

Slit-Lamp Photography With a Smartphone

How to obtain high-quality anterior segment photographs with an iPhone 4 or 4S.

BY CHRISTIAN HESTER, MD

The slit lamp is one of the most used devices in the eye care specialist's office. Photographs taken during an examination are useful for clinical decision making and for future follow-up of patients. Images are typically captured using a digital camera that is held in front of or attached to the oculus of the biomicroscope. It is also possible to capture slit-lamp images using a handheld smartphone. Here I describe my technique for obtaining high-quality images at the slit lamp using an iPhone 4 or 4S (Apple Inc.). Of note, this article references this model of iPhone, and cameras in earlier iPhone models will obtain images of different quality.

TECHNIQUE

My preferred technique for using an iPhone for image capture at the slit lamp involves the following equipment: a slit lamp, iPhone with a camera application that allows user control over exposure, and an iPhone slit-lamp adapter. Some additional equipment is used in the techniques I describe in this article, including a telescope photo adapter for the iPhone and the ProCamera iPhone app (Jens Daemgen; available from iTunes.com).

Step No. 1. Optimize Lighting

The importance of lighting cannot be overemphasized and can be divided into two sources: external illumination and slit-beam illumination. Although it is only necessary to use one source of illumination at a time, combining both sources can be useful. When using an external illumination source, the light source should be held in line with the pupillary axis; otherwise, a shadow will appear in the photograph.

There are multiple options for external illumination:

- **Room lights.** The simplest illumination source is to leave the room lights on; however, a more focused light source will result in better-quality photographs.
- **Transilluminator.** A transilluminator can be held by an assistant (Figure 1A) or the patient (Figure 1B). I prefer to use a transilluminator as my external light source.

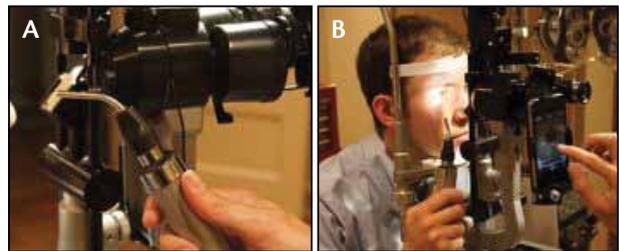


Figure 1. External illumination with a transilluminator, which can be held by an assistant (A) or by the patient (B).



Figure 2. External illumination with a clip-on light.



Figure 3. A SteadyPix Telescope Photo Adapter attached to a slit lamp.

- **Clip-on light.** A clip-on light can be attached to the slit-lamp (Figure 2). Some slit-lamp manufacturers (e.g., Haag-Streit) sell an external illumination light sources that can be attached to their slit-lamps.

External lighting can be enhanced with slit-beam illumination. My preference is to use a narrow slit beam of medium intensity in conjunction with external illumination.

Step No. 2. The iPhone Slit-Lamp Adapter

Although it is possible to obtain photographs without an adapter, its use will undoubtedly improve the quality and efficiency of taking photographs. There are a number of adapters available that serve this application, each with their own pros and cons. In writing this article, I used the SteadyPix Telescope Photo Adapter (Orion Telescopes & Binoculars), which is designed for a telescope. The major advantage of the SteadyPix adapter is its ability to

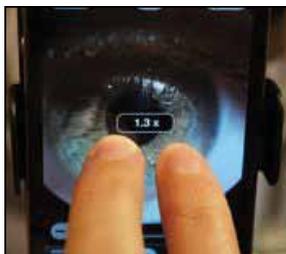


Figure 4. Pinch to zoom to eliminate empty space.



Figure 5. Turn on expert mode under settings to control focus and exposure.

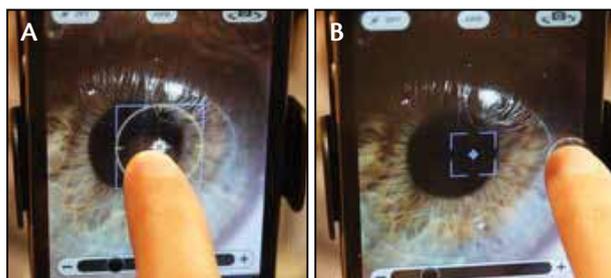


Figure 6. Tap and hold to set and lock focus (A) and exposure (B).

