

There's an app for that (iPhone slit lamp photography)!

by David F. Chang, MD

Dr. Chang: What inspired you to try the iPhone to obtain ophthalmic pictures and videos?

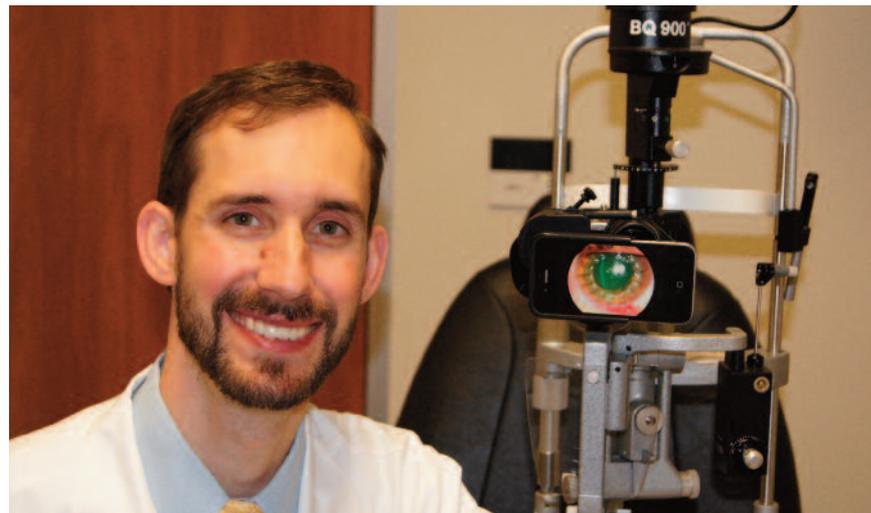
Dr. Hester: I was practicing in rural Arkansas and traveling between satellite clinics. I wanted to take high quality slit lamp photographs and videos but did not have the money to purchase the necessary equipment. While I own a high quality SLR camera, it was difficult for me to obtain photographs using the various slit lamp illumination techniques that I use during my examination. As a result, I scoured the internet for options and decided to order an iPhone adapter made for a portable slit lamp. It took a long time to attach this to my slit lamp, and the pictures I obtained were average at best. Additionally, I could not find any instructions on how to take slit lamp photographs with an iPhone. Ultimately, I became quite discouraged.

Dr. Chang: Most of us would have given up at that point. What did you try next?

Dr. Hester: First, I experimented with every decent iPhone photography app. During this process, I learned the importance of controlling lighting for obtaining high quality photographs and videos. Second, I evaluated multiple adapters for my slit lamp and surgical operating microscope. Many were designed for purposes other than ophthalmology. Third, I tried various iDevices (iPhones, iPads, iPods) and found that you need at least a 5-megapixel camera.

Dr. Chang: You told me that the illumination source is very critical for slit lamp photography.

Dr. Hester: Yes. First, since most slit beams will not illuminate a wide enough area, you will need an external illumination source if you want to photograph the entire eye. You can purchase an external illumination source to attach to your slit lamp from your slit lamp manufacturer or from EyePhotoDoc. Alternatively, you can also use a handheld transilluminator, which is what I use 90% of the time. Second, you need to control for exposure, glare, color balance, etc. It sounds complicated,



Dr. Hester at the slit lamp reviewing pictures of a deep anterior lamellar keratoplasty that he took with his iPhone

but don't worry—there is an app for that. I prefer to use ProCamera by Jens Daemgen, which is available through iTunes. By simply moving a yellow circle around the screen you can visually optimize the photograph's exposure within seconds. Third, taking pictures with this camera app at home under different lighting conditions and watching my ASCRS tutorial videos on various illumination techniques will ease your transition into ophthalmic photography. Proper lighting is the cornerstone for high quality ophthalmic photography, and its importance cannot be overemphasized.

Dr. Chang: Can you get good quality photographs with any iDevice?

