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TECHNICAL NOTE

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A New Method of Reproduction of Fingerprints from Corpses in a Bad State of Preservation Using Latex

ABSTRACT: In view of the problems arising while fingerprinting corpses in a bad state of preservation, especially in case of mummification and carbonization, the authors propose an innovative technique which uses latex film. To better illustrate the potential of the method, two cases where the latex technique was applied successfully are reported: the first one is a mummified body discovered in a shack on the outskirts of Milan and the second one is the case of a burnt corpse found in a car boot. Such a technique is versatile, easy to apply, and allows the operator to work quickly on cadavers without amputating parts, except in rare cases (i.e., burnt bodies with muscle retraction). By the latex technique, a perfect and enduring negative copy of the fingerprint is obtained, ready to be inked and photographed. The numerous copies produced this way can be inked several times allowing for the repeatability of the procedure and this is crucial in cases of problematic legal identification of corpses. In both the cases illustrated, the fingerprints obtained by the latex technique were useful for identification. The quality was good enough for the automatic fingerprint identification system research system to be applied.

KEYWORDS: forensic science, fingerprints, fingerprinting, identification, latex

Fingerprinting a corpse in a good state of preservation is easy and gives immediate results. Hence, postmortem fingerprinting is one of the most valuable identification techniques. Problems arise when fingertips have been damaged either by putrefactive and/or transformative events (mummification, saponification) or by postmortem factors (charring).

Depending on the cases, ridges can be deformed by folding (e.g., mummification), they can be leveled or smoothed by environmental erosional effects (i.e., water effects in presence of ''laundress fingers''), or dehydrated, thus fragile and rarefied, as a consequence of the exposure to high temperatures. Many authors (3–5) dealing with such situations have proposed several methods to treat the fingertips and make the ridge details readable and useful for identification purposes. Up to 1985, operators rehydrated and softened the skin by applying chemical–physical techniques directly on fingers (using methanol solutions, sodium or potassium hydroxide, EDTA). Usually they used a subcutaneous injection of glycerine or the immersion in solutions: salt solution, oil mixture, and sodium or potassium hydroxide solution. Later, Zugibe and Costello (6) proposed a brand new technique based on a chelating compound (EDTA) which softens the epidermis without deteriorating the skin. In 1988, Haglund (1) proposed a different method based on two chemical compounds easy to find (Metaflow, Restorative). The method gives good results but the skin must be dipped in the solution for a long time (it lasts between several hours and a few days). Ineichen (2) was the first who introduced the ''reproduction'' methodology of fingers. His technique is based on the creation of a silicone rubber cast of the fingertip (a 3D negative) and the consequent production of the positive fingertip using an artificial skin made by a mixture of white glue and talcum powder. This way Ineichen obtained a ''copied'' print that is free of deformations and wrinkles. Still, that same technique is limited to mummified bodies and suffers of a loss of definition due to the transfer from the print to the cast.

The method (used in the 1970s) reported by Berry and others on page 4 of reference (4) is the3paper. Their ''fingerprint lifts'' method allowed the authors to obtain the ridge detail of stuffed primate's fingerprints by spreading a thin layer of acrylic paint on the finger. As soon as it is dried out, they removed it and dusted it with aluminium powder obtaining a negative drawing they could retrieve with adhesive tape.

Materials and Methods

Our technique's preliminary step is the cleaning of the fingertip we must treat. To do that, we removed the grease from the skin using a brush soaked in ether. Afterwards, we spread a thin layer (about 0.5 mm deep) of liquid latex (Flockart, Milan, Italy) on the finger using a wooden rounded rod. To distribute the liquid at best into all the introflections of the plica, we blew on it patiently, paying attention not to create residues in every fold. Finally, we obtained a wrinkle and protrusion-free elastic film which reproduces the fingertip dermatoglyphics at best. After having spread the latex onto the fingertip, we must wait no longer than 10 min for the solvent present in the latex to dry out, leaving behind the thin elastic semitransparent film we need. Now, we can remove and place it over a medium fit for the fingerprinting identification procedure. To do that, we proceeded by dusting the surface of the film with talcum powder, using a dry and clean brush. This step prevents the film from curling up. Finally, using tweezers, we removed the film and placed it over a silicone