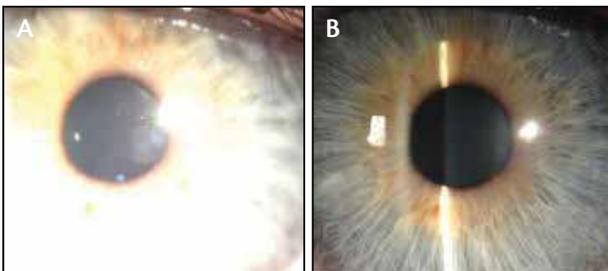


Figure 7. Adjusting the exposure can make the difference between an overexposed, difficult-to-view image (A) and an appropriately exposed photograph (B).

accommodate a large variety of eyepiece diameters (1.25"-1.5") and configurations. I have used it for taking pictures with a Haag-Streit AG BM 900 slit lamp (it will not fit the Haag-Streit AG BQ 900 model) and recording surgical videos with a Leica Microsystems Inc. M840 operating microscope. The three separate adjustable parts of the SteadyPix adapter can be cumbersome to properly align.

Other adapters, like the EyePhotoDoc Adapters (Terry Eye Institute), will allow for more rapid attachment and centration but are only compatible with specific slit-lamp models. EyePhotoDoc manufactures specific adapters for the Haag-Streit AG BM and BQ 900 and Topcon SL-3E model slit-lamps. When using the EyePhotoDoc adapter for the Haag-Streit AG BQ model slit-lamp, pull the oculars out a few millimeters in order to achieve the best positioning. Presently, the EyePhotoDoc adapter is my preferred adapter for slit-lamp photography.

Step No. 3. Attach the Adapter to the Slit Lamp

In this setup, the iPhone is placed in the adapter, and then the entire assembly is mounted to the slit lamp (Figure 3).

Step No. 4. Eliminate Empty Space (Optional)

Some adjustment of the camera's depth of focus may be necessary to obtain full-screen images. Although unadjusted images will appear with total clarity and resolution, they may appear on the preview screen with a black border (note the image in the center of the iPhone in Figure 3). Although these images are perfectly acceptable and clinically useful, a complete screen view can be obtained by zooming the lens in and out until the entire preview screen is filled. With the ProCamera app, zoom adjustments are made by touching the screen with two fingers at the same time and spreading the fingers apart or bringing them together (Figure 4).

Step No. 5. Optimize Focus and Exposure

The point-and-shoot camera on the iPhone 4 or 4s will automatically adjust the focus and exposure to capture the desired image. These components, however, may require minute adjustments to yield a high-quality photograph. To do this in the ProCamera app, turn on expert mode located under settings on the camera's main view page (Figure 5), which will allow manual control over focus and exposure. To set and lock focus (appears as a blue rectangle on the image preview) and exposure (appears as a yellow circle on the image preview), tap and hold the center of the screen (Figure 6A). Next, place the blue focus rectangle in the center of the screen (or over the desired point of focus) and drag the yellow exposure circle toward the side of the screen until the desired exposure has been reached before taking the picture (Figure 6B). If using the camera app does not permit the user's control over the exposure, the pictures may appear overexposed (Figure 7).

CONCLUSION

It is possible to obtain high-quality photographs at the slit lamp with an iPhone. Like any new skill, however, it may take practice to perfect. For additional tips and information on where to purchase equipment such as adapters, Google "slit-lamp iPhone" to find my www.eyewiki.aao.org article on smart phoneography. ■

Christian Hester, MD, is a fellow in cornea, refractive, and anterior segment surgery in the department of ophthalmology at the Baylor College of Medicine in Houston. He acknowledged no financial interest in the products or companies mentioned herein. Dr. Hester may be reached at (713) 798-6100; hesterchristianc@gmail.com

