RESEARCH ARTICLE

Casting Two-Dimensional Bloody Shoe Prints from Concrete, Fabric, and Human Skin:
A Review of Several Methods with Recommendations

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Introduction

The recognition of bloody footwear impressions at a crime scene is not an uncommon occurrence for the criminalist. Traditionally these impressions have been recorded by photography or videography either before and/or after chemical enhancement. Photography is an ideal method to begin with since it is considered to be non-destructive to the evidence. Chemical enhancement may improve the clarity and quality of the impressions as well, however, each enhancement technique may require additional skills of the analyst and/or equipment to appropriately document the evidence. Additionally, some agencies have limited resources and expertise in the development and photography of bloody footwear impressions, especially under low, or no light conditions. Several authors have discussed various photographic and chemical enhancement methods that work well for documenting such impressions (Barker 1999, Bevel and Gardner 2002, Gimeno and Rini 1989, and Gimeno 1989). Occasionally, however, the bloody impression may be found on a dark colored surface that makes traditional photography challenging. Barker's (1999) discussion of colored filters for documenting bloodstains may produce very good results as long as the criminalist has the appropriate filter. Some small agencies however do not have photographic experts on staff and their access to, and knowledge of, appropriate filters may be limited. Knapp and Adach (2002) have written on the use of dental stone casting to record footwear and fingerprint impressions developed with various powders, but did not discuss blood impressions. In addition, while Knapp and Adach (2002) do test a high number of substrates, they do not investigate the same surfaces discussed in this paper. This is very understandable since concrete, fabric, and human skin are not known to be good deposition surfaces for the development of latent footwear or fingerprint impressions. In this paper the author has experimented with several casting materials on red colored concrete, fabric, and human skin, in an effort to transfer bloody shoe impressions onto a medium which offers better contrast for general photography. I do not suggest that traditional photography methods be supplanted by casting. I merely offer these techniques as an additional tool available to the analyst should general photography and chemical enhancement techniques yield less than desirable results.

Materials Tested

Four casting materials were utilized for testing; Mikrosil®, Polyvinylsiloxane (PVS), Dental stone, and Alginate. All materials were recently obtained from well known suppliers and were not expired. Surfaces for testing included red colored concrete paving stones, denim fabric, cotton fabric, and human skin from a cadaver. All testing was done under room temperature (between 65 and 75 degrees Fahrenheit) and surfaces were allowed to remain under these temperatures for several hours prior to testing. Bloody shoe impressions were placed on each of the testing surfaces and allowed to air dry for a minimum of one hour. The impressions were made by wiping a thin layer of blood across the outsole of the shoe and then placing the shoe on the target. The impressions were not diluted, and no attempt was made to simulate a latent blood impression. Dental stone mixing volumes were two pounds of powder to both 12 and 16 fl.oz. of water. Powder was slowly added to existing water in mixing bowl and mixed by hand. Alginate mixing volumes were equal amounts of powder and water. Both Alginate and Dental stone materials were applied by pouring and hand spreading. Mikrosil® and Polyvinylsiloxane were mixed to the manufacturer's specifications. The Polyvinylsiloxane was applied by an "extruder" mixing gun while the Mikrosil® was applied by spreading with a wooden tongue depressor and rubber spatula. Casting materials were tested on both un-enhanced dry bloody shoe impressions as well as impressions treated with Leucocrystal Violet (LCV). Impressions on human skin were not pre-treated with LCV prior to casting.

Results and Discussion

Dental stone, Mikrosil and Polyvinylsiloxane yielded very poor results. All three materials failed to transfer any untreated bloody impression to the casting material on all surfaces tested. Dental stone and Mikrosil failed to transfer LCV treated bloody impressions on all surfaces tested as well. Polyvinylsiloxane did transfer some LCV treated bloody impression from concrete, but the quality was very poor (Figure 1). On the other hand, Alginate yielded very good results with both untreated and treated (LCV) impressions on all surfaces tested (Figures 2-4).

Figure 1. Polyvinylsiloxane cast of LCV treated shoe print from concrete.

Figure 2. Alginate cast of LCV treated shoe print from denim.

