


A viewer for correlation of fluorescein and color fundus photographs. ROBERT W.

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A simple viewer for superposition of a fluorescein angiogram on a color fundus photograph without compromising the most desirable characteristics of either is described. The usefulness of this device is described as an aid in correlating an angiogram with the patient’s retina, particularly in conjunction with a slit lamp photocoagulator.

The introduction of improved resolution photography for performing fluorescein angiography has permitted more precise studies of the retinal microcirculation. Also, new argon laser and Xenon arc slit lamp photocoagulation delivery systems now commercially available permit the photococagulation of areas as small as 50 microns in diameter. These two innovations have introduced new concepts in the management of patients with macular disorders and with intravenous neovascularization emanating from the optic disc.

When photocoagulating lesions near the fovea, precise localization is required and even for less vital areas of the retina, precise localization in relationship to visible retinal landmarks seen through the fundus contact lens with a slit lamp photocoagulator is desirable. When studying the patient through a slit lamp photocoagulator, the fundus details are visible with approximately the same contrast and similar highlights as are seen in standard color fundus photography. However, much higher resolution of fine microvascular ab-

normalities and also more precise localization of leakage sites is possible with fluorescein angiograms. Therefore, when treating a patient with a slit lamp photocoagulator it is usually necessary to extrapolate from the much higher contrast fluorescein angiographic landmarks to the fundus view seen through the slit lamp. This extrapolation is frequently difficult, especially where details of the smaller branch vessels are concerned.

The difficulty of this extrapolation has been lessened in some instances by use of color fluorescein photography as suggested by Allen and Frazier and more recently advocated by Schatz and co-workers at Hopkins. Color fluorescein studies permit a greater degree of orientation with respect to retinal landmarks as seen by standard ophthalmoscopy. However, the resolution of the fluorescein fluorescence is definitely diminished by exchanging color film for the black-and-white film ordinarily used in fluorescein angiography.

This report describes a fairly simple viewer which permits superposition of a fluorescein angiogram on a color fundus photograph without compromising the most desirable characteristics of either. The only requirement for producing the two fundus photographs is that they both be made using identical fundus camera optics. This assures that the two images produced are of identical magnification.

The viewer consists of two slide holders oriented at right angles to each other with an independently variable light source behind each (Fig. 1, D and E). A 50 per cent beam splitter is located in such a way that it makes a 45° angle with each of the two slide holders (see Fig. 1). The reflecting surface of the beam splitter (Fig. 1, A) is centered at the intersection of two imaginary lines.
Fig. 2. Exploded view of viewer showing construction details. A, slide holder; B, horizontal carriage; C, slide rod; D and E, slide rod holes; F, vertical carriage; G, horizontal return spring; H, horizontal adjustment screw; and J, threaded hole.

Fig. 3 shows a (color) fixation photograph (A), a selected fluorescein angiogram (B), and a photograph (C) taken through the viewer showing B superimposed on A. Note that the area of fluorescein leakage can be precisely located with respect to retinal landmarks.

In practice, the viewer is mounted on top of the laser slit lamp so that visualization of a patient’s fundus photographs can be conveniently referred to during photocoagulation (Fig. 4). It has also proved worthwhile to place a green filter in the slide holder with the fluorescein slide so that the image of the fluorescein-filled vessels are more apparent when superimposed on the color slide. A foot-operated switch has sometimes been employed to flash the light source behind the

originating at the centers of and perpendicular to the two slide holders. With this configuration it is possible for an observer to see a reflected image of one slide superimposed on the other. In order for the two slides to be in focus simultaneously for the observer, the path lengths from the observer to each slide are exactly equal. A telescope or a simple binocular viewing device can then be mounted on a bracket (Fig. 1, F) to provide binocular vision and to magnify the slides for study of details. It should be noted at this point that a useful superimposition of the two slides cannot be achieved simply by placing them together and transilluminating the pair. This is due to the fact that the densities of the two slides are usually very dissimilar; however, the independently variable light sources on the viewer can be adjusted to nullify those differences.

