

## Development of a Simple Smartphone Adapter for Digital Photomicrography

In 2008, Bellina and Missoni described a free-hand method to capture images from microscope using a smartphone.<sup>[1]</sup> In 2013, Morrison and Gardner described a similar conceptually simple free-hand method to stabilize smartphones while focusing on the image.<sup>[2]</sup> Most difficult aspect of free-hand digital photomicrography is the stabilization of smartphones.<sup>[3]</sup> Smartphone adapters for digital photomicrography are available to overcome this difficulty.<sup>[4]</sup> However, these adapters are costly and not available in many countries. In 2016, Singaravel and Aleem described a simple low-cost adapter for photomicrography.<sup>[5]</sup> However, the adapter had some limitations. Hence, we intended to develop a widely acceptable, technically sound, low-cost, and easy to make simple smartphone adapter for digital photomicrography (sSADP).

### Methods of making the adapter

Empty soft drink aluminum can was held on the left hand and a small hole was made with the help of a hacksaw blade [Figure 1]. One

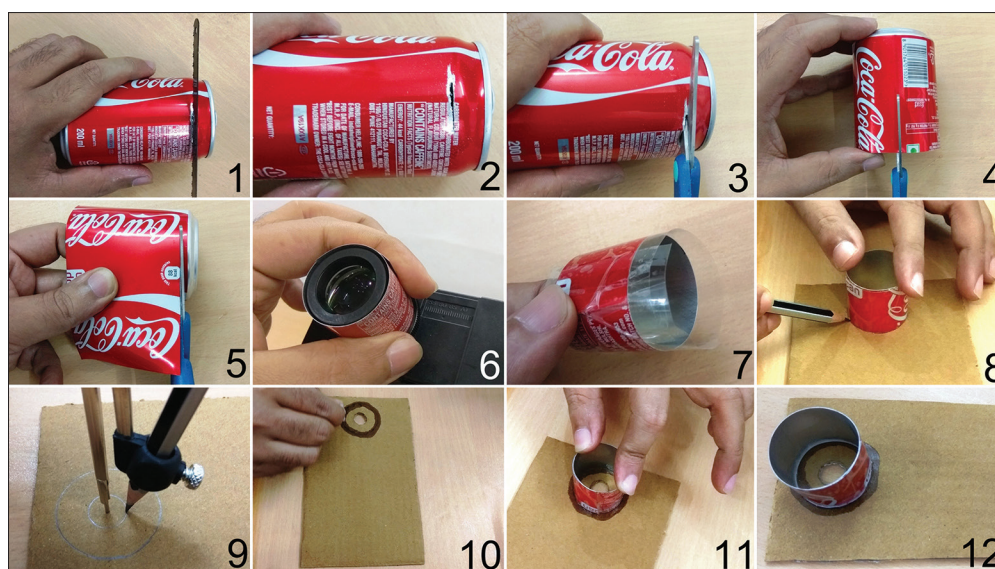
blade of scissors was introduced into the can and it was cut circumferentially, vertically, and circumferentially again to obtain a rectangular sheet of aluminum. The breadth of the aluminum was cut according to the height of the eyepiece. Then, the aluminum sheet was placed around the eye piece of the microscope and an adhesive tape was applied to fix the rolled sheet. Thus, a cylinder was made. After that, a piece of cardboard was taken from scrap packaging material. The cylinder was kept on the cardboard and a circle was marked surrounding the cylinder on the cardboard with a pencil. A compass was used to mark the center of the circle. A smaller circle was drawn according to the circular shape of the camera glass of the smartphone and was cut off. Then, the aluminum cylinder was attached to the drawn circle on the cardboard with an instant adhesive.

### Procedure of photomicrography

The smartphone was placed on the cardboard, opposite to the side of the attached cylinder.