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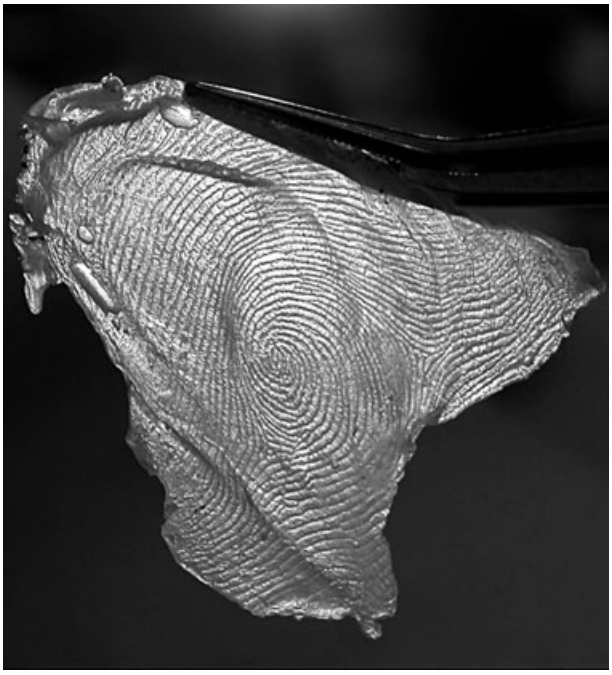

FIG. 1—*Removal of the latex film from the fingertip by tweezers. The film will be placed over a rubber finger.*

support shaped like a human finger, paying attention to leave the surface which was in direct contact with the corpse turned outward (see Fig. 1). This support must have been soaked in liquid latex and dried up before receiving the film. In this way, the medium is perfectly compatible with the film. If we need to speed up the process, we can put a single drop of liquid latex between the film and the rubber medium covered by latex. This will make the fixing easy and prevent us from waiting for the support medium to dry up. Once we place the film, we must stretch it at best; trying to remove all the air bubbles which may have formed in the process. Finally, we can ink and print it using the traditional methods. In this way, we obtained an exact print of the latex reproduction of the fingertip. We must remember that this is a negative record of the print of the original finger and that it must be reversed in color and shape before using it to perform the identification.

To better illustrate the potential of the methodology explained here, we report two cases where the latex technique was applied successfully.

The first case concerns a mummified body discovered in a shack on the outskirts of Milan. Its fingers were extremely dry, showing a skin tough and shriveled like a tuff parchment. We could not adopt the usual inking techniques because of the great number of introflections and extroflections, although the ridge pattern was clear enough, especially in the right hand. We applied our method starting with the cleaning of the fingertip by ether. Afterwards, a thin layer of latex was spread uniformly over the fingertip (see Fig. 2). Particular care was dedicated to the removal of residues of material from the skin. This precaution allowed us to stretch the dry film more easily, preventing curling up when we placed it over the rubber finger. Then, we inked it so as to obtain a negative readable print on paper useful for the identification procedure. The whole process required no more than an hour from the cleaning of the finger to the recording of the print. The method proved to be extremely rapid, inexpensive, and effective.

