It may be worth while to mention here that during sleep the pupil contracts, hence this factor can be easily said to have no effect on the condition.

A DIRECT RECORD SCOTOMETER FOR INVESTIGATING THE CENTRAL FIELD OF VISION*

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DURING recent years increasing attention has been given to the investigation of the state of the central fields of vision. Observations made by such investigations are of value to the physician and to the ophthalmic surgeon. The physician is interested in the appearances of scotomata as indications of lesions of the optic nerves in organic diseases and in the various phenomena that may be elicited in functional disorders. The ophthalmic surgeon is interested in these observations also, and more particularly in the state of the blind spots in suspected early onset of chronic glaucoma. There is general agreement on the value of the field of investigation opened by the work of Bjerrum, but most will equally agree that these investigations are laborious in the extreme, and that not a little of their value is lost since the results tend to be vitiated by the occurrence of fatigue on the part of the patient owing to the lengthy process of the investigation.

The instrument illustrated is a simple and convenient arrangement for making and recording Bjerrum's test and mapping out central scotomata. I have had it in use for over two years, and find it a great labour-saving contrivance. Besides that, the speed with which the observations can be made ensures an accuracy of measurement which I do not think can be beaten. A permanent record of the observation is made at the same time as this is taken without any calculation on the part of the surgeon; and withal the patient sees and knows nothing of what is happening and is not distracted by a number of manipulations or changes of position by surgeon or instrument.

My first experience of Bjerrum's test was made in the fashion recommended by the author of the test: with a black sheet hung against a wall. I soon felt the need of getting behind the screen so as to be able to see the patient's eyes without interruption. I thereupon used a blackened disc of three-ply wood fitted to the ordinary perimeter stand, with the degrees, circles, and radii graven upon its surface. The object used was gummed on to the point of a lead

*Instrument demonstrated before the Section of Ophthalmology, Roy. Soc. Med., on January 14, 1921.

pencil, so that its movements could be recorded by the marks of the pencil on the blackboard. The method was quick and accurate, but had the serious disadvantage that the record had to be copied on to paper, a duty one was apt to forget on occasions. After that I tried thin sheets of tracing paper fastened to the blackboard, so that the paper received the direct record of the observation. But this had to be discarded, for the patients saw what was being done. One patient brought me a sheaf of observations of his blind spot he had made himself; it is not desirable that neurotic glaucomatous patients should become habitual field-takers. Thinking to take the record on black paper, a handy piece of typewriter carbon was made use of, so that the form of recorder you see came about.

The carbon recorder has a real advantage in the fact that a continuous record of the movements of the object may be made throughout the observations by lightly dragging the pointer over the screen and pressing it upon the screen when it is desired to make heavier marks at salient points.

The screen is fixed to a stout iron frame. This can be shut down when not in use, but it is rigid when set up. There are no loose pieces, screws or joints, to be fitted together. The screen is of a dark grey cloth mounted on a wooden frame, chart and carbon are slipped behind the screen and the whole clamped in the frame. The frame slips on to the higher of the two uprights of the stand. The other upright ends in a ball against which the patient presses the side of his nose close to the cheek; he holds the upright with one

hand and covers the eye not under observation with the other. The fixation spot is marked on the screen by a white metal stud fixed into the cloth. The position of the blind spots are marked at the back of the frame by two knobs, one or other of which the surgeon holds as a guide so that no time is lost in finding the working areas. These knobs are most useful, they give such a sense of position that after a little experience it is possible to keep one's eyes fixed upon the patient's eyes during the whole series of observations, the feel of the knob at the back of the frame giving sufficient guidance for the movements of the object-holder in the other hand.

The surgeon stands behind the screen, holds a knob with the left hand, his right hand is enveloped in a black bag, and the object-holder projects from the hand through a hole in the bag. The object-holder is a rod fitted in a convenient handle to be held pen fashion. At the free end of the holder is fitted a small carrier with the object; at the back of this is fixed a blunt pointer which is moved over the face of the screen and pressed upon it when desired.

The chart measures $12\frac{3}{4}$ in. by 8 in., i.e., it is foolscap size, which at 33 cm. gives a range of 26 degrees laterally and 17 degrees vertically from the central fixation spot. The shape of the chart is determined by the size and shape of the typewriter carbons which are only made in certain sizes. I have found this chart of ample size, giving all the range that is required for such observations. A chart on so large a scale as this allows the use of the same sheet for several examinations of one patient at different times. Different coloured carbons are provided to distinguish the several records; by this means valuable comparison is provided.

The working distance of 33 cm. is the working distance of our best-known arc perimeters. I find no advantage in a longer working distance, but a shorter distance than 33 cm. is liable to introduce complication by reason of shadows from the patient's head.

The real advantage of this recording instrument is the speed and accuracy with which observations may be made. I find that in such work speed and accuracy are almost synonymous. My observations have convinced me that to get accurate results the work must be done so quickly that the patient does not get tired and let his eye wander from the fixation point. If in taking his records the surgeon has to move about, take notes, shift the instrument, or do anything which takes time, or diverts the patient's attention, accuracy of observation is seriously diminished, if not lost. I have taken a series of observations in measuring the blind spot of one of my own eyes, repeating the measurements one after the other without interval for rest. It was found that the fifth or sixth mapping was slightly larger than the first, and after that fatigue made a delineation erratic.

The instrument has been well made by Messrs. John Weiss and Son, Ltd., London.