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**Figure 1: Serial photographs of procedure of making the sSADP. \*Coca-cola® is the registered trademark of the Coca-Cola Company. We do not promote the company in any form**

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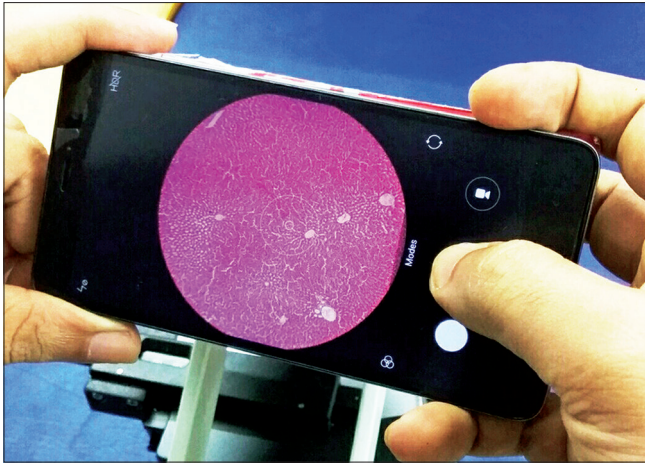
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**Figure 2:** Recommended position of fingers for photomicrography aided with sSADP for a right-handed person

The position of the smartphone camera lens was confirmed on the center of the small hole by looking through the cylinder. Left index finger and left thumb were used to stabilize the phone with the cardboard on the left side [Figure 2]. Right index finger and right small finger were used to stabilize the phone with cardboard on the right side. Right thumb was used to click the capture button on smartphone screen. Keeping the sSADP and smartphone together, the cylinder of the sSADP was advanced on the microscope eyepiece to the farthest lower position. A small illuminated area appeared on the smartphone screen. Then, the sSADP and phone was slowly moved upward to get a clear image on the screen and the image was captured. These images had a black background surrounding the circular field, as shown in the left column images in Figure 3. With the same settings, the camera was set at  $2.5 \times$  digital zoom and the same procedure was followed, and the captured images are shown on the right column of images in Figure 3.

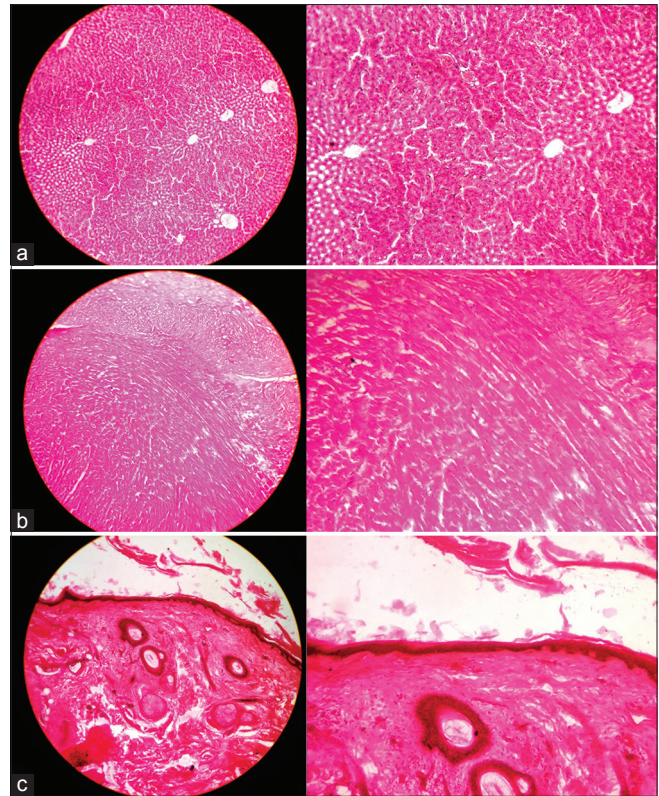
Developed with virtually zero cost this easy to make sSADP can be used in settings where advanced microscope with image capture facility is not available.

### **Financial support and sponsorship**

Nil.

### **Conflicts of interest**

There are no conflicts of interest.



**Figure 3:** Images captured from the microscope by 16 MP smartphone camera (Flash-Off, ISO-Automatic, White balance-Automatic). Right column images were taken with  $2.5 \times$  digital zoom. (a) Liver tissue; (b) Cardiac muscle; (c) Longitudinal section of skin (Images were transferred from mobile to personal computer and cropped from 16:9 to 4:3 ratio without any edit or enhancement)

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