FIG. 2—*A thin layer of latex is spread uniformly over the finger (the thumb of the right hand in this case). In this step, it is important to uniformly spread the latex on every fold using a wooden rod.*

The second is the case of a burnt corpse, discovered in a car boot in Milan. Its fingertips were covered in soot and oily substances. The typical inking techniques were avoided because of the numerous tiny ripples caused by partial dehydration and by the invisibility of the ridge pattern due to the oily substances. High temperatures forced muscular retraction in such a way that the body assumed the typical "pugilistic attitude" during the combustion. This made it necessary to cut off of the fingers at the level of the metacarpal-phalangeal articulation. Afterwards, we could proceed with the method explained, removing the grease from the digit first and then applying the latex film on it. In this case too the whole process required no more than an hour. In the end, we obtained a clear and valuable print to use in the identification procedure.

Results

The results can be appreciated from viewing Fig. 3 (from case 1). This shows the fingerprint we achieved using the latex technique applied to the mummified corpse (fingerprint of the left hand forefinger). The print is reversed by color and its place and quality is easily comparable to the fingerprint obtained by the police, affixed in the criminal identification photo card and recorded in the Automatic Fingerprint Identification System (A.F.I.S.) database. A.F.I.S. allows scientists of the police forensic department to carry out fingerprinting identification all over the country.

As far as the reversed partial fingerprint (fingerprint of the left hand forefinger) we obtained by latex technique applied to the charred corpse is concerned, the resulting fingerprint allowed the forensic scientists of the Italian police to perform the identification of the body. The comparison with the fingerprint attached to the criminal identification photo card gave a positive result. The image results from the second case are not shown here.

In both cases, the fingerprints obtained by the latex technique showed useful features for the identification procedure to be performed. Their quality was good enough for the A.F.I.S. research system to be applied. Hence, they were sharp and clear enough; they showed digital ridge continuity and no less than 16–17 identity points (the minimum limit to perform a juridical identification as decreed with several sentences by the Italian Supreme Court). All the fingerprints were scanned into the A.F.I.S. database, processed, and compared with a group of 50 fingerprints the system selected

FIG. 3—*A negative fingerprint obtained by the latex technique from the mummified forefinger of the left hand.*

on the grounds of the set of conditions previously introduced by the forensic scientist, reaching the complete correspondence for all the identity points.

Discussion

As far as handling with deformed skin (mummification, dehydration, or charring) is concerned, the latex technique offers a considerable benefit as regards Lee and Gaensslen's method (4), and indeed a smooth, folds-free copy of the ridge pattern is obtained in a very short time, ready to put either on a shaped medium or on a slide, to be inked or photographed.

Unlike Ineichen's (2), the latex technique can give the final print all in one go, avoiding the loss in definition caused by Ineichen's casting procedure. Besides, when handling charred fingers, this technique offers another great benefit: apart from getting a useful fingerprint (if the skin is not completely charred and the ridge patterns destroyed), each latex layer put on the skin cleans the fingertip surface of the numerous carbon particles. It is an easy to apply methodology, cheap and quick, and is very helpful when treating badly charred hands, mummified or decomposed fingertips. This methodology is a noninvasive technique that can be applied at will to the same sample without ruining it. The latex resulting fingerprint is a perfect and enduring negative copy of the original ridge pattern. The numerous copies produced this way can be inked several times allowing the repeatability of the procedure and this is a considerable surplus value in case of problematic legal identification of the corpse. Moreover, the latex fingerprint can be washed (simply with soap and water) if badly inked and inked again without invalidating the result in any way.

The adoption of casting techniques is not a novelty. In the past, authors suggested cheap materials easy to find such as clay and wax compounds (7). However, those substances cannot be directly inked and those methodologies required the use of optical scans to acquire the ridge patterns from the cast. For this reasons they call for more time and costs as regards the methodology we present here.

The only restriction imposed by the latex technique is that the mummified or charred fingertip must not be previously treated with sodium hydroxide, because it prevents the rubber from vulcanizing.

Considering the success we obtained applying the latex technique to such badly preserved fingertips, we are convinced that this methodology is extremely valuable in cases like those described here. Clearly, this must face the validation of further experimental enquiries, but we are optimistic that this innovative technique can increase the possibilities of identification of a corpse in a very bad state of preservation.

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