



Pathology/Biology Section - 2013

G83 Smartphone Image Acquisition During Postmortem Monocular Indirect Ophthalmoscopy

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After attending this presentation, attendees will learn how to use a smartphone to capture still and video images of projected aerial images produced during postmortem indirect ophthalmoscopy.

This presentation will impact the forensic science community by providing an overview of smartphone still and video image acquisition during postmortem monocular indirect ophthalmoscopy.

Postmortem Monocular Indirect Ophthalmoscopy (PMIO) permits examination of a decedent's posterior fundus facilitating detection of retinal abnormalities including Retinal Hemorrhages (RHs). The required equipment necessary for PMIO is relatively inexpensive; however, image acquisition of the projected aerial image typically requires a handheld fundal camera, which is prohibitively expensive for most medical examiner's offices. However, most smartphones have the capability of capturing the projected aerial image formed during PMIO. Smartphone image acquisition uses the smartphone's focal light source along with an aspheric convex indirect condensing lens. The light source of most smartphones can serve as the source of illumination if it is co-axial to the optical path of the camera's lens. Securing the smartphone on an adjustable mini-tripod permits the examiner to stabilize the condensing lens with both hands. Current aspheric lenses range from +14 to +40 diopters and come in different diameters permitting a field of view of 35 to 50 degrees. The condensing lens is pulled back slowly to image the fundus. High-quality still and video digital images of the projected aerial image are readily captured using this technique.

Various smartphone camera applications (apps) include tap screen focusing, zoom, voice or sound activated shutter release, and video recording, which facilitate high-resolution image acquisition. With the smartphone set on "camera" and the light source set to "on" for constant illumination, position the slider so the camera icon is activated. Position the condensing lens in front of the decedent's cornea making sure the lens, decedent's posterior retina, and camera are parallel. Slowly pull the lens toward the camera lens and light source to image the fundus. Since the projected aerial image is located near the focal point of the lens, it is necessary to tap-focus on areas of the thumb or index finger to bring the projected aerial image into clear focus. The camera's shutter is activated either by touching a screen icon or by a voice or sound shutter-release app.

To zoom in on an aspect of the image (up to 5x), pinch and drag to activate the zoom feature (put thumb and index finger together on the screen and drag them apart toward opposite ends of the screen). This will zoom in on the projected aerial image and reveal a slide bar at the edge of the image with a minus (-) on one end and a plus (+) on the other end. Zoom in or out for optimal composition by using the slide bar or pinch and drag.

Most smartphone cameras can also record video at up to 1080p HD. To change from taking still images to video, move the slider so that the button is under the movie camera icon and the camera will switch to video mode. To begin recording video, tap the button with the red circle in it. When recording, the red button will blink and a timer will appear onscreen. To stop recording, tap the button again.

Once recording of the projected aerial image is complete, the still images can be saved or the video images can be captured and edited from the video sequence. Various application programs enable users to upload still images or video sequences from the smartphone camera that is connected directly to a computer or network. Video editing software permits editing of images and video clips for documentation of the fundal findings. Still and video image acquisition using a smartphone during PMIO will be demonstrated. This technique has the potential to facilitate more widespread use of PMIO for fundus examination by forensic pathologists. Clinical application of the technique may permit telemedicine consultation, especially in poor resource settings.

Smartphone, Fundoscopy, Retinal Hemorrhages