H179 3D Rendering of the Human Body: A Proposal of an Operative Protocol for the Application of Photogrammetry in the Autopsy Room

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Learning Overview: After attending this presentation, attendees will have an overview of the benefits of photogrammetry applied to forensic pathology.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by proposing an operative protocol that allows accurate and simple data acquisition that can be used during postmortem examinations.

Forensic pathology has evolved in the modern era, thanks to new techniques aimed at improving the bodies' evaluations. The external and internal examinations are still critical to gather information, representing the gold standard for the investigation of the cause and manner of death.

The external examination represents the first approach to the body, allowing the forensic pathologist to gather information about the state of the body and the presence of tissue lesions. Unfortunately, due to the decompositional process, if an injury is missed during the external examination, it can be hard to identify even on subsequent re-examination of the body. At the same time, one of the most relevant issues with the autopsy is that it is an invasive, destructive, and non-repeatable analysis, so that the findings often cannot be accurately re-assessed.

To overcome these problems, taking photographs of the body before starting the postmortem examination is a crucial part of the medicolegal death investigation process. Photographs must be accurate and detailed since they are taken mainly for legal purposes and are intended to be shown in court. However, even photographs do not allow for a detailed review of an injury or an organ. Their main limitations stand in the 2D rendering of the human body, which has three dimensions, and in their non-repeatability.

Currently, there is an increased interest in "forensic photogrammetry." Photogrammetry is a tool that allows the making of measurements from photographs. It represents an accurate and low-cost method that can be easily implemented in the routine medicolegal death examination.

This study proposes a step-by-step protocol based on a 3D acquisition of the body and applying photogrammetry during the external examination. This technique makes it possible to obtain a 3D graphic reconstruction of the body based on single photographs. Photos must be taken following specific criteria to allow an accurate and reliable photogrammetric rendering. The 3D information is obtained through the acquisition of several partially overlapping photos. After that, a dedicated software recognizes points and areas with similar features and builds a 3D mesh of the body. Although any camera can be used to take photographs of the body (e.g., smart phone), the use of a good-quality camera is highly recommended to obtain the best results. At the end of the image processing, the software will display a 3D rendering of the body, showing the morphology, the texture, and allowing for measurement. The body will be shown as it is observed during the external examination, overcoming potential issues with bad quality single photos or missed lesions. Moreover, it is possible to use photogrammetry to obtain 3D documentation of internal organs or any other element of forensic interest that may be encountered during the postmortem examination.

The advantages of photogrammetry lie in its low cost, simple application, and accurate results. The 3D rendering admits the body rotation on a 360° axis, allowing for a better interpretation and presentation of the features of forensic interest, which can be helpful in court. This is particularly relevant in cases of homicides: in such situations, displaying the 3D images of the deceased to the court will make it easy to show the location and the features of any lesions, allowing a straightforward demonstration of the condition of the body before the autopsy. The main limitation of this technique is that it is time-consuming. A full photographic report requires taking pictures of the anterior and posterior aspect of the body, with an estimated time ranging from 20 to 40 minutes. Moreover, a good source of illumination is needed, and a clean background is preferable to avoid software misinterpretations.

It is believed that photogrammetry is a reliable and useful tool in forensic practice. The application of this protocol allows a simple and accurate 3D documentation of the body during the different phases of the autopsy.

Photogrammetry, Autopsy, Protocol

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