

TECHNOLOGICAL ADVANCES IN FORENSIC EVALUATION OF TRAUMATIC INJURIES: 3D/CAD PHOTOGRAMMETRY MERGED WITH 3D RADIOLOGICAL SCANNING

L. Tertisnii

Department of Radiology and Medical Imaging, Nicolae Testemitanu State University of Medicine and Pharmacy, Chisinau, Republic of Moldova

E-mail: nircaliuda@mail.ru

3-D/CAD photogrammetry: Photogrammetry is the process of making measurements and acquiring dense 3D geometric information from photographs or stereoscopic image overlaps, especially for recovering the exact positions of surface points. Three-dimensional/computer aided design (3D/CAD) photogrammetry has been shown to have extensive applications in a variety of fields, including for documentation of forensics-relevant traumatic injuries. Forensic, 3-D/CAD-supported photogrammetry creates morphologic data models of the injury and of the suspected injury-causing instrument allowing the evaluation of a match between the injury and the instrument [1, 2]. This enables comparing the virtual 3D model of the injury against the virtual 3D model of the possible injury-causing instrument. In subjects with traumatic injuries of the skin and bones, 3-D/CAD photogrammetry can help determine the shape and size of the injury as well as a true-to-scale correlation of the wound and inflicting tool.

3D radiological scanning: In addition to the 3D photogrammetric body surface registration, the radiological documentation provided by a volume scan, such as spiral multi-detector computed tomography (CT) or magnetic resonance imaging (MRI) scanning, allows the registration of the sub-surface injuries, which are not visible on photogrammetry [1]. The combined method of merging 3D photogrammetry and 3D radiological acquisitions creates the potential to perform many kinds of reconstructions and postprocessing of a variety of injuries for forensic analysis, which is particularly important in trauma patients. Recently developed programs aim at combining 3D colored photogrammetric surface and 3D gray-scale radiological internal imaging, representing a new step towards a new kind of reality-based, high-tech wound documentation and visualization in forensic medicine. Furthermore, the combination of 3D/CAD photogrammetry and 3D radiological acquisitions has the advantage of being observer-independent, non-subjective, non-invasive, digitally storable over years or decades and even transferable over the web for second opinion [1].

Other potential applications: Photogrammetric method has already been reported useful for surface topography determination before beginning radiation therapy, for three-dimensional evaluation of spinal correction in scoliosis, soft tissue profile and dental arches measurements in a variety of cranio-maxillofacial interventions, etc. In the Republic Moldova, a variety of 3D reconstruction techniques are currently being utilized for radiological evaluation of trauma patients. Given the pace of technological advancements during the last years, adding the 3-D/CAD photogrammetry to the utilized 3D radiological scanning remains a perspective for the near future.

- [1] Thali MJ, Braun M, Wirth J, Vock P, Dirnhofer R. 3D surface and body documentation in forensic medicine: 3-D/CAD Photogrammetry merged with 3D radiological scanning. *J Forensic Sci.* 2003;48(6):1356-1365.
- [2] Thali MJ1, Braun M, Brueschweiler W, Dirnhofer R. 'Morphological imprint': determination of the injury-causing weapon from the wound morphology using forensic 3D/CAD-supported photogrammetry. *Forensic Sci Int.* 2003;132(3):177-81.