

FORENSIC 3D/CAD SUPPORTED PHOTOGRAMMETRY (FPHG): BITE MARK EVALUATION AND RADIOLOGICAL SCANNING (RS) AS A COMPLEMENTARY TECHNOLOGY TO FPHG

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ABSTRACT: Forensic 3D/CAD supported Photogrammetry (FPHG) is a method of recording and documenting the surface of small objects, thus enabling a 3-dimensional image of these objects in virtual space. With this representation on the computer screen the course of forensically relevant events can be reconstructed. The procedure allows for examining patterned injuries of skin, soft tissue or bones for matching potentially incriminated instruments in shape, size and angle

KEY WORDS: Photogrammetry; Patterned injuries; Suspect instruments.

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Traditional photogrammetry is routinely used by the traffic police to generate accurate accident reports. It is also widely used in crime scene photography. In these cases the objects are normally as big as vehicles and bodies.

In tests, as well as in real life cases, we have shown that even very small objects can be evaluated with great accuracy using FPHG. The method has been successfully used to analyse and compare patterned skin injuries caused by objects such as a hammer, a tire, a shosole and even a set of teeth. The shape of a bite wound found on a victim's backside, showed clearly that the marks were the result of the dynamics of the bite and the reactions of the victim. The shape of the wound was compared with the model of the teeth of a suspect. A nearly perfect match could be found. The initial impressions of the teeth into the skin clearly showed distinctive marks. The reason for these distinctive marks is, that the dynamical interaction had not yet started in the very moment the teeth had had the first contact with the skin and therefore the interaction had not yet influenced the shape of the wound. The case shows that the examination of the initial impression left in the skin by the first contact with the teeth is absolutely necessary to make an accurate comparison. In the stage of the project development we had a close

co-operation with the Institute of Legal Medicine of the University of Berne. We resumed this close teamwork recently for the further development of the procedure; this with the help of specialists in Micro-RS-methods. FPHG and RS are at least in one sense very similar: They are methods of documentation. Therefore they complement each other very well. FPHG covers the surface of an object, RS the volume. With the help of this Complementary Technology we had success in evaluating a stab wound in a murder case. The victim was stabbed into the buttock. This was not a deadly injury; but the question was whether the causing weapon was a stiletto or a kitchen knife? The piece of bone with the stab injury was photogrammetrically and radiologically evaluated. With the help of comparing tests we could show, if one of the two knives caused the injury, it could only have been the stiletto. In the future – we have a vision: The “scalpel free” or virtual autopsy.

Traditional photogrammetry [3] is routinely used by the traffic police to generate accurate accident reports. It is also widely used in crime scene photography. In these cases the objects are normally as big as vehicles and bodies.

In tests, as well as in real life cases, we have shown that even very small objects can be evaluated with great accuracy using FPHG [1, 2]. The method has been successfully used to analyse and compare patterned skin injuries caused by objects such as a wrench (Figure 1), a hammer, a tire, a shoesole and even a set of teeth.

The shape of a bite wound found on a victims backside (Figure 2), showed clearly that the marks were the result of the dynamics of the bite and the reactions of the victim. The shape of the wound was compared with the model of the teeth of a suspect. A perfect match could be found. The initial impres-