Dr. Hester: For the iPhone 4 and other devices with a 5-megapixel camera, the quality is OK. For the iPhone 4S and other devices with an 8-megapixel camera, the quality is good. If the rumors are true and the iPhone 6 will have a 12-megapixel camera with more advanced lens optics, the pictures will likely be great. But don't take my word for it. Please visit my ASCRS web tutorial in order to judge the quality of pictures for yourself.

Dr. Chang: How is the quality of slit lamp or operating microscope videos taken with an iDevice?

Dr. Hester: For the iPhone 4S and higher models the quality of slit lamp videos is outstanding because you can record in 1080p high definition. I absolutely love that I can cap-

ture high quality slit lamp videos demonstrating dynamic exam findings. It really makes case presentations come alive. In the OR, the iPhone 4S videos are also excellent but because there are no adapters specifically designed for operating microscopes, it can take a few minutes to attach and align the adapter on the assistant's ocular. Of course, the setup becomes faster with practice and it currently takes me less than one minute. If you already have a video camera and recording system for your microscope, it will still be easier for you to just hit the record button on your current system. However, if you do not have a video recording system or if you want to capture a specific surgery using a higher definition recording, you may find the iPhone useful.

Dr. Chang: There are many adapters available, which makes it confusing. Which one do you like best?

Dr. Hester: It depends on the slit lamp or operating microscope that I am using. For Haag-Streit (Koniz, Switzerland), Marco (Jacksonville, Fla.), and Topcon (Oakland, N.J.) slit lamps, I prefer Dr. Clifford Terry's EyePhotoDoc adapter. His adapter is available for iPhones, iPads, and iPods, and it slides right over the slit lamp ocular in a matter of a few seconds. I am currently collaborating with EyePhotoDoc to evaluate adapter prototypes for use with other slit lamp models and smartphones. I am excited about their ongoing efforts to produce new adapters, and I should mention that



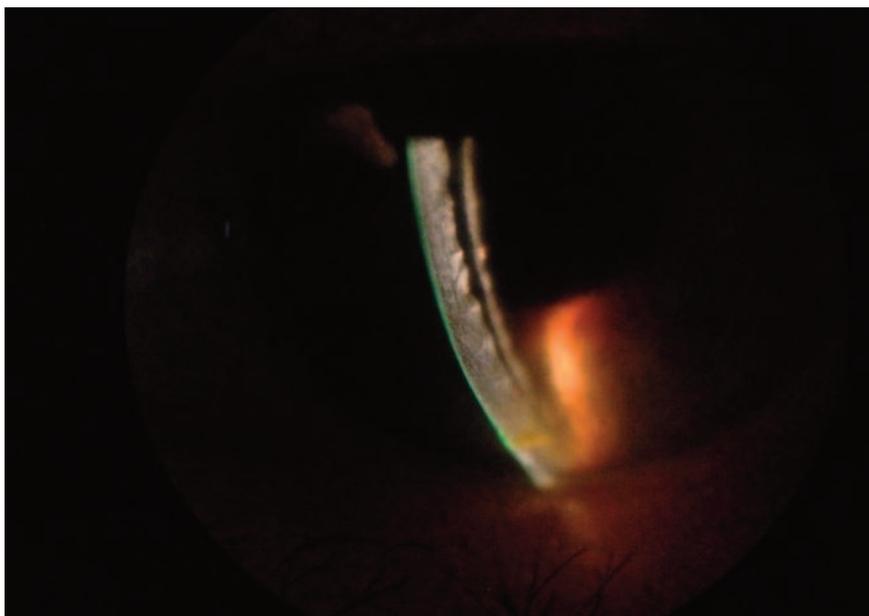
When I knew him as a California Pacific Medical Center (CPMC) resident, **Christian Hester, MD**, always struck me as being particularly creative, inquisitive, and focused. So naturally, I wanted to know what he was up to when I ran into him at a meeting one year ago. At that time Christian was starting his cornea fellowship at Baylor and he couldn't wait to show me his collection of beautiful slit lamp photos that he had taken with his iPhone. Viewing them was a "wow" revelation for me, and with Christian's subsequent emailed guidance I was eventually able to start taking iPhone slit lamp images of my own.