One of the slide holders permits a rotation of a slide about its center (Fig. 1, B), and the other slide holder permits horizontal and vertical movement of a second slide (Fig. 1, C). The slide in holder C must be reversed with respect to the slide in holder B, since a mirror image of C is seen by the observer. The images of the two slides can then be precisely aligned using the slide holder adjustments, and the intensities of the two light sources can be adjusted to give a proper balance between the color and black-and-white images.

Most of the viewer was constructed of clear plexiglas which was glued together and the inner surfaces were then painted black to cut out unwanted light. Construction details of the viewer are fairly simple as shown by the exploded view in Fig. 2.

The only part complicated enough to warrant further explanation is that which permits horizontal and vertical motions: Slide holder A is held in carriage B. Carriage B rides horizontally along two rods (only one is shown, C) each of which fit through holes D in the back of carriage B. The rods are then secured in the holes E of carriage F. Spring G is slipped onto rod C and is sandwiched between the left set of holes, D and E, and reacts against screw H which passes through the slotted hole in the viewer’s front and into threaded hole J of carriage F. This accounts for the horizontal motion. The vertical motion is accomplished in a similar fashion using the unlabeled spring, screw, and 2 rods (again only one of which is shown) to move carriage F with respect to the base and top of the viewer. The light source behind carriage F is attached directly to it and therefore also moves vertically.

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Fig. 3. A, fixation photograph (color); B, fluorescein angiogram; C, merged images of A and B taken through viewer.
fluorescein slide on and off so that the location of various features of a fluorescein angiogram can be better related to retinal landmarks of the color slide and hence to the patient’s retina. The ability to read fluorescein angiograms with simultaneous reference to the color photographic landmarks has also been useful in interpretation of retinal lesions causing “blocked fluorescence” of underlying fluorescein details.

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REFERENCES


Fig. 4. Viewer mounted on laser photocoagulator slit lamp.

Pigment granule movement in Limulus photoreceptors. WILLIAM H. MILLER AND DAVID F. CAWTON.

Intense illumination causes centripetal movement of pigment granules into the region of the rhabdom within retinular cells so that the rhabdomeres are “coated” with light-absorbing pigment. Moderate illumination alone causes other changes, but little pigment migration. Colchicine moves the pigment to the light position where it stays after hours in the dark. Retinular cells have previously undescribed 240 A diameter microtubules which are oriented radially. Because of the action of colchicine, we postulate that these microtubules control pigment position. There is no acute change in the electron microscopic appearance of the colchicine-treated microtubules in this preparation. Colchicine does not interfere with the electrophysiologic recording of nerve fiber activity.

Photomechanical responses in the retinas of vertebrates and invertebrates have been widely studied, but the underlying mechanisms are unknown. Shielding pigment granules of about 1 μm diameter migrate centripetally within the photoreceptor (retinular) cells of the compound eye of Limulus in response to bright illumination. We describe here: (1) radially oriented microtubules within the retinular cells as an underlying morphologic basis for this photomechanical response; and (2) a colchicine-produced pigment migration which does not interfere with electrophysiologic recording of the optic nerve response to illumination.

Methods. Limulus of about 6 inch carapace are maintained in artificial sea water at pH 7.5 on a 9-hour light, 15-hour dark cycle. Animals are removed from the tank near the end of the dark cycle. The eyes are excised and are injected with various solutions through a 27-gauge needle inserted through the cornea. One eye is injected with varying concentrations of colchicine dissolved in 1.0 to 5.0 per cent dimethyl sulfoxide (DMSO) made up in Limulus Ringer’s. The other eye is injected with the same solution but with the colchicine replaced by an equimolar concentration of dextrose (found to be without effect on pigment position). In some experiments the eyes are held in darkness during the injections. In other experiments the eyes are illuminated on an x-ray view box (450 μW per square centimeter) for varying periods of time, but usually 30 minutes, and are either immediately fixed, or are then held in darkness for periods of 30 to 90 minutes after which they are fixed or used in electrophysiologic preparations. The solutions to be injected are oxygenated to saturation and injected at a rate of 0.5 ml. per 2.25 minutes in illumination and darkness. Fixative composed of 10 per cent glutaraldehyde in 0.1