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The Development of Latent Fingerprints on Human Skin: The Iodine-Silver Plate Transfer Method

The successful development of latent prints on human skin would be of great use to the law enforcement officer in the investigation of crimes in which the subject has touched the victim. The iodine-silver plate transfer method has shown promising results in the development of such impressions from both live and cadaveric human skin. Numerous police agencies in the United States and Canada are presently experimenting with this process; it is still in the research stage and consequently has not been used in the investigation of an actual case.

This report describes a technique to develop latent fingerprints on human skin that has been used successfully by police agencies in controlled situations. Other agencies may wish to initiate their own program of research in the hope that an actual case will be processed in which the results of this procedure will be accepted as official testimony at subsequent judicial proceedings.

The iodine-silver plate transfer method was first described by Dr. John McMorris in an address to the California Division of the International Association for Identification in May 1936. Iodine vapors retained by the moisture of the latent fingerprint react chemically with silver to form silver iodide, which subsequently darkens when subjected to strong light. This process has proved to be very reliable for developing latent prints on paper, glass, oily and greasy surfaces, and, under favorable conditions, on cloth. Unlike standard fingerprint-lifting techniques, this method allows multiple lifts of a single fingerprint [1].

Materials

The iodine-silver plate transfer system used in this experiment includes a conventional iodine fuming gun and a silver plate. The reagents and equipment were purchased from Sirchie Laboratories, Moorestown, N.J.

The iodine fuming gun consists of two parts: a drying agent (calcium chloride) through which the breath is blown and the iodine crystals, which are vaporized by heat (Fig. 1). This vaporization can be accomplished either by cupping the hand around the portion of the fuming gun containing the iodine or by using an external heat source such as a match or a cigarette lighter. Glass wool is used to hold the calcium chloride and iodine crystals in place. Cotton has proved to be a successful substitute for glass wool.

The second component of the system is a silver plate approximately 2 in. (51 mm) square. Although it is adequate for the most part, a larger silver plate, perhaps about 3 in. (76 mm) square and 0.010 in. (0.25mm) thick, may be easier to work with. A sheet

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense. Received for publication 16 Nov. 1976; accepted for publication 6 Jan. 1977.

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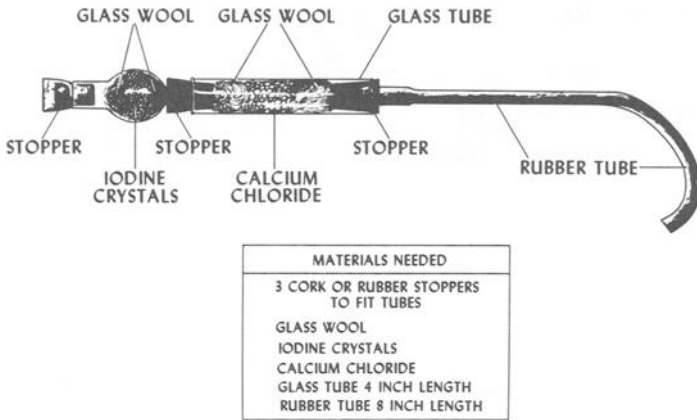


FIG. 1—*Diagram of the iodine fuming gun.*

any thicker is not pliable enough for the various body curvatures, and one that is too thin cannot be accurately controlled. These sheets should be free of scratches but not mirror-polished. Jewelers' whiting is an excellent cleaning agent for the plates.

A strong light is required to develop the prints. Ordinary house lights are too weak, but photoflood lamps or bright sunlight is satisfactory.

Experimental Procedure and Discussion

Photographs (Figs. 2-4) were taken to illustrate the procedure, in which a latent print

