Case Report

Can Dry Bloodstains Provide a Source for a Blood-Contaminated Fingermark?

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Abstract: This study approaches the matter of whether a dry bloodstain can provide a source for blood-contaminated fingermarks. This question was raised during a murder case, where the defense claimed that wet fingers may have transferred blood from a dry stain onto a clean surface. In order to examine this theory, experiments were conducted at different humidity levels caused by natural and induced sweating as well as by deliberate wetting of the hands. The results indicate that under certain conditions, this type of blood transfer may indeed be possible. However, such an action leaves a distinguishable trace: a “negative-type” fingermark on the original bloodstain remained each time. This conclusion may greatly assist the investigation in either confirming or rejecting the above hypothesis.

Introduction

Fingermarks in blood, either visible or developed, often play a major role in criminal investigations. Although an individual whose blood-contaminated fingermarks are found at a crime scene may not immediately be a prime suspect, this evidence supports that the person was present at the crime scene when the blood was still liquid or in the process of drying.

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During the last four decades, the fields of blood-contaminated fingermark detection and bloodstain pattern analysis have been thoroughly researched worldwide [1, 2]. Lee and Gaensslen [3] included a detailed comparison of the different methods for enhancements of fingermarks in blood. In 1997, Jaret et al. [4] investigated the possibility of transferring enhanced blood-contaminated prints from their original place to another, where they could be easily photographed. Laber and Epstein [5] and Brady et al. [6] examined the drying times for a single drop of blood on various surfaces under different environmental conditions. Langenburg [7] studied several important parameters related to blood-contaminated prints: pressure, volume of blood, inclination of the surface, and the effect of allowing the blood to dry. Among other significant conclusions, he reported the blood-drying times on a finger as a function of the amount of blood being between 30 seconds and 4 minutes. In 2013, Praska and Langenburg [8] examined the question “... whether a latent fingermark can be processed with blood reagents and subsequently be mistaken for a bloody fingermark”. This important question arises quite often in real cases by the defense lawyers and remains debatable in the forensic community. As one can see, the question related to bloodstains, fingermarks in blood, drying of blood on the finger, and so forth are numerous and complex.

Case Background

The Latent Fingerprint Laboratory was approached with the unusual question of whether a dry bloodstain could be a source for blood-contaminated fingermarks. The question was raised during the murder investigation of a man who was found dead in a construction site. On the basis of intelligence information, the business partner of the deceased was arrested as the prime suspect. The investigators’ theory suggested that the suspect shot the victim in the office and later transferred the body in the company’s red Fiat to the construction site. The Fiat, found parked close to the company’s office, had two blood-contaminated fingermarks on its rear doors. Both fingermarks matched the suspect, and the blood was identified as that of the victim. On the surface, this was a straightforward case.

However, regardless of all of the forensic evidence against him, the suspect claimed his innocence. He explained that late at night, after washing his hands, he went out to inspect the red Fiat, which had just been returned by one of the employees.
of the company. A possibility was raised that while inspecting the car, he may have accidently touched a bloodstain with wet fingers and then transferred bloody fingerprints to the car’s clean surface. This statement was also supported by the testimony of an expert witness for the defense.

**Materials and Methods**

A comprehensive experiment was carried out by the Latent Fingerprint Laboratory in the Israel Police to clarify the matter.

**Surfaces**

White car parts of the same type of Fiat were used as the test surfaces. White parts were specifically chosen for achieving better contrast between the surface and the blood. The surfaces were cleaned with ethanol (C. P. Bio-Lab, Jerusalem, Israel) and hot tap water. The surfaces were then allowed to air dry prior to depositing the blood samples.

**Blood Samples**

The blood samples were taken from six male participants, who donated it voluntarily and exclusively for this experiment. The blood samples were preserved with EDTA and kept at 10 °C for three days. (Preliminary experiments showed no difference in the results when using either fresh or preserved blood.) All experiments were conducted outdoors at an average temperature of 25 °C. The blood was added drop-wise onto the surface followed by a non-uniform smearing with a clean finger. The samples were then left to dry outdoors for three days and indoors for two more days. The samples were photographed by a Nikon D-70 camera with no further processing.

**Experimental Details**

Five experiments, each consisting of five trials, were conducted for all six donors (n=150 prints). For each experiment, different levels of moisture were applied to the fingers; the first experiment of a dry finger served as a control.
• Experiment 1: A dry finger was rubbed against a dry bloodstain followed by touching a clean car surface.

• Experiment 2: An extra-moist finger was achieved by natural sweating after wearing a plastic glove for 30 minutes, followed by the procedure of Experiment 1.

• Experiment 3: An extra-moist finger was achieved by natural sweating after physical activities (running, jumping, and weight-lifting), followed by the procedure of Experiment 1.

• Experiment 4: A finger was wetted with cold tapwater, followed by the procedure of Experiment 1.

• Experiment 5: A finger was wetted with cold tapwater and dried in air for 30-second time intervals, from 30 seconds to 3 minutes, followed by the procedure of Experiment 1.

Results and Discussion

The results are summarized in Table 1. Experiments 1, 2, 3, and 5 all gave negative results. This indicated that dry or slightly dampened fingers caused by induced sweating or wetting followed by natural drying were unable to transfer blood from a dry bloodstain onto a clean surface. However, the results of Experiment 4 were quite the opposite: A finger that was wetted with cold tap water and immediately rubbed against a dry bloodstain successfully produced blood-contaminated fingerprint marks on a clean car surface.

Another important and crucial observation was made in Experiment 4. For all five trials (30 attempts to create a fingerprint with transferred blood), the transfer of blood resulted in a clear sign of intervention on the bloodstain source in the form of a “negative-type” fingerprint (Figure 1) that was caused by the lifting of blood by the fingerprint ridges. This finding may greatly assist a criminal investigation team in determining the origin of the blood.

Table 1

Results of transferring blood to a clean surface by fingers with different moisture levels.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Moisture Level of Finger</th>
<th>Trial Number</th>
<th>Results of Blood Transferring*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dry</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Natural sweating–plastic glove</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Natural sweating–after exercise</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Wet</td>
<td>4</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td>Wetted and dried</td>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>

* Plus and minus signs indicate visible ridges and no visible ridges, respectively.

The five trials represent the results of all six donors.
Conclusion

The conclusions of the Latent Fingerprint Laboratory reported to the Tel-Aviv District Prosecution Office were as follows: It is possible to create a blood-contaminated fingermark by touching a dry bloodstain with a wet finger and then touching a surface. However, in such a case, there should be a clear “negative-type” fingermark on the bloodstain source. In the questioned murder case, because all dried bloodstains appeared intact, the Tel-Aviv District Court adopted the above findings, which contributed to the conviction of the defendant.

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Figure 1

Experiment 4 showing: (a) The transferred blood-contaminated fingermark; (b) A “negative-type” fingermark on the bloodstain source.
References


