MICROFILM PHOTOGRAPHY IN OPHTHALMOLOGY*

BY

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FUNDUS photography with the Zeiss fundus camera or moving picture equipment (Swan and Bailey, 1959; House, House, and Urban, 1959) is designed mainly for the posterior part of the globe. Interesting changes in retinal detachment and other conditions anterior to the equator cannot easily be recorded by these methods, and the cost and diversity of equipment do not permit general use in daily ophthalmic practice. This applies also to the presently available slit-lamp photographic equipment which is somewhat cumbersome for routine use. One problem is presented by the diameter of the eyepiece of the slit-lamp which limits the diameter of the camera aperture. This in turn necessitates improved illumination which usually requires flash attachments, thus complicating the equipment and raising the cost. If, however, a camera is used that utilizes the diameter of the slit-lamp ocular without limitation of its aperture, cumbersome flash attachments can be avoided and photography of the posterior and anterior eye segments accomplished with greater ease. Microfilm photography fulfils these requirements. The diameter of the open camera lens is less than that of the slit-lamp eyepiece. Full use of the open camera aperture is therefore possible and ordinary slit-lamp illumination suffices for photography. On this basis a microfilm camera was tried on the slit-lamp for fundus photography, gonioscopy, and photography of the lids and the anterior part of the globe.

Method

A microfilm camera ("Minox") is attached to the right eyepiece of a slit-lamp or gonioscope (Schirmer, 1964) (Figs 1 and 2) with the commercially available binocular attachment. The left eyepiece is used for focusing and a long cable runs from the camera to the focusing device of the gonioscope or slit-lamp (Fig. 2) to permit prompt release of the shutter. The camera is focused for infinity. The film used is 32 ASA for colour and 160 ASA for black and white. The illumination of the slit-lamp is used nearly coaxial with the objectives (Fig. 3). With the 6-volt stop on the transformer the slit illumination is completely opened on the Haag-Streit slit-lamp using the short mirror. The long Haag-Streit mirror reflects more light which permits shorter exposure but causes more reflections. The size of the mirror and the transformer voltage regulate the amount of illumination.

A Goldmann gonioscope attachment is preferred to the fundus contact lens because the plano surface (disregarding the mirror) permits reflex-free photography when tilted downward so that specular reflection is directed away from the observer. This is also possible with the fundus contact lens, but its convex front surface requires more extreme tilt to eliminate reflection. For photography of the anterior fundus, a faceted contact lens

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FIG. 1.—Minox camera attached to Haag-Streit slit-lamp. By using a longer release cable, the joystick and cable may be manipulated simultaneously.

FIG. 2.—Minox camera attached to gonioscope slit-lamp. Note right hand using focusing device and cable release. A faceted contact lens rests upon the cornea.

FIG. 3.—A, Method of avoiding surface reflection. B, Method of avoiding retinal reflections.

(Fig. 2) permits the use of a gonioscope with strong coaxial illumination. Goniophotography is possible when the spherical surface of the "Troncoso" lens is used but the plano facet, while reducing the magnification and illumination, provides a larger field of observation (Schirmer, 1964).

The shutter speeds required for fundus photography on the slit-lamp with the Minox, using 32 ASA colour film, range from 1/20th to 1/100th of a second, depending on illumination and object. An exposure meter applied to the ocular does not furnish accurate clues to the required exposure time. Several exposures at speeds above and below the assumed value are indicated for securing the best results. It is advisable also to over-develop the film to gain approximately one stop. On the Haag-Streit slit-lamp, using the short mirror, a practical setting for most fundi is 1/50th of a second exposure time with open slit, the illumination as nearly coaxial as possible, and the transformer on the 6-volt stop or 1/100th of a second at 7 volts on the transformer. With the change of object (e.g. dark, melanotic tumour), a change of illumination and exposure must be considered.