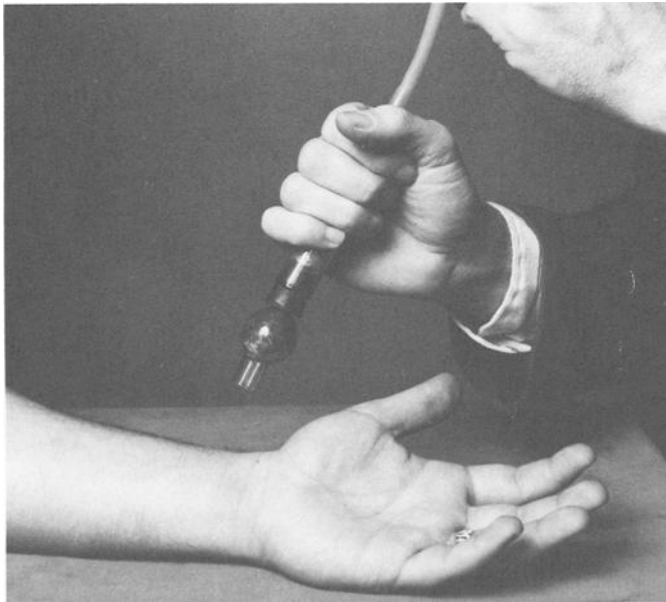


FIG. 2—*Fuming of the wrist area during controlled experiment.*

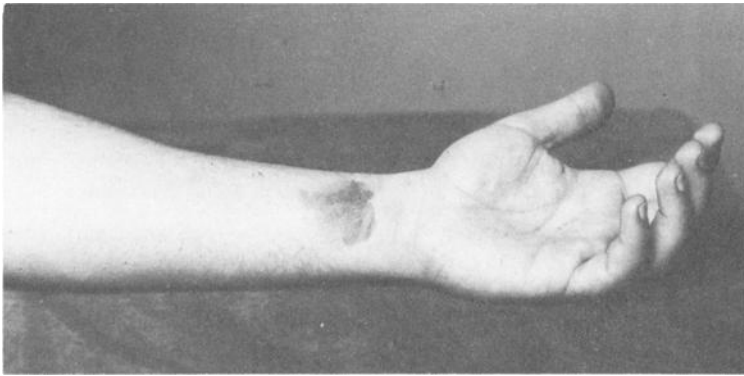


FIG. 3—*Demonstration of discoloration that can be found when print is present.*

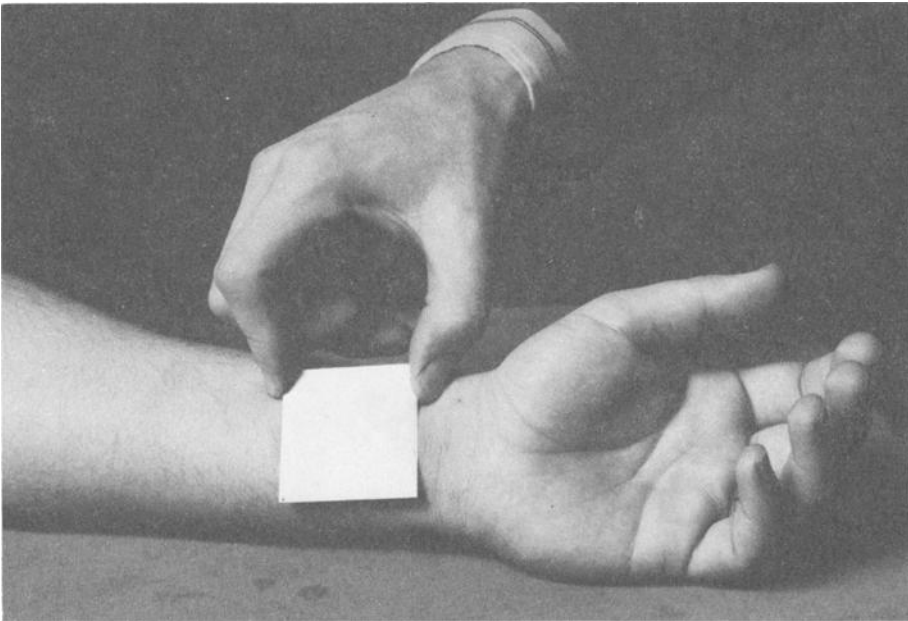


FIG. 4—*Placement of silver plate on wrist area bearing suspected print.*

was developed from the wrist of a live subject. The image was developed as described here, and it is suggested that these steps be followed for best results:

1. From a distance of approximately 1 to 2 in. (25 to 50 mm), fume the area of skin suspected of bearing a latent print (Fig. 2). If a latent print is present, a yellow-to-brown discoloration darker than the surrounding area will appear, indicating that "something" is there and that the silver plate should be used. No ridges will be seen at this point (Fig. 3).

