

Exploring the Relationship between Finger/Palm Prints and Blood

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Introduction

The identification of an individual's fingerprint in the blood of a victim of crime is extremely powerful evidence. However, there's very little published literature on the various factors that affect the appearance of a fingerprint with the interaction of blood.

One published technical report states that it's not possible to determine how a fingerprint has interacted with blood just from its appearance. Some fingerprint experts are prepared to comment on how a fingerprint has been formed, while others will only comment on the identification.

From previous experience, authentication of a fingerprint associated with blood should be a joint examination by a fingerprint expert and a forensic scientist. The scientist would consider the interaction and distribution of blood on the surface of the object and the fingerprint expert would look at the interaction of blood with the ridges and furrows of the fingerprint. This paper demonstrates that by analyzing the mark of a fingerprint, the scientist would be able to determine if:

1. The finger was wet with blood when it made contact with the object
2. A clean finger made contact with blood that was already on the object
3. Blood has come into contact with an existing finger mark on the object

There may be other explanations such as combinations of the three above. However, in the author's experience these are the most common explanations.

Proposition 1

The finger was wet with blood when it made contact with the object.

Occasionally, it can be obvious if a mark has been made by a finger bearing wet blood, but at other times, you have to look for the subtle detail (Figure 1).



Figure 1. Rolled finger with blood accumulating at one end of the print.

Here, the heavier distribution of the blood is only on one end of the fingerprint, which indicates that this finger has been rolled across the surface with moderate force.

Proposition 2

A clean finger made contact with blood that was already on the object.

These types of marks are dependent on the type of object, pressure of the finger and the rate at which the blood dries. Figures 2a and 2b demonstrate how fingerprints are formed when they come into contact with blood at various time intervals. Figure 2b shows that the optimum time for formation of a good mark was around fourteen minutes after the finger came into contact with the wet blood.

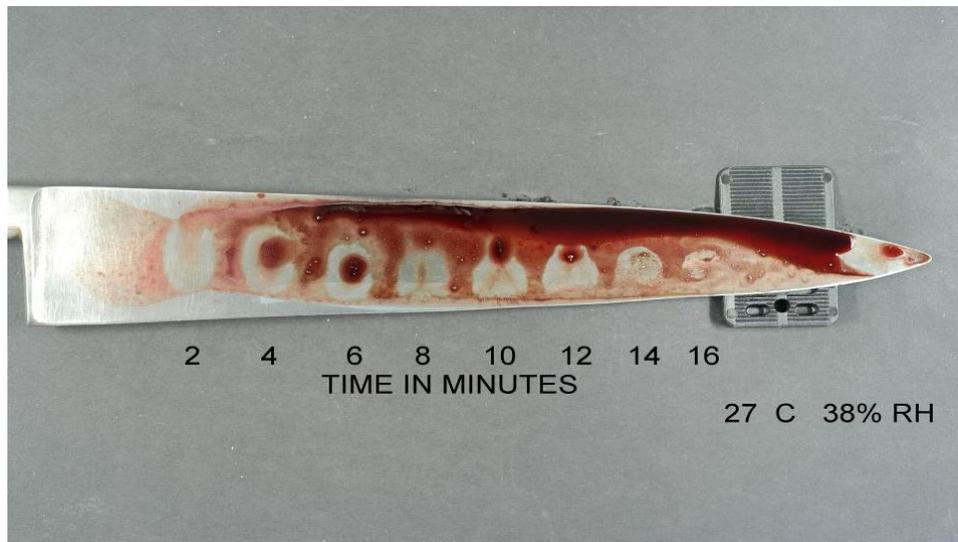


Figure 2a. As the finger lifts from the surface of the fresh wet blood, the blood gathers in the middle of the mark.

