

Fingerprint recovery from human skin surfaces[☆]

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Abstract

A study was conducted to investigate whether certain dactyloscopic powders and reagents can recover latent fingerprints on human skin surfaces. Four fingerprint powders, Magnetic Jet Black, Magnetic Silver, Silver Special, Swedish Black, and two other methods, cyanoacrylate fuming (CA) and Ruthenium tetroxide (RTX), were used. Having examined skin surfaces with a forensic light source, we observed that the fingerprint impressions remained visible up to 15 min after intentionally placing them on the skin surface of living subjects and dead bodies. Finger marks were recovered and positive results were achieved with Magnetic Black and Swedish Black powder on living subjects. On dead bodies finger marks treated with cyanoacrylate were visible but those treated with RTX, Swedish Black and Magnetic Jet Black powder were useful for potential comparison. On dead bodies best results were obtained with RTX method.

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1. Introduction

According to expert forensic literature, human skin is considered to be one of the least convenient surfaces for recovering ridge skin impressions [1]. It is evident that some eliminating components are present in both friction ridge prints and on the skin surface of a body. To date, no similar research has been undertaken by Slovenian forensic experts, however forensic literature reports several detection procedures for recovery of fingerprints from human skin. Sampson et al. [2] successfully carried out processing techniques for recovery of latent fingerprint evidence from human skin, whereas Delmas [3] presented the use of luminous magnetic powder coupled with cyanoacrylate fumes and laser post-mortem examinations. He examined intentionally deposited fingerprints on the skin of five victims with the time interval between death and deposition of prints ranging from 35 min to 36 h whilst the time interval

between placing the latent prints and examination ranged from 1 to 5 h. He obtained positive results in four cases.

Fingerprint detection is conducted in a given sequence [4]. Following visual examination, the examiner uses various sources of light, e.g. flashlight, UV-light and forensic light source (FLS). Direct lifting methods are then used such as lifting paper or tape. Cyanoacrylate (CA) fuming followed by magna powder is also used and these are considered to be the most successful method for detecting fingerprints on human skin [5]. When using the CA fuming method, humidity control is very important [6] as excessive humidity may cause condensation. Fuming produces best results if victims are examined at room temperature where relative humidity is approximately 66%. In such circumstances, thenoyl europium chelate may be used as a fluorescent dye [7]. Mashiko and Miyamoto [8] achieved positive results of fingermark recovery from human skin by means of the RTX method which Hebrard and Donche [9] used in their study of detection methods on 16 living persons and 23 dead bodies in addition to powdering [10–12], iodine fumes [11,12] and CA fuming [2].

Before recovering finger marks the skin surface has to be examined thoroughly. Prior to applying any technique, details concerning death, transportation and body storage have to be considered. The selection of which technique to use also

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depends on the state of the examined body and whether it is still warm or already cold.

This paper is part of a study on fingerprints deposited on to human skin of both living subjects and dead bodies. It contains findings and results of latent fingerprint recovery from these surfaces. In addition to the dactyloscopic methods for recovering fingerprints on the skin of living subjects and dead bodies, which are already in use such as powders, CA fuming, and RTX the examination focused on the applicability of the Swedish Black powder which has not yet been reported in the relevant forensic literature.

2. Materials and methods

In this study only those methods which Slovenian forensic experts most often apply were used. Nevertheless, the focus was on Swedish powder. Fingerprints were intentionally deposited on the skin surface of 15 living persons and on 5 dead bodies separately.

First, a forensic light source, (i.e. side white light), was used to visually scan for latent fingerprints on the surface of live epidermis prior of fingerprint deposition. No traces were detected on the examination site. Second, the site was labelled with an ordinal number and framed. A measuring tape was also placed beside the site. Fingerprints were deposited on the wrist area of living subjects and on wrist and neck skin surfaces of the dead bodies, i.e. areas thought most likely to exhibit perpetrator–victim fingerprint contact in the course of committing a crime. During deposition of finger marks the contact time was 1 s and 30 s respectively with the pressure of approximately 500 g/in.² for living subjects and approximately 2000 g/in.² for dead bodies. Finger marks were then processed by means of Magnetic, Swedish Black and Silver Special powder within 15 to 45 min of deposition for living subjects and within 15 to 180 min of deposition for dead bodies. On dead bodies, cyanoacrylate esters and RTX were also used. All methods used are further described below and are also listed in Table 1.

All procedures were recorded by a Canon EOS 3 camera fixed on a tripod, using a Fuji superia 400 ASA film, 50 mm macro lens, and by a Canon EOS 10D camera, with resolution 3072 × 2048 dpi, with an 1.8" LCD screen and compact flash II memory unit.

2.1. Fingerprints on skin surface of living subjects

It was anticipated that different participants were likely to produce fingerprints of different quality. Fifteen participants

impressed fingerprints on each other's wrists. The hands of each participant were not washed prior to the deposition of the finger mark. Finger mark depositions were carried out within the forensic laboratory under controlled conditions, (room temperature ranging between 22 °C and 26 °C and relative humidity was roughly 60%).

2.1.1. Visual examination

Visual examination was initially used. The latent prints were examined using white light (Spex Mini-CrimeScope®-400). Latent prints on the skin surface were visible using this method.

2.1.2. Lifting method

Square areas with dimensions 2 cm × 1 cm were marked on the skin. Four different lifters (transparent instant lifter, mipofilm for microtrace, fuji glossy paper and silver plate.) were used for the transfer of untreated finger marks from the skin surface 30 min after deposition of the marks. Each of the lifters was placed on one of the marked areas on the skin surface for at least 10 s. After this time the lifters were removed and processed by applying various dactyloscopic methods. In total, 20 samples of latent fingerprints were recovered using the various lifting methods.

The lifting techniques were also used to recover finger marks which were treated with different powders from both living subjects and cadavers.

2.1.3. Powder/brush

Magnetic Jet Black powder (200/500 g) and Magnetic Silver powder (200/500 g) were used for detection as a physical method. Both powders were applied to the examined area with a magnetic brush. We also used Silver Special powder (100/250 ml) and Swedish Black powder (100/250 ml). These fingerprint powders were applied with a round fingerprint brush.

2.2. Fingerprints on skin surface of dead bodies

Fingerprints were deposited by eight separate volunteers onto five dead bodies. The hands of each volunteer were not washed prior to deposition of the marks. Examinations were conducted within the forensic medicine laboratory. All bodies had been deceased for 20 to 30 h and had been stored for at least 12 h in a cold room at 6 °C. At the time of fingerprint deposition the skin temperature of the bodies was between 6 °C and 7 °C. The air temperature in the laboratory was between 18 °C and 22 °C and the relative humidity level was approximately 60%.

2.2.1. Visual examination

Visual examination was used before any other recovery procedure. For example, if the victim had been dragged or strangled, finger-tip impressions might be apparent on the surface of the skin at the neck and wrist. Such latent prints were detected using a crime scene forensic light source (Mini-CrimeScope®-400) with a UV light at 365 nm and white light.

Table 1
Review of methods used by skin surface type

Methods used	Live skin	Dead skin
Magnetic Jet Black	Yes	Yes
Magnetic Silver	Yes	Yes
Silver Special	Yes	Yes
Swedish Black	Yes	Yes
Cyanoacrylate	No	Yes
RTX Developer	No	Yes

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