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Smartphone Technique for Fundoscopy, Step by Step

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Abstract

Objective: To describe a relatively simple technique for fundus photography in humans using a smartphone and an indirect ophthalmoscopy lens.

Methods: Fundus images were captured using smartphones (iPhone and android) and a 2.2 mm, 20 D, or 28D Pan retinal® lens. Using the phone's light source, this system functions as an indirect ophthalmoscope that creates a digital image of the fundus. We record high-definition videos of the fundus and subsequently extract high-quality images.

Results: The described technique of smartphone fundus photography captured excellent high-quality fundus images in children and adults.

Conclusion: Fundus photography with a smartphone is an inexpensive, portable, safe, fast and convenient method to obtain retinal images during the consultation, which can be attached to the medical record for follow-up of different pathologies and academic purposes.

Introduction

The use of smartphones in fundus imaging is becoming an increasingly powerful clinical tool [1].

The simplest and least costly way to obtain fundus images in the office requires using a smartphone and an indirect ophthalmoscopy lens in patients with dilated pupils. As a potentially affordable instrument that is easier to use than other conventional methods, it is an excellent advantage for clinical practice and has a screen that allows it to be used as a teaching aid for students and explanation to patients during the consultation [2].

We present a technique for fundus imaging using smartphones. It's aimed at medical students, ophthalmology residents, and ophthalmologists.

Methods

Tools

1) Drops ophthalmic: Tropicamide + phenylephrine for pupillary dilation.

2) Smartphone (Google's Android or Apple iOS).

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Figure 1: (A-E) Examiners perform a video fundoscopy with different smartphone brands (iPhone and android), in a room with penumbra and without penumbra, with an indirect ophthalmoscopy lens of 20 diopters and Pan retinal 2.2, respectively.

3) Indirect ophthalmoscopy lens: 20 D, 28 D, 2.2 mm Pan retinal.

4) A dim light room[3-5].

Technique

Photography and videography techniques are simple but may require a few attempts to master. The step-by-step procedure for obtaining the images is described as follows:

1. The patient should be seated and reclined while the examiner stands. **(Figure 1 A and B)**.

2. Set the smartphone to video mode, flash on, and maximum screen brightness.

3. Hold the indirect ophthalmoscopy lens about 5 cm (2 inches) from the patient's cornea. Maintain the lens position with the 4th and 5th fingers of your non-dominant hand. You may need to use the 3rd or 4th finger to magnify the patient's eyelid. An assistant can lift the upper eyelid with a swab while the procedure is being performed [6-8].

4. Hold the smartphone about 35 to 40 cm from the indirect ophthalmoscopy lens (Remember to align the phone's light source with the lens and posterior pole) **(Figure 1 C-E)**.

5. Adjust the video zoom 2x, 2.5x or 3x, depending on the type of smartphone after having the image located for higher quality.

6. To take pictures, a screenshot of the video should be taken **(Figure 2)**.

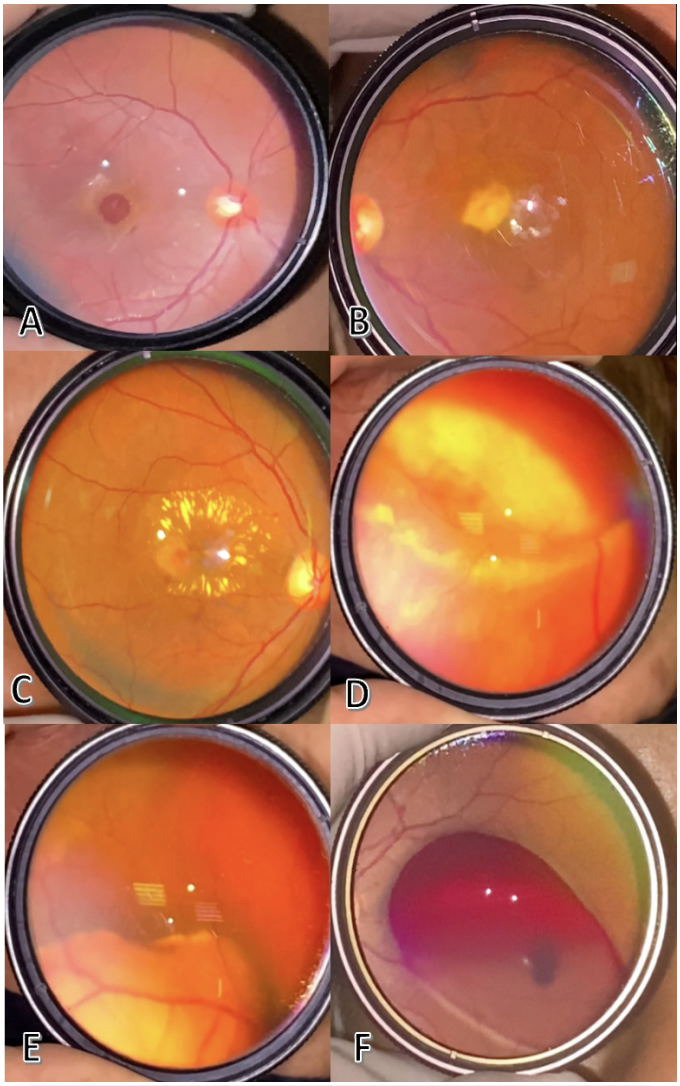

Figure 2: Fundus images taken by smartphone representing different retinal pathologies: **(A)** Traumatic Macular Hole, **(B)** Choroidal Metastasis in left eye, **(C)** Choroidal Metastasis in right eye, **(D and E)** Choroidal Melanoma after Brachytherapy, **(F)** Subhyaloid hemorrhage.

