NEW METHOD OF SLIT-LAMP MICRO-OPHTHALMOSCOPY*

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BIOMICROSCOPY of the fundus gives invaluable information in diseases of the vitreous and retina. The slit beam, focused on the fundus, gives an optical section of the retina similar to that which we obtain in the cornea and lens, making possible the estimation of depth. The method is also of value in affections of the optic nerve and of the choroid.

- (1) *Vitreous*.—Detachment of the vitreous, shrinkage of the vitreous, and “synechiae” between retina and vitreous can only be clearly seen with the slit-lamp.
- (2) *Retina*.—In the optical section of the slit-lamp, holes in the retina can be differentiated from cysts and retinal haemorrhages, and detachment can be differentiated from oedema and retinal exudations.
- (3) *Optic Nerve*.—The extent of oedema, and the shape and degree of cupping of the optic nerve head can be ascertained by the slit-lamp.
- (4) *Choroid*.—Choroidal melanomata may be diagnosed from primary or exudative retinal detachment. Scars in the choroid from past inflammation can be seen through an atrophic retina (Ridley, 1952). Goldmann (1938) described cystic degeneration of the retina over choroidal angiomata.

Available Methods

Koepe (1918) was the first to examine the fundus with the slit lamp. He attached a mirror in front of the illuminating lens of the slit lamp to bring the axes of illumination and observation nearly parallel, and abolished the refractive power of the cornea by employing a contact lens with a flat anterior surface.

Goldmann (1937) demonstrated an improvement in the method of exploration of the posterior portions of the eye by means of the Haag Streit slit-lamp. This consisted of a very light contact lens (0.8 g.) which lies flat on the eyeball, and a prism (the Goldmann *reduktion-prisma*) which permits the angle of observation-illumination to be reduced to 5°. The contact lens methods are difficult and cause discomfort and annoyance even to a co-operative patient. They are not suited for general clinical application.

The use of a high power concave lens for fundus examination was first described by Lemoine and Valois (1923). Significance has recently been given to the method by the investigations of Hruby (1941, 1942, 1948). Hruby's *minusglas* is a great advance; it has a refractive power of —58 dioptres and serves to nullify the effect

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of the optical system of the examined eye. It is held near but not in contact with the cornea and so avoids the difficulty and discomfort of using a contact lens.

The introduction by Littmann (1950 a, b) of a new slit-lamp apparatus* whereby the source of light can be moved across the axis of observation is undoubtedly a great advantage. Without the use of a mirror or reduction prism, the illumination-observation angle can be reduced to 0. In the central position it is possible to look binocularly past both sides of the slit-lamp. This same arrangement was adopted in the Aimark (A.I.M.) slit lamp.†

Fundus examination with the Hruby lens is easy, but has some limitations for the field of view is very small, and with a widely dilated pupil hardly larger than the diameter of the optic disc. Examination of the periphery of the fundus and examination with high magnifications are also difficult.

Present Technique

By using a strong convex lens placed in front of the patient's eye, with the slit lamp in the central position, I have evolved a method of seeing binocularly an inverted magnified slit image of a large area of the fundus.

The procedure is as follows:

- (1) The pupil of the patient is sufficiently dilated.
- (2) The illumination-observation angle is reduced to a minimum. The slit-lamp is placed either between the two objectives of the microscope or to one side. With the Littmann (Zeiss) or Aimark apparatus this can be easily accomplished and with other types of slit-lamp apparatus a mirror or Goldmann reduction prism may be used.
- (3) A plano-convex lens of about +60 dioptres is held in front of and near the cornea, with the convex side towards the patient.
- (4) If the microscope is now moved backwards (away from the patient) an inverted aerial slit image of the fundus can be focused. Focusing is made easier if one remembers that the aerial image of the fundus is situated 16 mm. behind the supplementary lens (on the observer's side), and that the optical centre of a plano-convex lens lies on its convex surface.

The advantages of this method are these:

- (1) The field of observation is large. With a dilated pupil the slit image is about six times the optic disc diameter.
- (2) The periphery of the fundus is made accessible by the large field of vision, and by decentring the supplementary lens, bending both illumination and observation axes, a still closer approach to the ora serrata is possible.
- (3) High magnifications are practicable through increased depth of focus.

The optical principles are illustrated in the accompanying diagrams. In Fig. 1 the path of the rays is shown where the slit lamp is placed centrally between the microscope objectives. In Fig. 2 the slit lamp is placed to one side and the illumination-observation angle is about 5°. The shaded areas

* The Zeiss-Opton Slit Lamp obtainable from Rayners Ltd., 100 New Bond Street, London, W.1.

† Obtainable in England from Clement Clarke Ltd., 63, Wigmore Street, London, W.1., Curry & Paxton Ltd., 22, Wigmore Street, London, W.1., and Alfred Hawes & Son Ltd., 79, Leadenhall Street, London, E.C.3.

FIG. 1.—Path of rays when slit lamp is centrally placed. Shaded area represents illuminating beam, bold lines observation rays.

FIG. 2.—Path of rays when slit lamp is laterally placed. Shaded area represents illuminating beam, bold lines observation rays.

FIG. 3. Optical system of Zeiss-Opton slit-lamp microscope (after Littmann, 1950 a).

represent incident rays and the straight lines emergent rays. Fig. 3 shows the optical principle of the Littmann slit-lamp microscope.

As in all other methods of ophthalmoscopy, the glare of the reflexes formed by the surfaces of the ocular media, particularly of the cornea, should be

avoided. Light is also scattered from the illuminating beam throughout its whole course in the ocular media. To avoid the light reflected by the surfaces and that scattered from the ocular media, the whole area of radiation both of the illuminating and of the observation rays should be completely separate in passing through the ocular media. This is achieved by using one area of the pupil of the examined eye for the illuminating beam and another separate area for observation.

Fig. 4 shows the position of the slit beam on the pupil of the patient, and the areas used for observation when the slit lamp is centrally placed. Fig. 5 shows the positions of the beam and observation areas when the light is laterally placed. It should be noticed that, in the latter position, the beam on the pupil should be situated on the side opposite to that of the slit lamp.

FIG. 4.—Pupil of examined eye showing areas occupied by slit-lamp beam and observation areas when slit lamp is centrally placed.

FIG. 5.—Pupil of examined eye showing areas occupied by slit-lamp beam and observation areas when slit lamp is laterally placed.

As the beam of the slit lamp is gradually widened, there comes a time when the illumination and observation areas overlap and reflexes appear in the field of view. With a widely dilated pupil and a relatively broad slit beam, a considerable area of the fundus can be examined at one time without disturbing reflexes. The reflexes from the surfaces of the supplementary lens can easily be avoided by a very slight tilting of the lens so that the reflected light does not enter the microscope.

I am indebted to Prof. Dr. Karl Lindner who first taught me to examine the posterior vitreous and fundus with the slit lamp. My interest in the subject was stimulated by the lectures on scleral resection, detachment of the retina, and pathology of the vitreous, which he delivered in Cairo a few months ago (Lindner, 1953).

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