APPLIANCES

DIAGNOSTIC CONTACT LENS*

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THE direct examination of the various internal parts of the eye is complicated by its refractive system; *e.g.* the angle of the anterior chamber cannot be observed directly because of the high curvature and refractive power of the cornea.

Méry (1704) knew that a direct view of the fundus might be obtained if the refractive system of the eye could be neutralized. In the 19th century, Helmholtz (1856) devised an indirect technique of observation resulting in the admirable instrument we now have in the modern ophthalmoscope. There have been successful attempts at producing direct-vision ophthalmoscopes, based on the principle of neutralization of the refractive system of the eye, but these instruments were never very popular.

Koepe (1919, 1920) reiterated the principle of this method of direct examination. He used a contact lens of -60.0 D to neutralize the power of the eye and examined the fundus with the aid of a slit lamp and a binocular microscope. By using a contact lens he eliminated the possibility of any distortion which would be caused by separation of the neutralizing lens from the eye. One practical difficulty he encountered was that the slit-lamp body interfered with the movement of the microscope. To overcome this Koepe used a small mirror to deflect the beam from the slit lamp so that the latter could be well separated from the microscope. With this arrangement he was able to obtain fairly satisfactory views of the fundus.

Goldmann (1941) found that the same technique could be used for viewing the angle of the anterior chamber. To neutralize the power of the cornea he used a -40.0 D contact lens, to which he gave the name of gonioscope. Instead of a mirror Goldmann used a small prism to deflect the slit-lamp beam.

Hruby (1950) later invented the method of using a -60.0 D lens placed close to, but not in contact with, the eye. By careful adjustment of this lens he was able to combine the two functions of neutralizing the refractive system of the eye and deflecting the slit-lamp beam.

After investigation of the various methods described above, I arrived at the following conclusions:

(1) *Gonioscopy*.—The results of this examination, using Goldmann's technique, are quite satisfactory once one acquires the manual dexterity necessary to manipulate the gonioscope, prism-bearing slit lamp, and binocular microscope.

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(2) *Fundus Examination.*—This was carried out with Koeppé's lens. The results were less satisfactory than those for gonioscopy, for these reasons:

(a) For a detailed examination of the various parts of the fundus it is very difficult to control simultaneously the prism-bearing slit lamp, the binocular microscope, and the direction of the patients' eye movements.

(b) A binocular view is obtainable with only a few eyes. The angle subtended by the dilated pupil at the image of the fundus is usually less than the angle between the two optical axis of the microscope; the view in this case being, therefore, monocular (Figure).

FIGURE.—Diagram to illustrate that the angle subtended by the optical axes of the microscope is larger than that subtended by the pupil at the retina.

After these studies, it was decided to try to evolve a lens which would be more universal in application; the diagnostic contact lens described below seems to fulfil this condition.

Apparatus

The lens is a contact lens, having a dioptric power of approximately -120.0 D sph. To accommodate this very high power the lens is made with a concave outer surface.

The image of the fundus produced by this lens is virtual, diminished, and erect. It is situated between the retina and the contact lens, at a distance approximately 9 mm. from the anterior corneal surface, *i.e.* 2 mm. behind the posterior surface of the crystalline lens. The angle subtended by the pupil at this distance is much greater than that between the two optical axes of the microscope; thus a true binocular view is assured in every case. The same principle applies to the examination of the posterior vitreous.

The examination of the angle of the anterior chamber and the periphery of the fundus is facilitated by the large base-out prismatic effect produced by the outer concave surface of the contact lens. The image in this case is displaced towards the apex of the prism, *i.e.* towards the centre of the lens, and is thus made easily visible.

Method of Use

In practice, for gonioscopy, the normal slit-lamp examination technique is

used. No additional prism or mirror is necessary to deflect the slit-lamp beam.

For examination of the fundus the technique is rather different. The patient's eye is first anaesthetized and the pupil dilated. After insertion of the lens the slit-lamp beam is directed on to the lens surface. When the red fundus reflex is seen, the beam is focussed on the retina. Then, by careful adjustment of the lamp and the direction of the patient's eye, the area of retina to be examined is sought out. A detailed examination is then carried out with the aid of the binocular microscope.

Through the courtesy of the National Research Development Corporation, Messrs. Theodore Hamblin Ltd., have agreed to produce this lens.

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