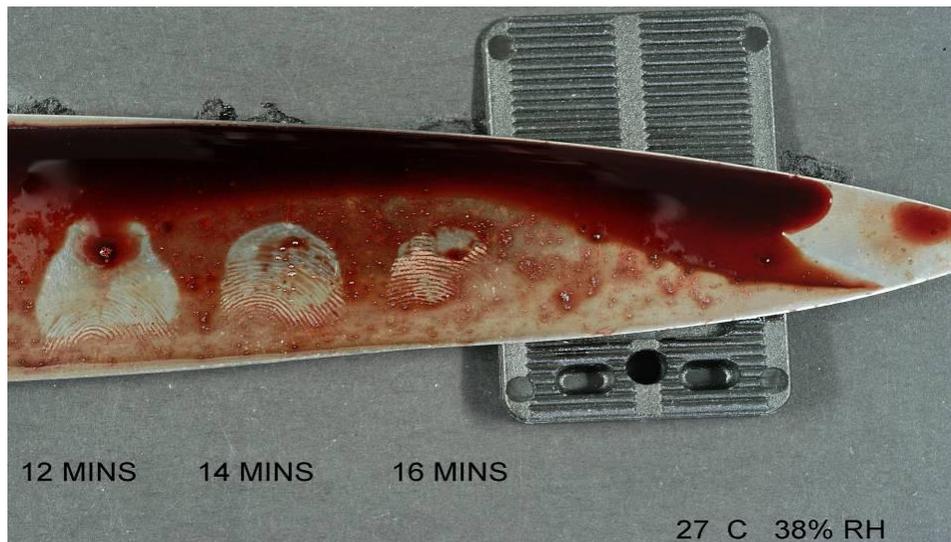


Figure 2b. Optimum time - fourteen minutes.

Proposition 3

Blood has come into contact with an existing finger mark on the object.

These types of marks are less common but can often be considered by the defense counsel in an attempt to reduce the impact of the fingerprint evidence. This is because if the fingerprint was simply from sweat with very little sebaceous material, then there isn't much interaction with blood. The majority of sweat is water soluble, so it dissolves away when it comes into contact with blood. (Figure 4).

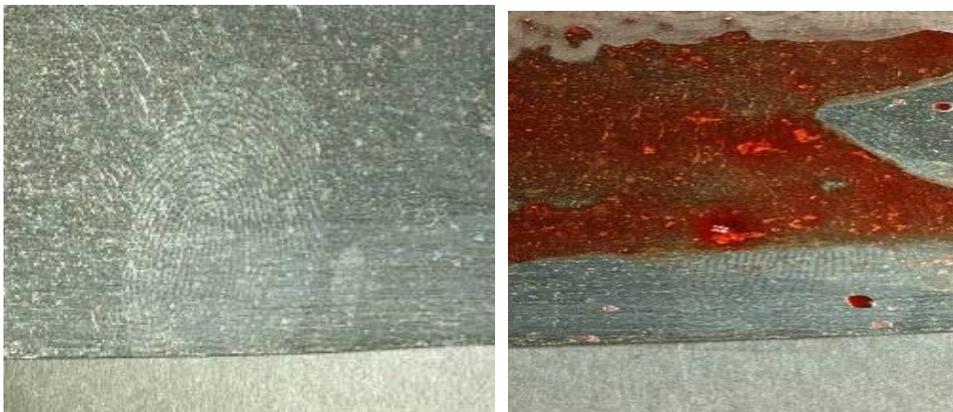


Figure 4. There is no interaction with the blood and the fingerprint in sweat.

However, as the grease content of the fingerprint increases, then there is interaction with the blood (Figures 5 and 6).



Figure 5. Interaction with a greased fingerprint with blood.



Figure 6. Blood migrating along the edges of the fingerprint.

The scientist reviews the appearance of the fingerprint under a microscope with the distributions of any other blood on the object to determine a suitable area to sample. The object may be subjected to a sequence of optical, physical and chemical treatments to establish the presence of blood and the proposed means for its formation. Figures 7a and 7b show two hand marks associated with blood. Figure 7a was made by a hand contacting wet blood and 7b was made by a hand bearing wet blood.



