

Phone-based ophthalmoscopy for Peek, the Portable Eye Examination Kit

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Abstract—Peek, the Portable Eye Examination Kit, leverages smartphone technology to provide a range of ophthalmic diagnostic tests in low-income settings, thus empowering health workers to diagnose eye diseases and to manage and monitor patients within the community. A low-cost adapter on the phone native camera provides Peek with retinal imaging functionalities. The intrinsic connectivity of the smartphone allows transmission of geo-tagged patient records and, potentially, diagnostic data.

The ease of use and field of view of the Peek ophthalmoscope represents a seed change in handheld direct ophthalmoscopy. The intrinsic telemedicine capabilities show promise in remote diagnostics and in integration with screening programs.

I. INTRODUCTION

Globally, 39 million people are classified blind. Of these, 80% can be prevented or cured. 90% of avoidably blind people live in low-income countries [1]. The number of ophthalmologists in such countries is extremely low, in stark contrast to the subtended population, with a resultant unmet need for identification, directly in the community, of the patients who need to be further directed to trained specialists [2]. In this respect, mobile screening technology designed to be used in the field by non-specialist personnel is particularly advantageous.

II. THE PORTABLE EYE EXAMINATION KIT

Peek, the Portable Eye Examination Kit, is a smartphone-based suite of ophthalmologic tests, specifically designed for field screening of eye pathology by minimally trained personnel [3].

Peek is currently implemented on a Samsung Galaxy SIII (Samsung, South Korea). It currently comprises software for visual acuity testing, cataract imaging, and color and contrast sensitivity. Non-mydratic retinal imaging is provided via a

low-cost clip-on adapter (Fig. 1) which directs the light from the phone flash LED to the native phone camera, matching imaging and illumination fields.

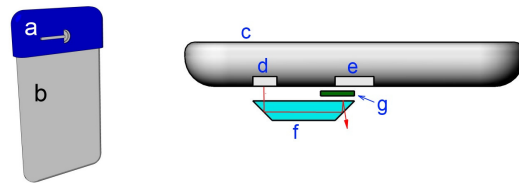


Figure 1. The Peek ophthalmoscope clip (a) on the phone (b,c). The LED light (d) is captured and deviated in front of the camera (e) by a prism (f). A screen (g) blocks the backscattering from the prism.

The patient records and fundus images are captured alongside GPS data, enabling follow-up of patients who do not have a formal address. The data can be transmitted remotely, for storage and further diagnostics.

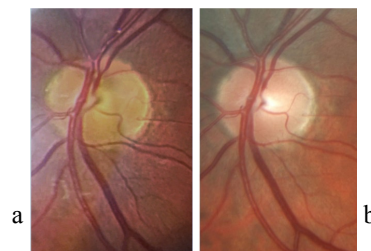


Figure 2. Comparison between Peek (a) and fundus camera (b)

Fig. 2 presents the comparison of image quality with a conventional retinal camera (Topcon TRC-50EX, Italy), demonstrating good agreement between traditional fundus photography and Peek. Formal validation is in progress, comprising data from over 2000 study participants in the Nakuru Eye Disease Study, based in rural Kenya.

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