2. Wait about 10 to 20 s and then gently apply the silver plate directly or roll it over the discolored area (Fig. 4). Hold for approximately 2 to 3 s.

3. Remove the plate and expose it to a strong light. When the plate is removed from the skin, the beginnings of an impression may be seen. Whether or not anything is visible, expose the plate to the light for short periods until a suitable impression becomes visible (Fig. 5).

4. Once the desired impression becomes visible, photograph it. If this is not feasible, place the plate in an envelope and make a photograph as soon as possible.

The image on the plate can be photographed several ways. Some agencies use a Polaroid® fingerprint camera and photograph the plate immediately. This is adequate, but "hot" spots sometimes appear in the photograph. In this experiment, photographs of good quality were consistently obtained with both the 4 by 5 Speed Graphic and a 35-mm SLR camera. Orthochromatic film was used with the Speed Graphic camera. Being sensitive to longer wavelengths, it showed more detail by reacting to the redness of the iodine on the plate. Side lighting or natural lighting is suggested for best results with this equipment (Figs. 5 and 6).

Diffuse lighting should be used with an optical system that has sufficient magnification to fill the 35-mm format. When a 35-mm SLR camera was used, best results were obtained with a Macro lens, tungsten film, and photoflood lamps bouncing light off a white surface (Figs. 7 and 8).

Two points must be remembered when the silver plate is being photographed. First, the longer the image on the plate is exposed to light, the darker it becomes. Eventually the image will be too dark to be discernible (Fig. 6). Second, the photonegative must be reversed before photographic prints are made for comparison, because the image on the plate is reversed, as in the use of rubber lifters.

As mentioned previously, unlike the techniques in which fingerprint powders are used, the iodine-silver plate transfer method allows the same latent print to be lifted more than

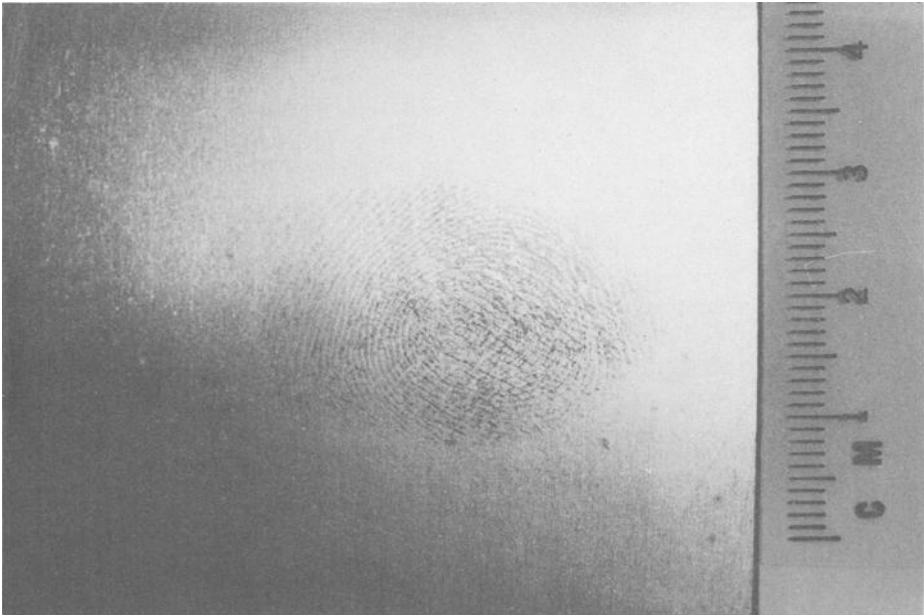


FIG. 5—Fingerprint on silver plate after being removed from wrist area and exposed to light source.