Figure 7a

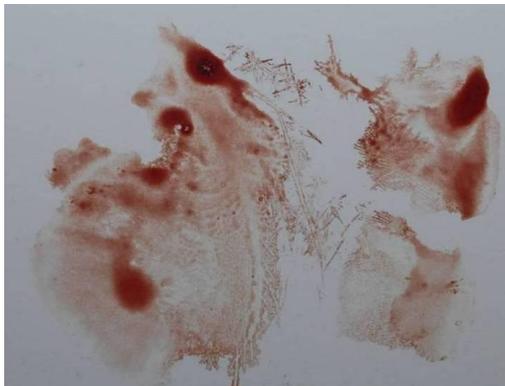


Figure 7b.

Guidance for the Different Appearances with these Mechanisms

It is not always possible to determine whether it is a hand bearing blood or a hand going into wet blood and there is sometimes a combination of events. The following mark was produced with the palm of the hand bearing wet blood (Figure 8).

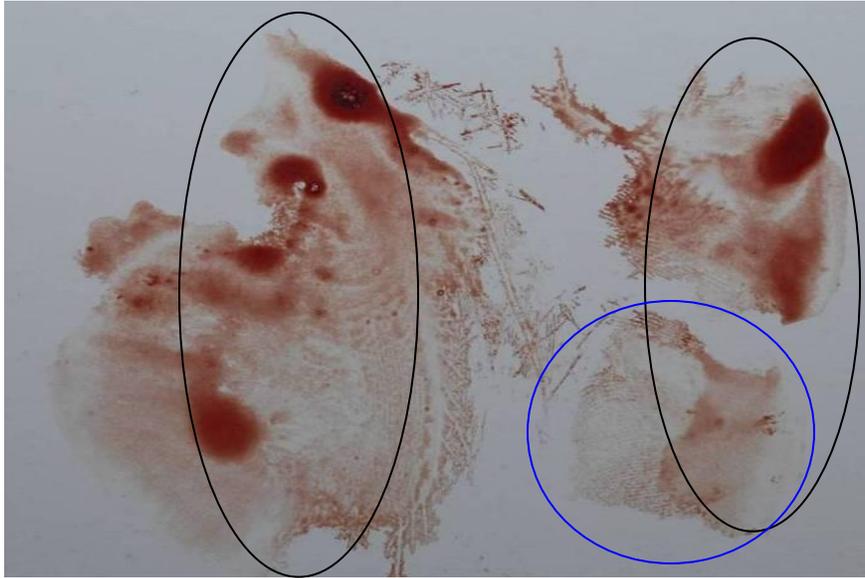


Figure 8. Mark produced with the palm of hand bearing wet blood.

The first observation is the distribution of blood is either side of the palm mark as indicated by black elliptical lines. Note also the absence of blood within the central region of the palm mark. The hand has made contact and on lifting the hand from the surface, the blood has pooled, due to the vacuum created. The following image (Figure 9) is a close up of the palm detail, as indicated by the blue circle.