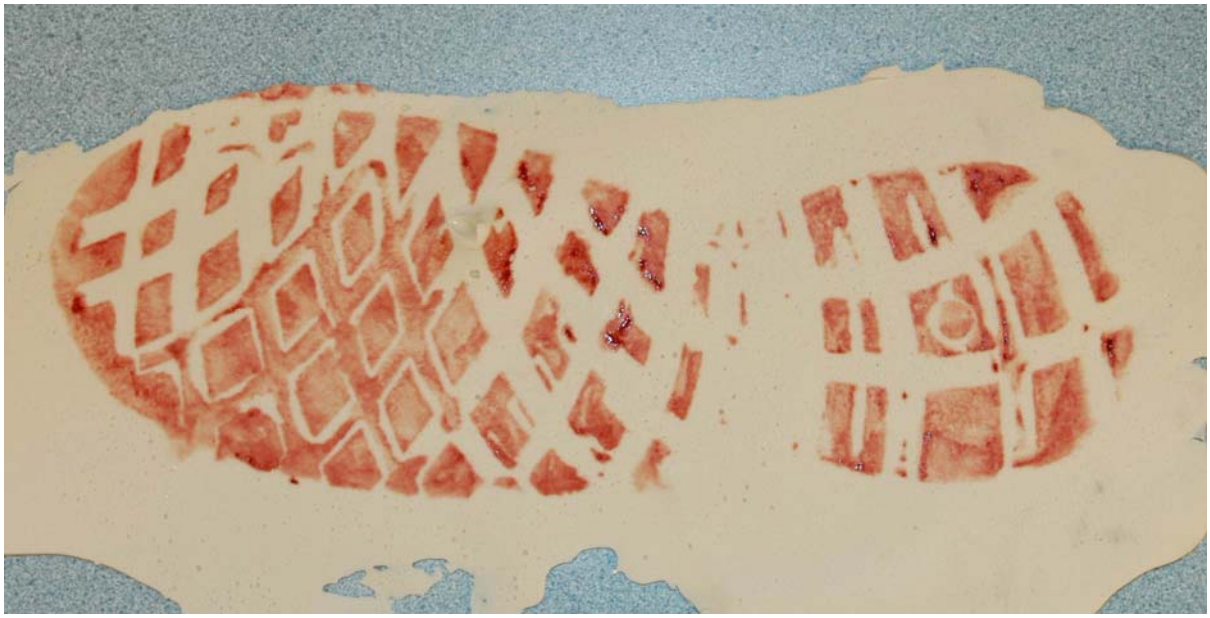

Figure 3. Alginate cast of bloody shoe print from human skin.

