Abstract

When friction ridge skin is compromised by various destructive influences, it often breaks down into flaccid skin with no discernible friction ridge detail. The boiling technique is a specialized procedure that uses boiling water to recondition friction ridge skin. This reconditioning process rehydrates the skin, enhancing and exposing friction ridge detail. As a result, quality impressions, even from the most distressed bodies, can be recorded and compared to a known antemortem standard or searched through an automated fingerprint or palm-print system to verify or establish identity.

Introduction

Obtaining friction ridge impressions from deceased individuals can be challenging, even for the most skilled forensic examiner. Recovered bodies and remains often exhibit damaged friction ridge skin due to various environmental influences resulting from the deadly event. These influences include:

- Fauna (animals or insects).
- Fire (charring).
- Water (maceration) (Figure 1).
- Weather (cold, heat, or humidity) (Miller 1995).
When recording friction ridge prints from deceased persons, the examiner must (1) inspect and clean the friction ridge skin to determine whether and what type of damage has occurred, (2) use proper techniques to recondition the friction ridge skin when necessary, and (3) attempt to obtain identifiable postmortem impressions.

This report introduces the boiling technique as a means of reconditioning friction ridge skin to obtain quality postmortem prints. The technique works best on damaged friction ridge skin resulting from advanced decomposition and maceration. This damage involves the degeneration of the skin, resulting in the destruction or disintegration of the epidermal (outer) skin, leaving exposed dermal (inner) skin with little or no visible friction ridge detail. Although the boiling technique has been used on epidermal skin, it is most effective in reconditioning the dermal skin, allowing the examiner to utilize friction ridge detail present on the dermis to record identifiable postmortem impressions.

**Equipment and Materials**

The following items are needed to perform the boiling technique:

<table>
<thead>
<tr>
<th>Supplies</th>
<th>Protective Equipment</th>
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<tbody>
<tr>
<td>Adhesive lifters (HandiPrint*)</td>
<td>Lab coats</td>
</tr>
<tr>
<td>Black fingerprint powder</td>
<td>Protective glasses</td>
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<tr>
<td>Electric hot pot</td>
<td>Latex or nitrile gloves</td>
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<td>Electrical outlet</td>
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<tr>
<td>Fingerprint brush (short-bristled)</td>
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<tr>
<td>Fingerprint magnifier</td>
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<td>Isopropyl alcohol</td>
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<td>Palm-print cards</td>
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<td>Soap</td>
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<td>Sponge</td>
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<td>Standard fingerprint cards</td>
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<td>Tap water</td>
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<tr>
<td>Transparent fingerprint cards**</td>
<td></td>
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<tr>
<td>Towels</td>
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*For information, go to http://www.kinderprint.com.
**Transparent ten-print cards can be made by photocopying a standard ten-print card onto a transparency.

** Procedure **

Universal safety precautions must be followed when handling all human remains. The following steps detailing the boiling technique should be used to recondition friction ridge skin:

Step 1: Visually examine the friction ridge skin on the hands to determine whether and what type of damage may be present (Figure 2). If excessive contamination (dirt, oils, etc.) is present on the skin, remove any loose contaminant from the hands using a sponge and warm, soapy water (Figure 3). Minor contamination adhering to the hand that cannot be dislodged will be removed later in the procedure. When cleaning the hands, ensure that there is no further damage to the skin, keeping the friction ridge skin intact as much as possible. Decaying and macerated hands often will show no visible friction ridge detail. The absence of this detail should be expected and does not mean the hands are soiled but is often a sign that the examiner is working with dermal skin.

![Figure 2: Putrefied hand](image-url)
Figure 3: Removal of contaminants with a sponge and warm, soapy water

Step 2: Fill an electric hot pot approximately half full with tap water or with enough water to completely submerge the hand into the pot. The use of hot pots large enough to fit a whole hand is recommended to avoid water overflow. After filling the pot with water, plug it in and allow the water to boil (Figure 4).

Figure 4: Electric hot pots containing boiling water
When the water starts to boil, unplug the hot pot and place the hand into the pot of water for 5 to 10 seconds. The authors suggest placing the hand into the boiling water for 5 seconds, then removing it to observe whether friction ridge detail is present. If no detail is visible, place the hand back into the water for another 5 seconds. This process should be repeated no more than three times because prolonged exposure to intense heat will harm the skin. The boiling water reconditions the friction ridge skin and removes any contaminant still present after Step 1. One examiner can perform this procedure by standing behind the head of the deceased, grasping the individual’s wrist, and bending the arm back toward the head as demonstrated in Figure 5. This allows the hand to be easily submerged into the pot of boiling water even when the body exhibits rigor mortis. If the arm is not bent as described, submerging the hand into the boiling water may require two examiners to perform the procedure safely.

![Figure 5: Placement of hand into boiling water. The arm of the body is bent back toward the head to allow the examiner to safely perform the boiling technique without assistance.](image)

If the friction ridge skin on the hand contains abrasions or cuts, an alternate form of the procedure should be used. Placing a hand with skin lacerations into boiling water will increase the size of any cuts and may cause further damage to the friction ridge skin, rendering it unprintable. Instead of placing the hand into boiling water, the examiner should soak a sponge in boiling water and squeeze the sponge so the water washes over the friction ridge skin. This will have the same effect as placing the hand into the pot of boiling water but will allow the examiner to have more control over the reconditioning process.

