

A simple method to colour balance mobile phone photographs to improve remote assessment of burn depth

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INTRODUCTION

The utility of digital photographs as an adjunct to communicating burn distribution and depth has been revolutionised by the convenience and ubiquity of mobile telephone cameras. However, cameras are often set up by manufacturers to deliver aesthetically pleasing, saturated colour balances suited to consumer photography. In the context of a burn photograph, over- or under-saturation of red can alter the perception of injury depth.

However, mobile devices are also designed to recognise white objects in the image field, and adjust colour balance accordingly. We therefore hypothesise that inclusion of a white cotton swab within the image will force a mobile device to produce true colour balance, and hence improve the colour fidelity of a photographed burn.

METHODOLOGY

- 10 consecutive acute burn injuries were imaged with identical framing.
- An Apple iPhone 6 Plus and a Samsung Galaxy S6 were utilised, with factory software on default settings. Six images were taken on each device. Flash lit and ambient lit images of the burn were obtained with of the burn only, the burn with a white cotton swab, and the burn with a professional white colour swatch.
- Two control images were obtained using a Sony α 7R camera, with a Voigtländer 58mm f1.4 lens mounted on a Metabones adaptor. These images were flash and ambient lit, colour swatch only, and then manually colour balanced to true white in Adobe Photoshop CC.
- An identical area of burn was sampled with the 31x31 pixel eyedropper tool in Adobe Photoshop CC. The red-green-blue (RGB) values were recorded. The G and B channels, being similar for a pink object, were averaged and then the relative R channel saturation ("R value") expressed as ratio of this – 1.00 representing pure white, <1.00 being undersaturated, and >1.00 being oversaturated.
- Mobile device R values were then compared to those of the matching control image.



Above: Control photograph of an acute burn injury, sample area indicated by the yellow box

Below: iPhone 6+ crops of the area shown under different colour balance conditions

- a) No flash, no white object
- b) No flash, white cotton swab
- c) No flash, white swatch
- d) Flash, no white object
- e) Flash, white cotton swab
- Flash, white swatch



RESULTS

Photograph	Mean R saturation value	SD
No flash, no white object	0.95	0.13
No flash, white cotton swab	1.01	0.14
No flash, white swatch	1.03	0.14
Flash, no white object	1.00	0.12
Flash, white cotton swab	1.05	0.13
Flash, white swatch	1.07	0.13

Without flash:

- Red fidelity without flash was significantly more accurate with a white source in the image, whether a swab (p=0.0002) or a swatch (p=0.0001)
- There was no significant difference in colour balance between using a white cotton swab or a white swatch (p=0.06)

With flash:

- The most colour accurate photos in our series were taken with flash, but no white object
- Flash images with white swabs and white swatches were significantly worse (p=0.0003 and p=0.0001 respectively)
- Flash images were characterised by reflection artifacts, uneven exposure and vignetting

CONCLUSIONS

- Consistently colour accurate mobile device photography for documentation of burn injuries can be achieved by simple inclusion of a white cotton swab in the image. The results are comparable to a high end dedicated digital camera
- These swabs are cheap, readily available and sterile
- Assuming a well-lit clinical environment, we recommend the use of ambient lighting without flash

Do not cover this area - Do not cover this area.



