary to remove as far as possible everything which can divert the patient's attention,

* Read at the Oxford Ophthalmological Congress, on July 15, 1920.

or may lead him astray. The ideal method is thus the one whereby all the senses of the patient, except the eye, receive as little irritation as possible, and whereby the eye does not detect anything else than :

(2) The object which moves in the periphery, and regarding which the patient must promptly indicate whether it appears or disappears, and,

(3) The background on which fixation point and moving object stand out clearly.

On these three points I will now make a few comments.

Various oculists have tried to attain their object of avoiding all unnecessary irritation to the patient, by making themselves as far as possible invisible, and, dressed in black clothes and wearing black gloves, taking up a position behind a sort of screen, from which shelter they move little objects, attached to a long stick, to and fro in front of the curtain. This is really a good method of keeping disturbing influences away from the patient, although it has been asserted that all these precautions must make the patient somewhat drowsy, a verdict however that is by no means confirmed by experience. On the contrary one perceives that a patient whose attention is centred solely on the task imposed upon him—a task that is often very difficult for him—gladly dispenses with all disturbing outside influences, by whichever of his senses these may be brought to his consciousness. By the *modus operandi* described above, a portion of the unnecessary retinal irritants is excluded, but another part still remains, as for instance, the whole apparatus that must be erected near the patient (and which casts a shadow on the screen, also the moving stick, and then the signs that must be made on the screen, be these almost invisible, to indicate where the patient has seen the object appear or disappear. Moreover, if the operator stands very much to one side, he himself cannot see very well whether the patient keeps the eye, which is partly hidden behind the nose, quite still. In order to avoid these disadvantages—which for brevity's sake cannot very well be gone into in greater detail—one can span a large black cloth of dull woollen material,* and have a small opening made about 4 ft. 4 in. from the ground, wherein a fixation object is attached. By using a revolving chair and a chin support that can be raised or lowered, one can be assured that the eyes are always about 4 ft. 4 in. above the ground. On the side of the screen that is turned to the light, nothing is visible but the object on which the gaze must be fixed. On the other side, however, a division in circles and radii is painted. The circles are so far from each other

* The cloth I use is 4 feet by 6 feet. He who has more space available would do well to take a larger cloth (as also indicated by Bjerrum), and let the patient sit in front, about 6 feet away, thus double the distance of my patients.

that the distance between any two successive circles measures exactly 1° , as seen from the point of observation, which is about 40 in. from the screen.

The radii are drawn at distances of 5° (or 7.5°) from each other. The observer has eight or ten small (button-hole stitched) holes, a few millimetres in diameter, made in the cloth at about the height of his own eyes, so that he can see the patient from any of those points behind the curtain. These holes, however, are practically invisible to the patient, especially if the illumination behind the screen is weaker than it is in front, which usually is the case.

For objects, one uses coloured steel balls of 2, 3, 5, 7, and 10 millimetres diameter, which can be caused to make all the required movements by means of a small hand electro-magnet moved in all directions behind the screen. He who possesses a Hirschberg magnet with the accompanying accumulator will find that it answers very well for this purpose.

If there is electric light in the house (continuous current) one can, by inserting a wire or lamp resistance, connect up to a 6 or 8 volt magnet. If, however, one has only an alternating current, then one must get an accumulator of 6 or 8 volts, with a suitable magnet, not too heavy, and easy to handle.

The mapping of the visual field, in front of the screen, is now quite simple. Through the small holes in the screen one controls the patient, at the same time moving the magnet (and also the steel ball that is in front) in the same manner to and fro as one does the stick generally used for defining the visual field. As soon as the patient states that he sees the ball, one makes a sign with white or coloured chalk at the back of the screen at the place where the ball was when he made that assertion. The marks which one has made are combined later, when the whole examination is concluded, on a suitable plan, according with the divisions on the screen.

The advantages of this campimetric manner of investigating the visual field are, in my opinion, the following:

(1) Everything that is not an attribute to the testing of the visual field is eliminated.

(2) It is not necessary to make any lines or other signs at the front of the screen, so that the patient is unable later on to refer to his own statements, which, voluntarily or involuntarily, he often does.

(3) The even diffusion of light on the screen is greatly improved by the installation above described, which, especially with patients with a disordered sense of light, is a great advantage.

(4) It is easy with artificial light—although one does not use this by preference—to examine the visual field by a frosted electric lamp placed in a slanting direction above the patient, so that no shadow is thrown on the screen.

My final remarks treat of the manner in which the patient's gaze is kept in a certain direction. First of all, I must point out that in the fixing of the gaze, the eye, as is well known, even where the patient exerts himself to the utmost, is never entirely still, but constantly makes small deviations of about 5' in various directions. This physiological nystagmus, which cannot be suppressed, does not, of course, play any rôle in the determination of the limits of the visual field in which mistakes of a few degrees are often made, and, therefore, need not be taken into consideration.

The gaze is usually arrested by a fixation point, a white dot, or a black dot in the centre of a slightly larger white patch, both of which are excellent means of bringing the eye into a position of rest for people with a good central visual acuity. If, however, there are central scotomata, this method will leave us in the lurch, and then one can help oneself in different ways, for instance, by letting the patient look at his own finger, which he lays on the middle of a peri- or campimeter. This, however, is only possible when those instruments are very near, and, therefore, not by the method of Bjerrum, apart from other noticeable disadvantages which are connected with this method.