The pitfalls of the method are glare and reflection. The stronger the illumination needed for photography, the more reflection and glare will result. Reflection of the front surface of the gonio lens can be avoided by using a contact lens with a plano surface and letting it incline so that it does not cause specular reflection in the line of observation (Fig. 3A). Specular reflection from the retinal surface may be avoided by shifting the light source a few degrees off axis (Fig. 3B) although white, convex surfaces (e.g. papilloedema) will always cause reflections. This, however, can be minimized by a decrease in illumination and an increase in exposure.

Strong illumination causes discomfort or blink reflex in the patient and upward movement of the globe. It is therefore advisable to set the illumination (voltage) and reduce it at first to a narrow slit. This is focused on the object with the observer's ocular. The slit is then suddenly opened and the shutter simultaneously released. The speed of this permits taking the photograph before Bell's phenomenon changes the position of the eye.

Results

Fig. 4 shows the results obtained: A, follicular hypertrophy of the conjunctiva in the lower fornix. B, pterygium of the left eye. A follow-up photograph one month later showed identical extension into the cornea and vascular distribution. The follow-up has since proved that no further change has taken place. Rate of growth can be evaluated by comparison of photographs taken at various intervals. C and D show gonioscopic findings, the former showing angle closure and the latter an open-angle recess. The slit beam, unlike flash illumination, aids in the perception of depth. The advantages of the slit-beam examination are retained by this method of photography. E, normal optic disc. F and G, a case of central serous retinopathy. The colour difference in F between the macular area and the perimacular area suggests oedema of that area. The lateral slit illumination in G, however, proves the presence of a flat serous detachment, another advantage of this method of fundus photography. H, optic disc in choroideremia with narrowing of retinal vessels and atrophy of choroid. In the midperiphery of the fundus (I) the atrophy of the choroid is complete and the bare sclera is visible in the fundus. The blood vessels are narrow and irregular pigment agglomerations are scantily scattered.

No examples of photography anterior to the equator are given as this is best accomplished with transillumination and depression. This particular aspect of the subject will be discussed in a future paper.

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FIG. 4.—Examples of colour photographs taken with a Minox camera on 8-mm. film (*see text*).
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Discussion

In attempting fundus photography with this method personal experience must be gained, especially with regard to illumination and shutter speed. Individual light absorption of the object and the age of the patient must be taken into account as the media change in light transmission with increasing age. For the adjustment of these varying conditions only a minimum of photographic understanding is necessary, not more than is required for outdoor photography.

The microfilm constitutes a valuable record of a case for comparison and follow-up of pathology, such as tumours, the progress of pterygium, or changes in the fundus (Fig. 4). The necessary equipment is relatively inexpensive, easily used, and every ophthalmologist can apply the method even in routine practice. A microfilm record of a case is also of medico-legal value. Complete ocular photography from the lids to the optic nerve is quickly and simply accomplished without complicated attachments. Any detail observed through the slit-lamp can be photographically recorded. The attachment of the camera to the slit-lamp takes no longer than the attachment of the applanation tonometer. The small size of the camera permits easy storage.

The limitations of this method of ocular photography are inherent in the small size of the picture (8 mm.). Transparencies are therefore preferable to enlarged prints because of grain. If the slide is underexposed, the increased luminosity provided by reducing the projector-screen distance will improve the image. The large magnification of the slit-lamp will aid in the resolution of details. The field of observation depends on the slit-lamp and its setting. By using an open aperture, sharp definition of detail is obtained of the point on which the slit-lamp has been focused, but the depth of focus is somewhat limited. This becomes particularly obvious with wide-angle view of the fundus because of the curve of the globe, or with greatly protruding details, such as tumours or papilloedema. However, the recording of intra- or extra-ocular details, especially for comparison on follow-up, is easily accomplished. This, together with the simplicity of handling, is the main advantage of the method.

It is hoped that this method of photography may eventually become fool-proof. This is, above all, a challenge to manufacturers for better microfilm equipment (single lens reflex models, better film, etc.).

Summary

By attaching a microfilm camera to a slit-lamp or gonioscope, microfilm photography of the anterior and posterior ocular segments is possible. Microfilm equipment at present available can be satisfactorily adjusted to modern slit-lamps and gonioscopes with good illumination.

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