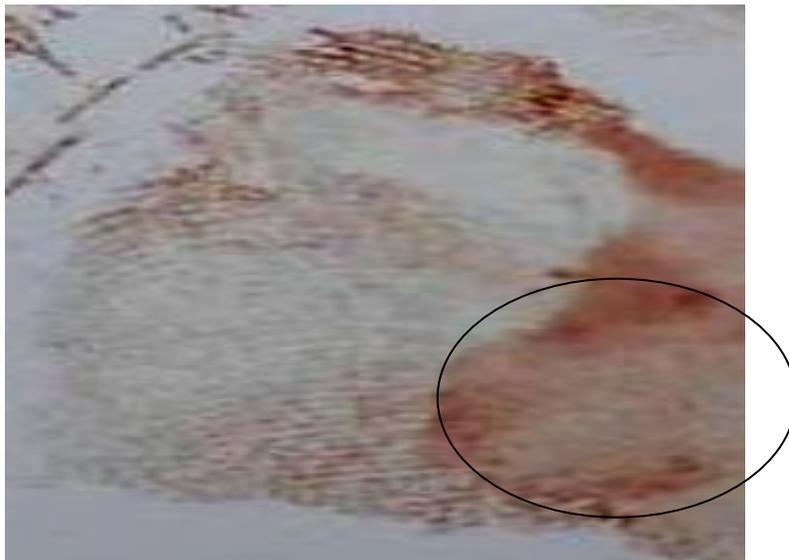


Figure 9. Close view of palm detail of figure 8.

Note the amount ridge detail in blood is still present under the pooling effect, as indicated by the black circle. This amount of detail would not be expected if the blood was already present and the effect is probably due to the blood drying on the hand prior to contact with the surface.

The following mark was produced with the palm placed into wet blood (Figure 10).



Figure 10. Mark produced with palm of hand placed into wet blood.

The first observation is the presence of the large pool of blood in the central region, as indicated by the black circle. Note also that the majority of the friction ridge detail is only present on the outer aspects of the blood. There is also the odd satellite of blood forced out by the pressure of the contact, as indicated by the red circle. The following image is a close up of the palm detail as indicated by the blue circle (Figure 11).

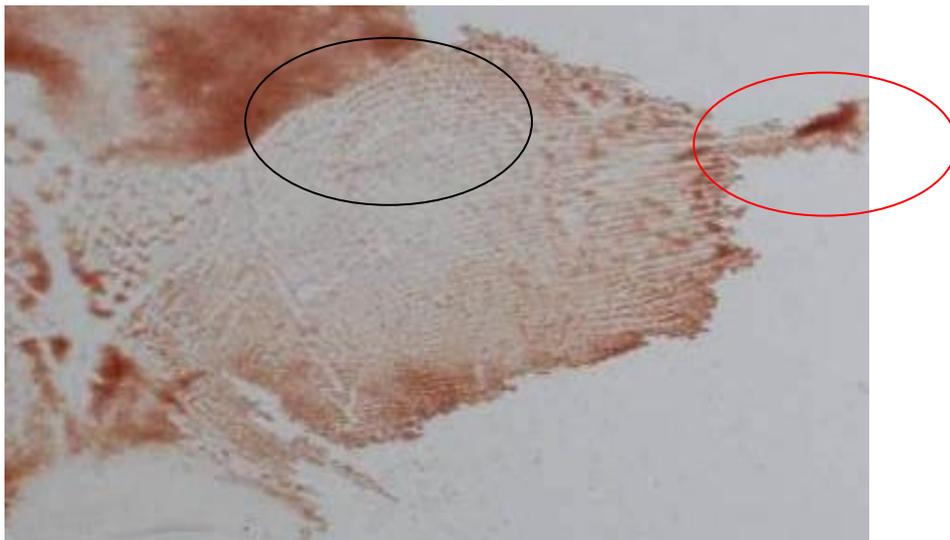


Figure 11. Close view of palm detail from figure 10.

Hardly any friction ridge detail under the pooled area, as indicated by the black circle and blood has flowed to the end with little pooling when the hand has lifted from the surface. Sometimes it not always possible to determine which mechanism is the most likely; however there is additional information with each mark. Both these impressions have been made whilst the blood is wet and there are no obvious signs of clotting/drying, which may assist with the time line for the enquiry.

Conclusions

These mechanisms are only part of the process. Not all ridges associated with blood are as apparent, and marks can often be developed during chemical treatments. It's critical they are independently reviewed in each case to ensure that justice always prevails. The development of such marks associated with blood and the effects on DNA by such chemicals will be explored in a future paper.

References

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