After the skin has been exposed to boiling water, it will be taut and should have friction ridges clearly visible on the hands. This observation indicates that the friction ridge skin has been sufficiently reconditioned (Figure 6).
Figure 6: Left and right hands, both exposed in the same environmental conditions, from a body recovered after the December 2004 South Asian tsunami. The hands prior to boiling were macerated, exhibiting wrinkles and no visible friction ridge detail (left hand). The hands after boiling were reconditioned, exhibiting visible friction ridge detail and no wrinkles (right hand).

Step 3: Before attempting to print, dry the friction ridges by using a blow dryer (warm setting) or by pouring isopropyl alcohol on the hands and blotting dry with towels. The examiner may use cloth or paper towels; however, paper towels may leave fiber traces on the hands, which may interfere with printing results.

The preferred printing method for recording friction ridge impressions from bodies involves the use of black fingerprint powder and adhesive lifters. To record powder prints, use a fingerprint brush to lightly dust the fingers (including palms when necessary) with black powder. Place each finger on a contrasting adhesive lifter, such as Handiprint (mailing labels also can be used), to record the impressions (Figures 7 and 8). Affix the adhesive lifter with the recorded impression to the correct fingerprint block of a transparent ten-print card (Figure 9). This printing method produces better results than the standard inking procedure and allows the examiner to easily record each finger while it is still attached to the hand.

Figure 7: Adhesive lifter wrapped around and removed from a powdered finger, leaving a recording of the friction ridge impression on the adhesive surface
Figure 8: Fingerprint reviewed by the examiner to confirm that a clear and complete impression was recorded that is of suitable quality for comparison

Figure 9: Adhesive lifter affixed to the correct fingerprint block of a transparent ten-print card
Discussion

The boiling technique uses boiling water to elicit thermodynamic and osmotic responses that rehydrate the skin, raising friction ridge detail and eliminating body fluids associated with decomposition. This reconditioning process enhances detail present on the hands and exposes ridge detail not visible to the naked eye, allowing the examiner to obtain quality postmortem impressions from deteriorating friction ridge skin. Examiners should be aware that recordings of dermal prints will appear different than epidermal prints under a magnifier (Figure 10). This difference often involves a slight variation in size, with the dermal recordings being smaller than the epidermal prints. In addition, dermal ridges consist of double rows of papillae pegs, which the examiner must follow in dermal impressions to ascertain ridge path for comparison.

Figure 10: Recording of an epidermal and dermal fingerprint. The dermal print (right) varies in size from the epidermal print (left). In addition, the dermal friction ridge detail is recorded as double rows of dermal papillae compared to epidermal friction ridge detail, which is recorded as single ridge units.

The authors used the boiling method on hundreds of bodies recovered and processed in the months following the South Asian tsunami (December 2004), producing identifiable friction ridge impressions from some of the worst conditioned bodies. Both Figures 11 and 12 are recordings of a right palm from an unrecognizable body printed months after the tsunami. The friction ridge skin on the hands was macerated, showing dermal skin with no visible ridge detail. The right hand was cleaned, blotted dry with towels and isopropyl alcohol, and then printed. The result, depicted in Figure 11, is a smudged impression, recording virtually no friction ridge detail. Figure 12 is a recording of the same palm after using the boiling method. The right hand was cleaned, submerged in boiling water, blotted dry with towels and isopropyl alcohol, and then printed. This resulted in an identifiable impression that could then be compared to a known standard or searched through an automated fingerprint or palm-print system. The boiling technique also was used to recondition friction ridge skin on bodies recovered weeks after Hurricane Katrina (August 2005) in the U.S. Gulf Coast region, resulting in friction ridge impressions that were used to determine and confirm the identities of victims.
Figure 11: Palm print recorded without using the boiling technique

Figure 12: Same palm as in Figure 11 but recorded after using the boiling technique
Conclusion

Friction ridge impressions are instrumental in establishing the identity of deceased individuals. The examiner must consider the condition of the body and the fact that damage to the friction skin may prevent the effective recording of quality prints using standard fingerprint procedures. The boiling technique is presented as a significant advancement in the recording of quality postmortem impressions for the identification of deceased persons.

Acknowledgments

1This paper was originally published in the May/June 2007 issue of the Journal of Forensic Identification. It is reprinted here with the permission of the editor. The paper was modified only to fit the format and style of Forensic Science Communications. Individuals wishing to cite the paper should refer to and cite the original:


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This is publication number 06-10 of the Laboratory Division of the Federal Bureau of Investigation. Names of commercial manufacturers are provided for identification only and inclusion does not imply endorsement by the FBI.

The authors would like to recognize the members of the FBI Disaster Squad and the Missing Persons Bureau of the New York City Police Department. Their efforts to identify human remains from the September 11, 2001, tragedy laid the groundwork for this report. We also thank Special Agent Kevin Hogg and Physical Scientist Lori Higginbotham of the FBI for their assistance with this document.

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References