If only one eye has a defective visual acuity, then the other one can serve to indicate the direction of the gaze of the first one, to which end various methods are available; for instance, with complementary colours (Schlösser) or with the aid of the stereoscope (Haitz), or with a projected centre (Walker), all methods into which I need go no further, as none of them is of any assistance if both eyes are defective.

If there is an absolute or relative central scotoma, then nothing else remains to be done but to enlarge the fixation point to a more or less extensive fixation field, and to request the patient to gaze at the centre of it. By adopting this long used and tested method, more of the retinal elements are of course irritated, and if the patch is big enough, perhaps also some that are not affected. The patient hereby gets, in any case, an idea of the direction in which he must look. A white ring with a black centre, however, is better than a patch, especially as one can make tests in the centre of this ring, just as well as outside of it. Here again one has the same contra-distinction of the white or coloured object with which one works in contrast with the dark background, whilst this contra-distinction is a different one on the white central fixation area.

Central scotomata, especially small ones, should never be sought for in any other way than this, because the difference in the value of the white, between an object and a white or black background is very great, so that the patient gets quite a different impression of a moving object that stands out against the white centre to that obtained when the same object is seen in front of the black background.

If one wants to use this fixation of the centre point of a ring more universally, then one must know with what degree of accuracy this fixation is performed. As one wants to apply the method indicated chiefly to patients in whom one presumes that a central scotoma is present, it will be useful, if possible, to imitate somewhat the vision of such sufferers, to learn experimentally how and what they perceive.

An observer with normal eyes can do this by going for a short period into the dark, after which the well-known central physiological scotoma of about 4° shows itself, through which he will not be able to perceive a weak light in the centre.

One has prepared the following test beforehand: A ring covered with luminous paint is so attached that the inside of the ring can be seen from the place of the observer at an angle of 4° . In the middle of this ring is an instantaneous shutter of a photographic apparatus, which can easily be opened and closed by the observer from his position. Behind the photographic shutter a Nernst lamp is placed, the vertical wire of which goes exactly through the middle of the round opening in the apparatus and thus also through the centre of the luminous ring. After the appearance of the central physiological scotoma the observer begins as accurately as possible to fix the centre of the faintly luminous ring, and when he thinks that his gaze is correctly directed on the centre, the instantaneous shutter is opened for a fraction of a second, for such a short period of time in fact, that in the meantime not the slightest movement of the eye is possible. The irritation of the light of the glowing Nernst lamp has, nevertheless, worked long enough in this short period to produce a sharp after image and this after image is now drawn on the piece of paper, placed vertically, which had been prepared in advance, and in the middle of which a black fixation point had been indicated. As the distance from the eye of the observer to the paper is known, it is possible to calculate from the point where the copies are drawn, how far the eye has fixed outside the centre of the luminous ring, and it now appears that this deviation—out of an average of twenty tests—has never been greater than $1^\circ 15'$ in any direction.

Of course, one cannot immediately compare the results attained with artificially induced central scotoma, with the fixation of patients who are suffering from pathological scotomata. But experience with a greater number of patients has taught me that people with a bigger or smaller central scotoma, whatever its cause, can keep the gaze fixed on the centre of a white ring. Deviations of 1° to 2° , however, in the direction of the gaze, have practically no influence on the definition of the limits of the visual field, or of scotomata in that field.

In order to compare the probability of the deductions drawn from

the preceding reasoning with the reality, it has been necessary to examine a normal visual field, once with a small white central fixation point, and then with a fixation ring. The result of this examination with a small coloured ball made on the above-mentioned screen is that there is no more difference between the two tests than between two successive tests with a central fixation point.

For normal observers, however, fixation of the centre of a ring is more difficult than fixation in the ordinary manner, so that the first method should only be used with patients having central scotomata, hemianopsia, etc., as one can also hold the gaze fairly well through part of a ring—the rings can easily be made visible on the above screen. This is done as follows: Small aluminium plates, which have been made slightly globular, are attached to the centre of the screen by means of a small bolt on the back, and a nut. A white ring of a few millimetres breadth is painted in the periphery of these plates, which must be of different diameter, so that they can be seen at different angles, whilst, again, the centre of the plate is either painted black or covered with black material. Owing to the slightly globular inclination to the front, the balls run easily on the discs, the centre of which can be tested also in this manner.

DISCUSSION ON PERIMETRIC METHODS

Professor Van der Hoeve (Leyden), wished to congratulate Dr. Peter on the very accurate and scientific way in which he had treated the subject.

It was the duty of the ophthalmic practitioner to carry out his perimetric methods as rapidly as was consistent with accuracy, for it must always be borne in mind that hurry and exact perimetric examination do not agree. Perhaps it would be better to make no perimetric examination at all than to do it hurriedly; haste might cause the observer to overlook many valuable scotomata. Exact perimetric examination must occupy a deal of time, more time than can properly be spared in the hurly-burly of a polyclinic; it asks two things: time and patience on both sides, i.e., on that of the patient and on that of the doctor. Therefore we have to make our methods as good as possible for quick examination and take advantage of as much assistance as will enable us to carry it out at our ease.

A second point which must be considered is the size of the object. We should not continue to diminish the size of the object and increase the distance of the patient from the screen as otherwise we shall be more and more troubled with physiological scotomata.