To no surprise, Christian had managed to figure out how to do this on his own, and he is probably now the world's leading expert in iPhone slit lamp adapters, apps, and photography. He has even created an EyeWiki page (Google "EyeWiki iPhone") with tips and pointers. At the past ASCRS annual meeting, Christian teamed up with **Clifford Terry, MD**, and **Mitch Weikert, MD**, to give an instruction course on iPhone photography, and this is now archived on our ASCRS Phaco Fundamentals Classroom (phaco.ascrs.org). At my suggestion, Christian has also generously created a web tutorial for this same website to teach anyone interested how to take iPhone images and videos.

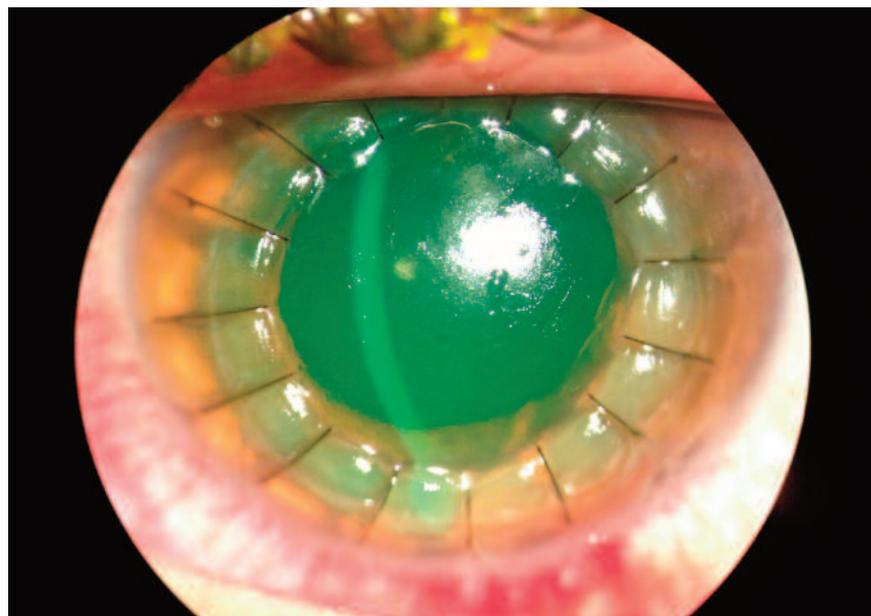
iPhone slit lamp photography was one of the hot topics at the recent ASCRS annual meeting. A presentation by Christian and **Stephen Pflugfelder, MD**—"iPhone Slitlamp Photography and Videography as Tool to Evaluate Ocular Surface Disease in Dry Eye"—won Best Paper of Session. A video by Christian and **Mitch Weikert, MD**—"How to Obtain High-Quality iPhone Slitlamp Photographs, Slitlamp Videos, and Surgical Microscope Videos" won two different ASCRS Film Festival awards, including the People's Choice Award as the film voted best by the ASCRS attendees.

For this month's column, I asked Christian to explain what inspired him to explore this idea and how he managed to solve the various problems he encountered. This is an inexpensive and incredibly elegant system, which is bad news for slit lamp camera manufacturers. However, it could really propel ophthalmic telemedicine—particularly in the developing world. I urge all of you to check out Christian's online tutorial and get started.