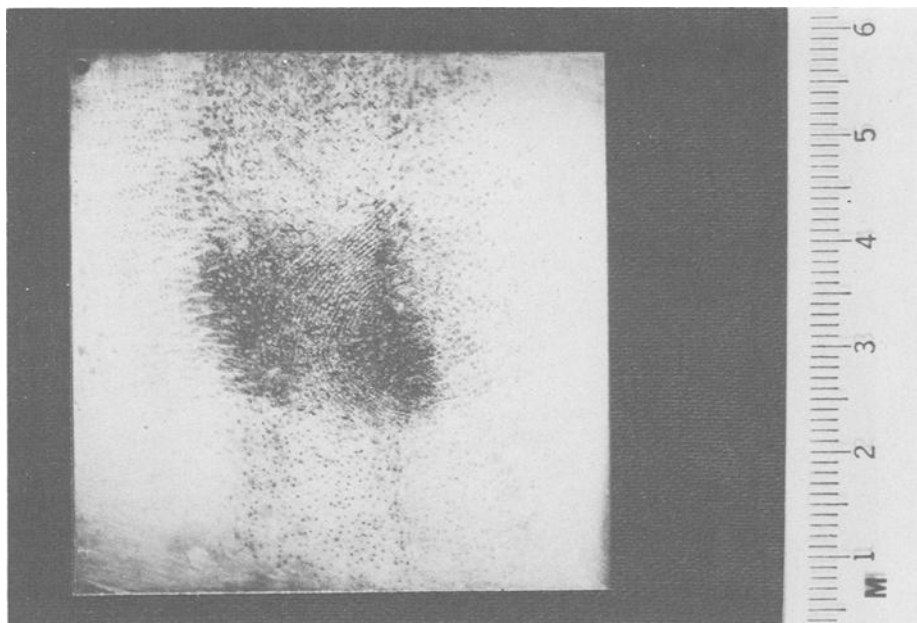


FIG. 6—Fingerprint on silver plate that was overexposed to the light.

once. Initially, as reported by Dr. McMorris, this could be done as many as five times, with the fifth lift being of the same quality as the first. Because of the complexity and variability of human skin it is not possible to state the number of lifts obtainable from a given latent print, but the experiences of this investigator indicate that multiple lifts per print are easily obtainable.

Canadian researchers have reported that on live tissue impressions can be developed for up to 2 h after the print has been placed [2]. Success for up to 1 h has been obtained with the technique reported here. With cadavers, experiments by the Canadian researchers and the FBI have indicated that impressions were developed that were from two to five days old.² The results seem to vary, depending on whether or not the body was previously embalmed. It is unknown at this time whether the embalming process had any bearing on the final results. Experiments by these agencies are continuing. In an experiment conducted by a Maryland police agency to determine whether prints could be developed on a victim of drowning,³ the officers used a cadaver that had not been embalmed. They planted a print on the wrist of the body. The wrist was fumed, and a suitable impression was developed. The cadaver was then placed under refrigeration at 38°F (3°C), with the wrist immersed in a bucket of water. Twenty-four hours later, the area was refumed and another suitable image was developed. With the technique reported herein, experience has shown that by following this same procedure except for submerging the wrist in water a suitable image could be developed after 24 h (Fig. 8).

In dealing with lightly pigmented skin there is no problem in detecting the discolored area for placing the silver plate. In deeply pigmented skin, however, it can be very

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³W. Henniger, Baltimore County Police Department, Towson, Md., personal communication, Oct. 1975.

