

## Smartphone photomicrography: A quick, easy, useful technique for the clinician

Dear Sir,

We would like to bring into the attention of clinicians that a technique that we found very quick and useful in obtaining photomicrographs.

Photomicrography—a photographic capture of an image seen through a microscope—is important for documentation, consultation, teaching, and publication.<sup>[1]</sup> The best images are obtained using specialized, dedicated digital cameras mounted on microscopes where images obtained are retrieved and processed using proprietary computer software. These systems are very expensive and are often not available in resource-limited settings such as in Nigeria. From our experience, Universal Serial Bus (USB) microscope cameras produce poor images while microscope adapters for DSLR (Digital Single Lens Reflex) cameras are difficult to use.

Smartphones<sup>[2]</sup>—Internet-connected mobile phones with e-mail, Internet browsers, social media applications and others—are now widely available in Nigeria. Smartphones with rear cameras of 8 megapixels (MP) or above are quite capable of taking clear pictures, which can be stored in the phone, transferred to a computer or the Internet cloud (e.g., Dropbox, Google Drive, Skydrive) or shared with contacts through e-mail, Whatsapp, or other messaging application.

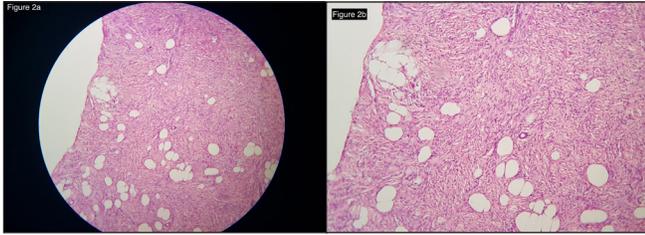
Use of a phone camera to capture microscope images is a fairly recent development. Bellina and Missoni<sup>[3]</sup> in 2009 described how they took microscope pictures of a blood film with a 0.8-MP mobile phone camera. Use of adapters to attach smartphones to microscopes has been impeded by availability, cost, and ease of use.<sup>[4]</sup> Photomicrography using hand-held smartphone cameras is, subsequently, now increasingly recognized.<sup>[5]</sup> From our experience, it requires a smartphone with a good (at least 8 MP) rear camera, a good binocular microscope, good ambient light, and steady hands. The technique can be mastered in 5 minutes. We believe that wide adoption of this simple technique has the potential to invigorate photomicrography in developing countries.

To take photomicrographs with a smartphone, use the following steps:

1. Focus area of interest on the slide using the  $\times 4$  objective of the microscope. Leave your camera setting on the phone to automatic. The camera software will adjust on its own until the best image appears on the phone screen.
2. Hold the mobile phone so that the left index finger holds the left upper corner of the phone and the left thumb holds the left lower corner. The left middle, ring, and little fingers rest on the back of the phone. The right index finger should hold the right upper corner of the phone, while the right middle, ring, and little fingers rest behind the right backside of the phone leaving the right thumb free.
3. Move the phone slowly toward the microscope, carefully positioning your camera lens over the left ocular of the microscope until you can see the circular light coming from the microscope and a sharp image appears.
4. Wrap the free left middle and ring fingers around the left ocular of the microscope to stabilize your left hand.
5. Use your free right thumb to click on the on-screen shutter to take a picture. Modern fast phones allow rapid taking of pictures with multiple clicks [Figure 1].
6. If the image disappears, gently move the phone away and slowly move it back a little at a time to reposition the camera over the left ocular again.
7. You may pause to check the quality of pictures taken before proceeding to take more pictures of same magnification or move on to next magnification or adjust slide to show area of interest.
8. Examine captured images in the phone gallery application where pictures can be resized (cropped) and sharpened and areas of interest zoomed and screen shots taken. Photos can also be transferred to a desktop, laptop, or tablet computer where similar processing can be done on a larger screen. See [Figure 2a and b] for sample photos.



**Figure 1:** Technique of photomicrography using a hand-held smartphone



**Figure 2:** (a) Photomicrograph of dermatofibrosarcoma protuberans taken using a Samsung Galaxy Note 4 smartphone camera—before cropping (Hand E  $\times 100$ ). (b) Photomicrograph of dermatofibrosarcoma protuberans—after cropping (Hand E  $\times 100$ )

One minor drawback of smartphone photomicrography is “vignetting” where the periphery of the circular image is slightly blurred<sup>[5]</sup>; this can be corrected by zooming the image before capture or cropping out the blurred periphery.

### Financial support and sponsorship

Nil

### Conflicts of interest

There are no conflicts of interest

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DOI: 10.4103/1119-3077.198312

**How to cite this article:** Yahya H, Ayuba GI. Smartphone photomicrography: A quick, easy, useful technique for the clinician. *Niger J Clin Pract* 2017;20:264-5.