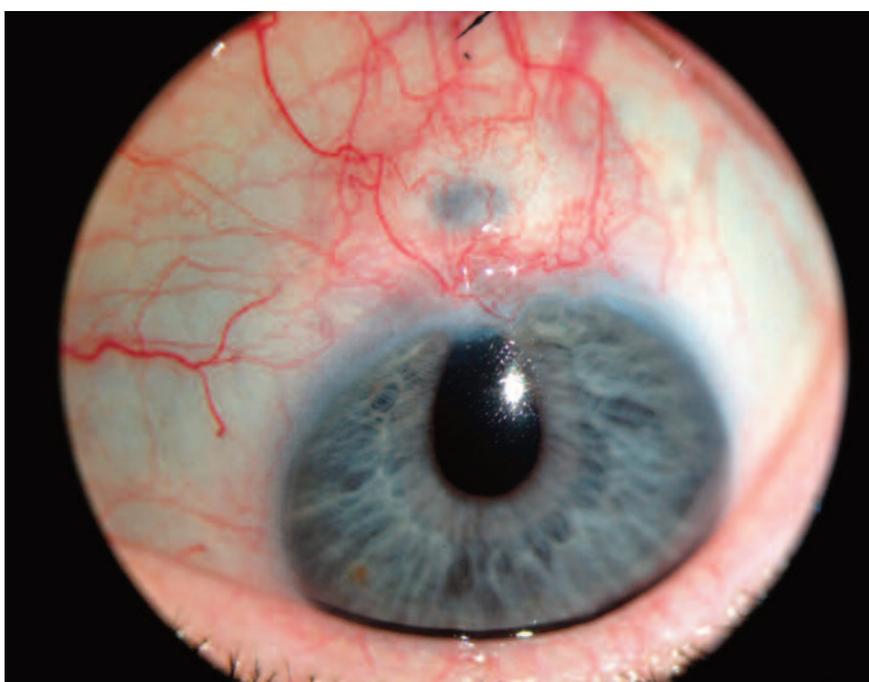
David F. Chang, MD,
chief medical editor



Shallow detachment of a DSAEK corneal graft captured using a thin slit beam at a 60-degree angle on a low intensity light setting, iPhone 4S, EyePhotoDoc Adapter, and ProCamera iPhone App



Postoperative day one status post deep anterior lamellar keratoplasty captured using diffuse illumination from a transilluminator, a thin slit beam on a low intensity setting, iPhone 4S, EyePhotoDoc Adapter, and ProCamera iPhone App



Resolved surgically induced scleritis with scleral thinning, peaked pupil, and uveal show captured using diffuse illumination from a transilluminator, iPhone 4S, EyePhotoDoc Adapter, and ProCamera iPhone App

Source (all): Christian Hester, MD

I have no financial interests. For other slit lamp models, Zarf Enterprises (Spokane, Wash.) offers an adapter that slides into the barrel of the slit lamp's ocular. For Zeiss (Jena, Germany) operating microscopes with f125 oculars, I prefer the Magnifi adapter. For Leica (Buffalo Grove, Ill.) M840 operating microscopes, I prefer the Orion SteadyPix Telescope Photo Adapter. A comprehensive list of available adapters, including Dr. Rajesh Fogla's instructions on how to make an adapter for less than \$5, can be found on my EyeWiki page on Smart Phoneography (Google "EyeWiki iPhone" to find the page).

Dr. Chang: Congratulations on winning the coveted People's Choice Award at the recent ASCRS Film Festival.

Dr. Hester: It was a good meeting for my team at Baylor. During my fellowship, I have had an opportunity to work with an incredible group of ophthalmologists who have made many contributions to iDeviceography. The ASCRS film was the brainchild of the film's first author, Dr. Weikert. I can't applaud

him enough for his creativity and video editing expertise. Everyone knows Dr. Pflugfelder's research acumen is second to none. It was incredibly exciting to partner with him in order to incorporate iPodography into his dry eye research. We feel that our video techniques are allowing us to document dry eye disease with a higher degree of accuracy than ever before. Furthermore, by sending the videos with a few clicks to a centralized reading center, we will be able to eliminate inter-grader variability, which should be valuable in multi-center research trials. Finally, Drs. Douglas Koch, Bowes Hamill, Hart Moss, Elizabeth Yeu, and Joe Hester all contributed to this work through their time, feedback, and support for which I cannot thank them enough. **EW**

Editors' note: Dr. Hester is a fellow in cornea, anterior segment, and refractive surgery, Department of Ophthalmology, Baylor College of Medicine, Houston. In July he will join Little Rock Eye Clinic, Little Rock, Ark.

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