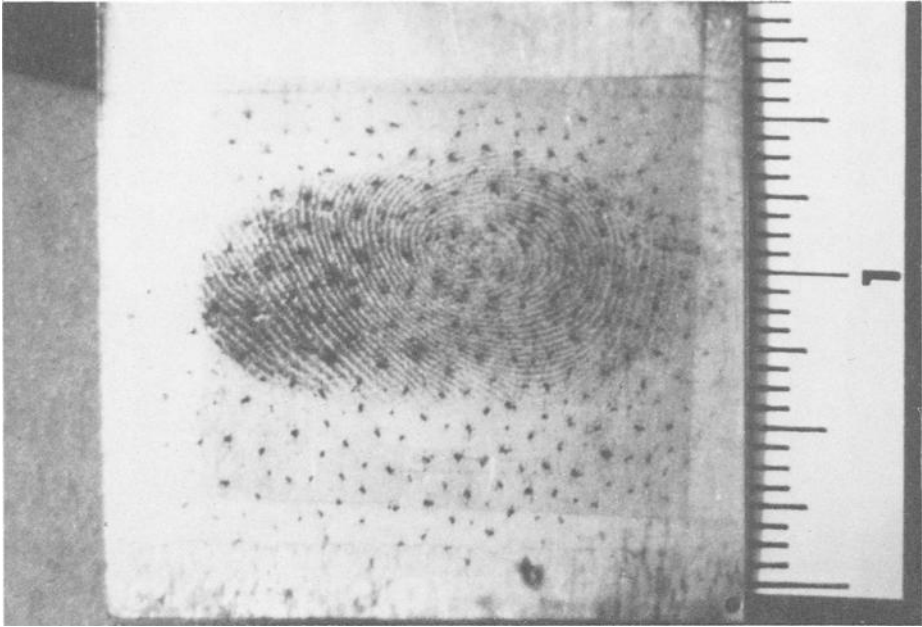


FIG. 7—Fingerprint on silver plate taken with 35-mm camera and bearing hair pores in the image.

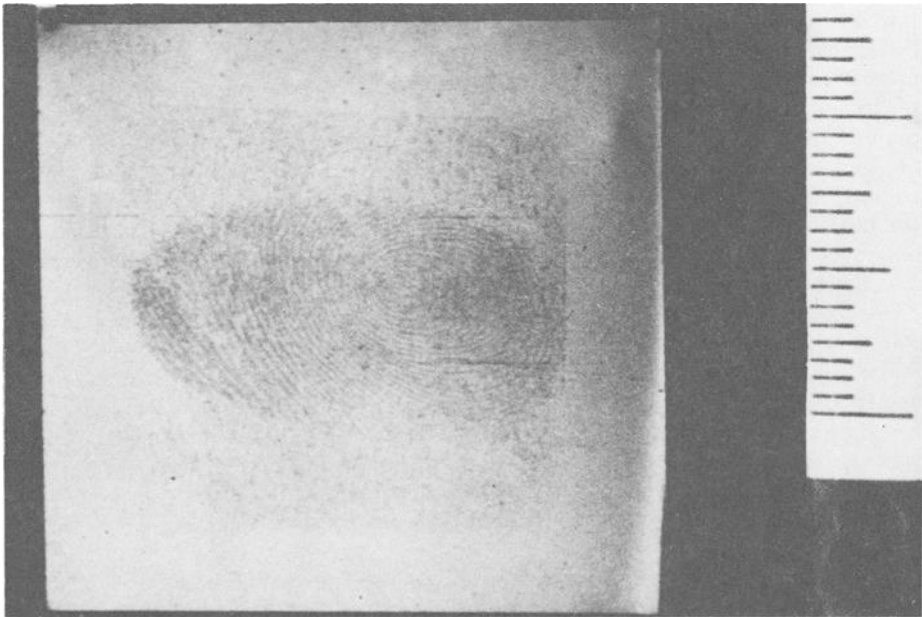


FIG. 8—Fingerprint on silver plate developed after 24 h and taken with 35-mm camera.

difficult. Figure 7 is an impression from a black male cadaver. In a controlled environment such as this, where it is known exactly where the print has been placed, no difficulty in placement of the silver plate is encountered. In a situation likely to be encountered in the field, the searching for a similar latent print could be very time-consuming. Figure 7 also illustrates a common artifact. The little black spots in and around the image are hair pores in the skin. To achieve the best results the area processed should be free of hair.

The usual precautions should be taken in the handling of hazardous chemicals. There should be no danger if the iodine fumes are not inhaled in excessive amounts.⁴ Before this process is used on a subject, it should be ascertained whether there is any history of allergies or unusual reactions to iodine or any reason to believe there would be. Regardless, it is suggested that a waiver of liability be obtained from the person.⁵

Conclusion

With the iodine-silver plate transfer method latent fingerprints on human skin can be developed. The continuation of experiments leading to the eventual application to a bona fide case processed through a judicial system will indicate the "arrival" of a new and useful tool for the law enforcement officer in identifying the perpetrators of our more serious crimes.

Acknowledgments

The author wishes to thank supervisory fingerprint specialist Robert Hazen of the FBI Academy for his assistance and encouragement, which helped to make this paper possible. Thanks are also due Sgt. Wayne Henninger and Dr. Frank Johnson for their contributions and Mr. Joe Durick of the AFIP Photo Lab for his patience and support.

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