Clinically Useful and Cost-effective Mobile Retinal Screening

By Veronica Kon Graversen, MD; and Pooja Jani, MD

In 1846, Dr. William Cumming wrote, “Every eye could be made luminous if the axis from a source of illumination directed towards a person’s eye and the line of vision of the observer were coincident.” Applying this principle is necessary when performing a detailed ophthalmic exam and when obtaining ocular images for documentation.

In an era of fast-paced technological advancement, developments in digital imaging are revolutionizing ophthalmic photography for research and clinical care. Digital imaging devices provide a means for immediate capture and conversion of images to electronic formats for evaluation, diagnosis, clinical decision-making, and medical record keeping.

Limitations of Traditional Ophthalmic Imaging

Currently, fundus cameras represent the standard technology used for retinal imaging in ophthalmology departments. These cameras are impractical, however, for use in settings outside a fully equipped ophthalmology practice and, therefore, create barriers to eye care for patients. They require an investment in costly equipment that is difficult to mobilize for bedside consultation in hospitals. Additionally, they are impractical for utilization in general medicine clinics where primary care physicians are at the front line of identifying patients with systemic disorders that may have ophthalmic manifestations (eg, diabetic retinopathy). Medical clinics in developing nations also may not have the resources or expertise to operate highly specialized ophthalmic equipment.

Alternative Methods of Imaging

With their built-in cameras and mobile image capture capability, smartphones represent an alternative technology that can be utilized for portable, cost-effective retinal screening and imaging. Adapters for slit-lamp examination are already becoming popular. For example, an adapter capable of producing a 26º field of view has been developed for the Panoptic ophthalmoscope (Welch Allyn). Additionally, the Portable Eye Examination Kit (Peek Vision) allows fundus evaluation via clipping an attachment to a smartphone so retinal images can be obtained in a manner similar to using a 14.00 D indirect lens. Although these technologies allow for greater mobility in ophthalmic imaging, they still require an investment in additional equipment for use in conjunction with a smartphone.

Ret-iKon

We have developed a retinal examination technique that eliminates the need for additional equipment by using only a smartphone and an indirect lens (20.00 D and 25.00 D [Figure 1] and 28.00 D and 30.00 D [Figure 2]). The technique uses a smartphone application that we have created, Ret-iKon. Ret-iKon will allow an observer to take retinal images, collect demographic data, adjust the flash brightness, and upload this information to a database. The application will be available soon.

To obtain retinal images, a patient should be fully dilated and lying in the supine position. The smartphone should be in
video mode with its flash on. Holding an ophthalmic lens in the dominant hand, the observer should then position the phone about 23 cm to 25 cm away from the eye using the nondominant hand. The phone's flashlight should be parallel to the lens and approximately 8 cm from the eye. Correct positioning will reveal the posterior fundus filling the entire lens (Figures 1 and 2). With practice, this technique can be used successfully by both ophthalmologists and non-ophthalmologists to examine the posterior fundus.

**Summary**

We believe that this technology and technique will help screening efforts for pathologies, such as retinopathy of prematurity or diabetic retinopathy, in countries where access to ophthalmic care is limited. *Retina Today* will alert readers when this application is available, most likely in the first quarter of 2014.

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