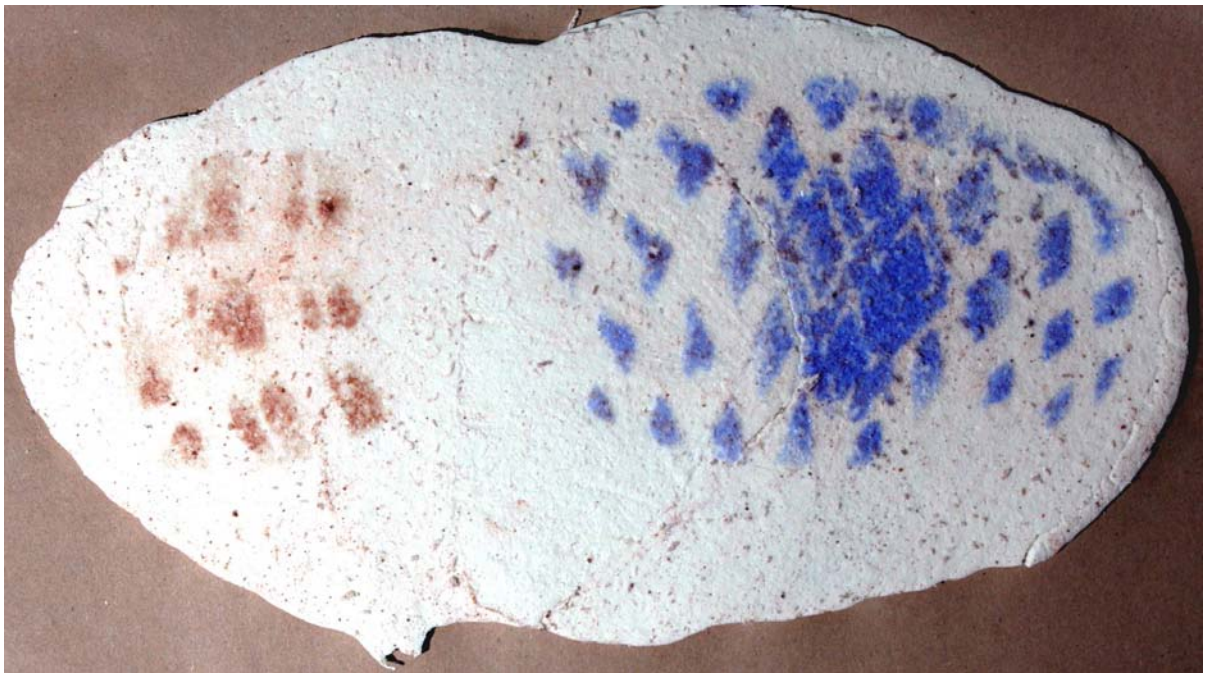

Figure 4. Alginate cast of bloody shoe print from concrete showing post-treatment with LCV in ball and toe area.

Blood impressions were indelibly embedded into the casting material with very nearly the same clarity as the original. In some casts, unique marks of damage were seen in the outsole impression that would aid in individualization of the footwear. Another interesting finding was that bloodstained Alginate casts could be post-treated with LCV to further enhance a weak image. Figure 4 shows a cast of a bloody print lifted from concrete, half of which (toe and ball area) has been post-treated with LCV. Alginate was allowed to dry for approximately 30 minutes before removal from the tested surfaces. The cast was then immediately photographed. These images will be reversed, so additional work with the negative or image will be needed for comparison.

Alginate casts can become very brittle and shape distorted when fully dried so it is recommended that good quality photographs be taken immediately after lifting. It is also recommended that the criminalist practice regularly with any casting material to become familiar with the dynamics of usage. While making several lifts from human skin it was noted that too thin of a mixture of Alginate tended to distort the edges of the bloody impression giving it a diffused appearance. Care should be taken to follow the manufacturer's mixing directions and error on the side of having a cast of a little thicker viscosity. These findings also suggest that bloody impressions should be fully dried before casting. Attempts at casting "wet" blood impressions may yield less than desirable results. A Dental stone backing can be placed over the back of the Alginate cast (once it has set up) to strengthen it if desired. This backing should be placed immediately following initial photographs. Strips of cut burlap (1" x 6") placed between the two casts will help add strength to the bond. Again, the application of LCV and subsequent photography should occur immediately after lifting the cast so pre-planning is important. Failure to document the impression with photography within a few hours could negate the value of the cast for comparison to known footwear.

This research indicates that Dental stone, Mikrosil®, and Polyvinylsiloxane will likely yield very poor results when used to cast bloody shoe impressions from the described surfaces. As such, their use for this type of documentation is not recommended. Alginate, however, appears to be an effective casting product for recording bloody shoe impressions not suitable for basic photography due to a dark colored background. The light color of most common alginate mixtures means the blood impression should have improved contrast relative to the dark colored surface from which it was lifted. The ability to cast treated blood prints and post-process these casts with LCV adds additional choices of documentation and collection for the criminalist. The wide availability of Alginate, commonly used in dental offices, the ease of mixing, and the low cost, combine to make Alginate a versatile tool in the criminalist's arsenal. Photographic or video documentation of treated and untreated bloodstain impressions should still be utilized to the fullest extent possible of the agency. The non-destructive nature of photography as well as the likelihood of obtaining the best possible image should not be overlooked or replaced by casting. This method of casting however, may present the criminalist with another means of recording impression detail that otherwise may not be obtained. Additional findings with other surfaces and enhancement reagents should be reported so that we may better understand the full utilization of casting methods for bloody impressions.

References

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Acknowledgements:

I am grateful to Dr. Michael Dobersen and the staff of the Arapahoe County Coroner's Office for their assistance and input to this research.