Extended Testing of the First Smartphone Application for Microsurgery Monitoring

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Purpose: Postoperative care of a microsurgical flap requires intensive monitoring. Despite the development of devices for this purpose, clinical judgment remains the gold standard for the detection of vascular compromise. Smartphone colorimetry is a developing method that involves the use of a smartphone application to accurately detect changes in flap color. The purpose of this study is to investigate the ability of a smartphone application to detect vascular insufficiency in the digits of light, medium, and dark skinned individuals.

Methods: SilpaRamanitor, an Android application currently under development[1], was used to assess various degrees of vascular occlusion in 18 individuals. The testing group was chosen to represent light, medium, and dark skin tones according to the Von Luschan chromatic scale. A digit pressure cuff was used to occlude vessels of the left index finger. A light control box was used to standardize pictures across the same smartphone lens and flash. Each person underwent a series of 5 photographs comparing the index and middle fingers, beginning with a control, followed by partial venous, complete venous, partial arterial, and complete arterial occlusion. Images were subsequently analyzed by the application to predict the type and degree of occlusion present. Sensitivity, specificity, and accuracy were calculated by comparing the results from the application to the actual amount of occlusion present. Group errors were compared using multivariable logistic regression including interactions of group by occlusion type, as well as degree of occlusion.

Results: Overall sensitivity, specificity, and accuracy of the application was 83%, 94%, and 86% respectively. For venous and arterial occlusion, sensitivity was 78% and 91% respectively while specificity was 91% and 94% respectively. Accuracy for diagnosing venous or arterial occlusion were 84% and 92% respectively. There was no significant difference in errors made between the three groups of skin tones.

Conclusion: Smartphone colorimetry offers a promising adjunct in the evaluation of surgical flaps by standardizing color and lighting. Despite a limited data set, the application performs with a very low false negative rate. With development, this technology holds potential as a reliable system for postoperative microsurgical monitoring.

1. Kiranantawat K, Sitpahul N, Taeprasartsit P, et al. The First Smartphone Application for Microsurgery Monitoring: SilpaRamanitor. *Plast Reconstr Surg*. 2014;134(1):130-139. doi:10.1097/PRS.0000000000000276.