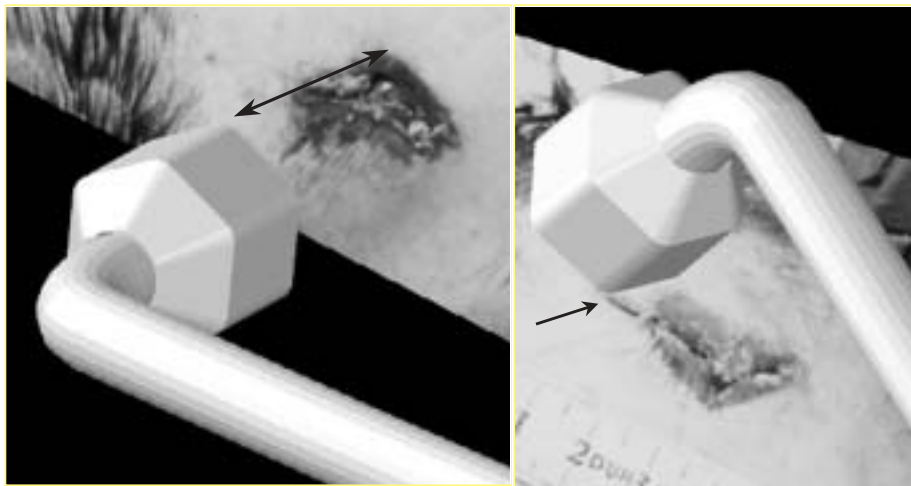
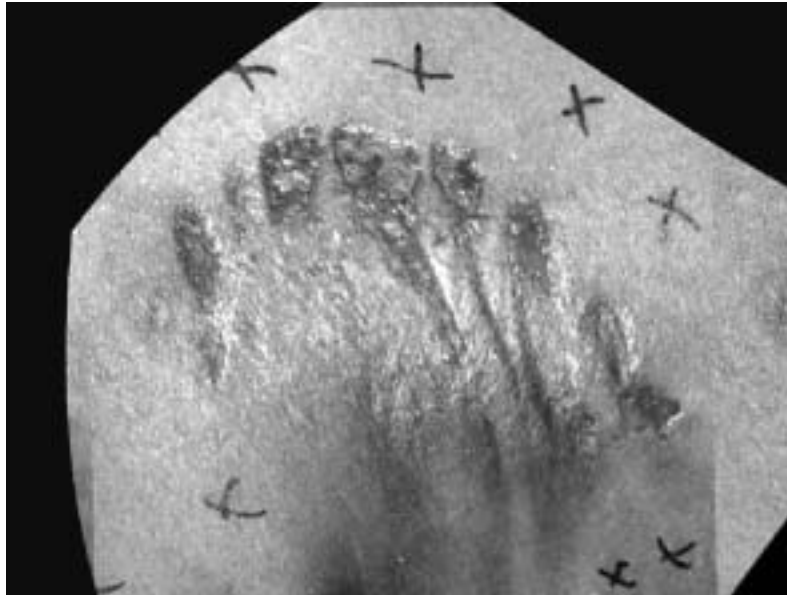


Fig. 1. The foto with the two slash wounds and the two heads of the wrench for wheel nuts.



Nr. 2: The bite wound (without the teeth).

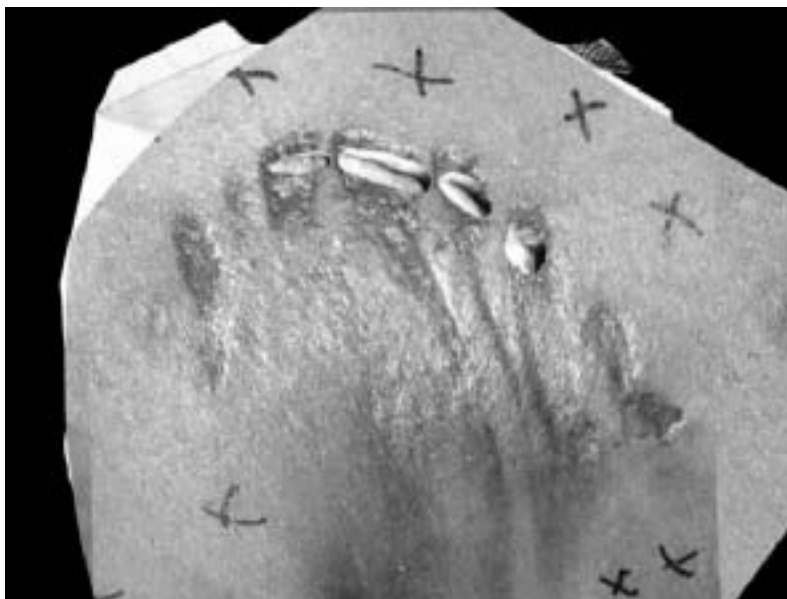


Fig. 3. The bite wound with the teeth penetrating from the background.

sions of the teeth into the skin clearly showed distinctive marks (Figure 3). The reason for these distinctive marks is, that the dynamical interaction has not yet started in the very moment the teeth have the first contact with the

skin and therefore the interaction has not yet influenced the shape of the wound.

The case shows that the examination of the initial impression left in the skin by the first contact with the teeth is absolutely necessary to make an accurate comparison.

In the stage of the project development we had a close cooperation with the Institute of Legal Medicine of the University of Berne. We resumed this close teamwork recently for the further development of the procedure. FPHG and radiological scanning [4] are at least in one sense very similar: They are methods of documentation. Therefore they complement each other very well. FPHG covers the surface of an object; RS – in our cases Micro-Computer Tomography (Micro-CT) – covers the depth or the volume of the object.

