H108 My Darkest Hour: Bringing a Consumer LED Torch Light Into Forensic Macrophotography Through 3D-Design of a Lamp Mount for a Consumer Point-and-Shoot Camera

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Learning Overview: After attending this presentation, attendees will understand how a mounted Light-Emitting Diode (LED) can result in great forensic macroscopy photos with a point-and-shoot consumer camera.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating how extremely affordable materials (3D-printed lamp mount, LED torchlight) can cause massive quality improvements in forensic macrophotography.

Macrophotography contains an application domain with an extremely limited parameter space circled by sensor size, aperture, exposure time, and International Organization for Standardization (ISO) number. This study pragmatically asks how to proceed to achieve cost-effective equipment for around ten assistant doctors of a medicolegal institute to perform optimal hand-held "action" shots on death scenes or event scenes or during clinical forensic medicine examinations. The benchmark lesion is the single conjunctival pinpoint hemorrhage as encountered after strangulation.

Analysis, Methods, and Materials: High aperture numbers (i.e., small opening) promise great depth-of-field and not only reduce but also diffract light, which lowers image quality, particularly on small sensors. Reduced light is remedied with higher ISO numbers that increase visual noise. Increasing exposure time risks motion blur. Despite optimizing these parameters, image quality remains severely restricted. This study fitted an LED lamp (CREE-XML-T6, ~$2 USD) on a 3D-designed hot-shoe fitted mount with an interlocking joint (3D-printed PLA ~$1.50 USD, screw assembly ~$2.20 USD) on the consumer camera (Canon® G16, modified firmware to read out scene illumination in L=cd/m^2), yielding a total cost of the LED lamp including Mount (LEDMNT) of ~$4.20 USD (not counting batteries). This study compared images in realistic settings photographed: (1) with no extra light; (2) using LEDMNT; and (3) the integrated as well as a hot-shoe mounted Canon® Speedlite 270EXII flashlight.

Results: A first series of 20 photos of skin injuries photographed postmortem at normal autopsy room ceiling light showed that luminance measured on the sensor at a medium range (28cd/m^2–60cd/m^2) dropped to 2cd/m^2–10cd/m^2 for close range macro photos with no extra light source (1). Using the LEDMNT (2) values of 90cd/m^2–500cd/m^2 were achieved while flashlight (3) caused significant shadows in close-range macro photos. The image quality improved drastically after installing the LEDMNT.

Discussion: It is not a new insight that more light can improve photographs. However, this contribution is not theoretic but practical and represents an extremely affordable and practical approach to a very relevant problem.

Virtopsy, Forensic Macro-Photography, 3D Printing