Settings

WHAT PARAMETERS DOES IT HAVE?

Tips or Suggestions: We provide a tutorial on the technique of fundus photography and videography using a smartphone for ophthalmologists, ophthalmology residents and medical students who don't have inexperienced in indirect ophthalmoscopy [9-11].

Discussion

A study compared the quality of fundus images taken by a smartphone and by fundus cameras, where no significant difference was found. Additionally, it is stated that image quality improves when experienced examiners take images compared to inexperienced examiners [8,10].

The technique used for fundus photography with smartphones is a safe, simple, and fast technique. However, it can present degrees of difficulty at the beginning. Mastering the technique requires practice. The inexperienced examiner must focus on coordinating the hands performing the video, lens, phone alignment, and the indirect ophthalmoscopy lens [12].

Current smartphone light sources are not harmful to human eyes. This is safe for photography and videography without causing retinal damage. However, it can be uncomfortable for the patient, so a short time of minutes is required to perform the exam [11].

Most smartphones do not adjust the light intensity in video mode, so tapping over the light source or using apps to adjust the light intensity is recommended. This is optional for taking photographs and depends on the taste of each examiner [4,12].

Kim et al. [13] conducted a study where they measured the light intensity of a conventional smartphone, describing that the light levels from a smartphone light source were 150 times below the limit set by the International Organization for Standardization (ISO 15004-2.2) for ocular thermal hazard and 240 times below those limits for photochemical hazard [9]. Although light intensity and energy have not been measured on other smartphone models, it is suggested that they may be well below the hazard limits [11].

These photographs have a limited field of images, and wide-field imaging can be time-consuming.

Informed consent should be obtained from the patient or the minor's guardian if there is an intention to publish the images for academic purposes or social networking.

Conclusion

The smartphone fundus photography technique is simple, affordable, and has a short learning curve, allowing rapid mastery. It can be helpful for the rapid acquisition of fundus images in a practical way, which can be attached to the medical record for control and follow-up of various pathologies. They can also be used for academic and scientific use.

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References

1. Toy BC, Myung DJ, He L, Pan CK, Chang RT, et al. Smartphone-Based Dilated Fundus Photography And Near Visual Acuity Testing As Inexpensive Screening Tools To Detect Referral Warranted Diabetic Eye Disease. Retina Phila Pa. 2016; 36: 1000-1008.
2. Toslak D, Ayata A, Liu C, Erol M, Yao X. Wide-Field Smartphone Fundus Video Camera Based On Miniaturized Indirect Ophthalmoscopy. Retina Phila Pa. 2018; 38.
3. Ademola-Popoola D, Olatunji V. Retinal imaging with smartphone. Niger J Clin Pract. 2017; 20.
4. Darma S, Zantvoord F, Verbraak F. The quality and usability of smartphone and hand-held fundus photography, compared to standard fundus photography. Acta Ophthalmol (Copenh). 2015; 93.
5. Adam M, Brady C, Flowers A, Juhn A, Hsu J, et al. Quality and Diagnostic Utility of Mydriatic Smartphone Photography: The Smartphone Ophthalmoscopy Reliability Trial. Ophthalmic Surg Lasers Imaging Retina. 2015; 46.
6. Collon C, Chang D, Tabin G, Hong K, Myung D, et al. Utility and Feasibility of Teleophthalmology Using a Smartphone-Based Ophthalmic Camera in Screening Camps in Nepal. Asia-Pac J Ophthalmol Phila Pa. 2020; 9.
7. Hong S, Wynn-Williams G, Wilson G. Safety of iPhone retinal photography. J Med Eng Technol. 2017; 41.
8. Iqbal U. Smartphone fundus photography: a narrative review. Int J Retina Vitr. 2021; 7.
9. International Standard ISO, 15004-2.2, Ophthalmic Instruments, Light Hazard Protection, International Standards Organization (ISO), Geneva, Switzerland. ISO. 2007.
10. Wintergerst M, Jansen L, Holz F, Finger R. A Novel Device for Smartphone-Based Fundus Imaging and Documentation in Clinical Practice: Comparative Image Analysis Study. JMIR MHealth UHealth. 2020; 8.
11. Rodenbeck S, Mackay D. Examining the ocular fundus in neurology. Curr Opin Neurol. 2019; 32.
12. Wu A, Fouzdar-Jain S, Suh D. Comparison Study of Funduscopic Examination Using a Smartphone-Based Digital Ophthalmoscope and the Direct Ophthalmoscope. J Pediatr Ophthalmol Strabismus. 2018; 55.
13. Kim TN, Myers F, Reber C, Loury PJ, Loumou P, et al. A Smartphone-Based Tool for Rapid, Portable, and Automated Wide-Field Retinal Imaging. Transl Vis Sci Technol. 2018; 7: 21.