With the help of this Complementary Technology we had success in evaluating a stab wound in a murder case. The victim was stabbed into the buttock. This was not a deadly injury; but the question was whether the causing weapon was a stiletto or a kitchen knife? The piece of bone with the stab injury was photogrammetrically and radiologically evaluated (Figure 4). With the help of comparing tests we could show, if one of the two knives caused

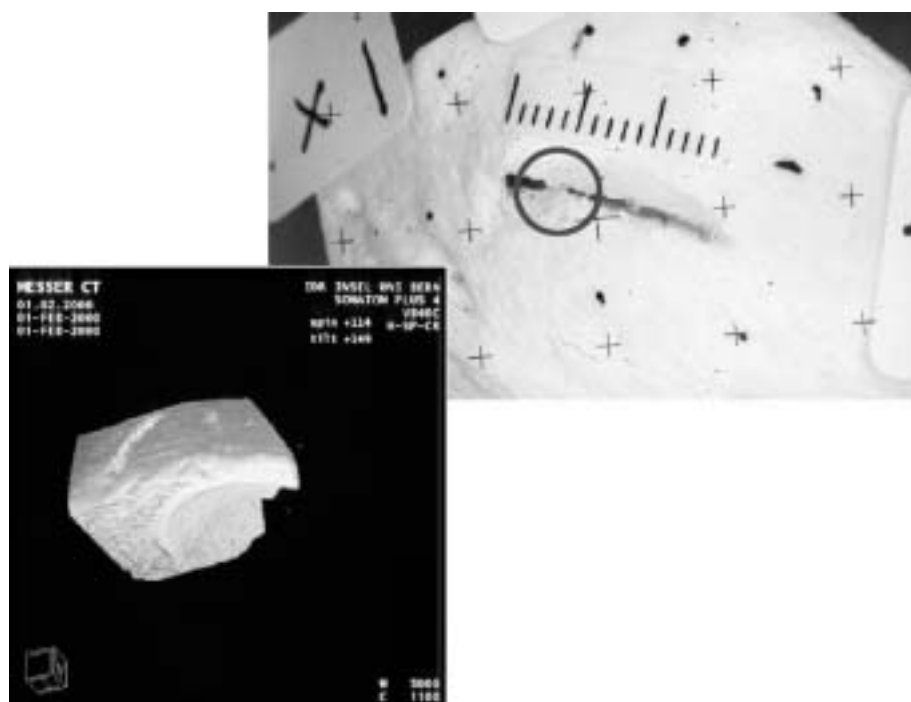


Fig. 4. Two fotos of a piece of bone. The upper right foto: FPHG evaluated; the lower left foto Micro-CT evaluated.

the injury, it can only be the stiletto (Figure 5). In the future – we have a vision: The “scalpel free” or virtual autopsy.

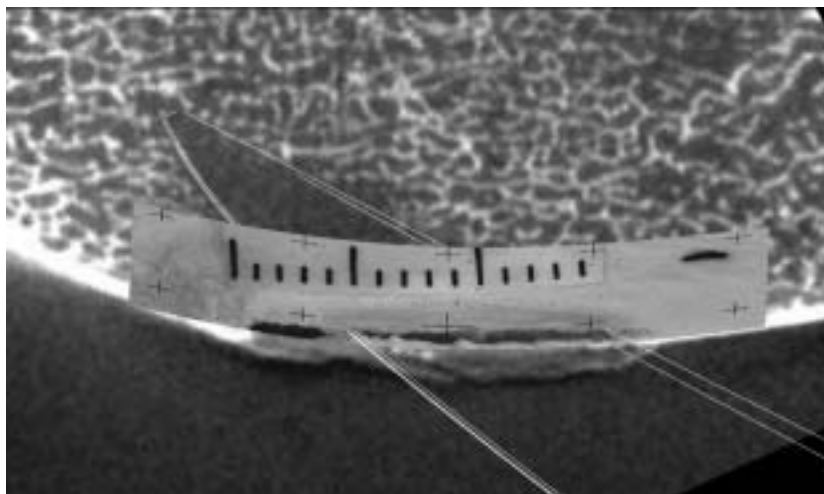


Fig. 5. Four fotos of the injury, each shown with the tip of an intruding instrument

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