BULLET CASTINGS: RECOVERY OF STRIATIONS

Kristen Fowble and Timothy Palmbach, J.D
University of New Haven-Department of Forensic Science
Henry C. Lee College of Criminal Justice and Forensic Sciences

ABSTRACT

Fired bullets can be traced back to the gun they were fired from by careful examination and comparison of the tiny scratches known as striations on their surface. These striations are used to compare a recovered bullet from a scene to a bullet fired from a suspected weapon at the crime laboratory. Instead of sending the questioned bullet from one jurisdiction to another for comparison, castings can be made. This allows one jurisdiction to keep their original evidence and maintain chain of custody while still providing assistance to another jurisdiction.

The first casts were made with Mikrosil® and TRITECHFORENSICS Silicone Casting Material. These casts were negative images of the bullets. Since they are negative images, it is not possible to compare a bullet with a cast; only cast to cast comparisons can be done. To combat this, a double cast was made my pouring Rio Grande® jeweler's wax into the casts to make a wax bullet.

The striations on each land and groove of the fired bullet were counted. The striations on each land and groove of the wax bullet made from the same bullet were counted. The obtained average percent recovery was 85% for the lands and 82% for the grooves.

MATERIALS AND METHODS

Fired bullets were placed under Leeds Firearm Comparison Microscope. Each land and groove of the bullet was photographed using SPOT Advance version 4.6 software. The first casting material used was Mikrosil®. Mikrosil® is a silicone based casting putty that comes in two separate tubes. Equal lengths of each tube were squeezed onto a card and mixed together for a few seconds. The Mikrosil® was then spread onto the fired bullet's surface. This method caused many air bubbles in the cast. Next, the Mikrosil® was mixed and placed in a bottle cap. The fired bullet was then placed in the cap and rotated to cover all sides of the bullet. This method also left behind many air bubbles in the cast. A small piece of solid wood was then drilled with holes ⅛ inch, 13/32 inch, and 23/64 inch in diameter. The Mikrosil® was then mixed and spread into opening of the 13/32 inch hole and the bullet was forced in the hole to allow the Mikrosil® to cover its entirety. This hole was used for 9mm bullets and the ½ inch hole was used for .40 and .45 caliber bullets. The Mikrosil® was found to not be easily removed from the wood bar. A small steel bar was then drilled with the same diameter openings. The Mikrosil® was easily removed from the steel bar, but under the microscope air bubbles were still present. Since Mikrosil® takes longer to dry in colder temperatures, the steel bar was then placed in the freezer to cool. The Mikrosil® was then mixed and placed in the opening of the cold steel bar. The bullet was then guided to the center of the hole using a toothpick and forced in the hole. The bar was then returned to the freezer for approximately 20 minutes while the Mikrosil® set. The bar was then removed from the freezer; the bullet and cast were removed from the bar. The cast was then inverted to show the side with striations and photographed under the microscope.

The second casting material used was the TRITECHFORENSICS Silicone Casting Material. Four parts silicone rubber, one part catalyst and 2 drops of accelerant were mixed together. This mixture was then placed in the opening of the metal bar. The fired bullet was then forced into the opening and allowed to set for 30-45 minutes. The bullet and cast were then removed from the bar. The cast was photographed under the microscope. These casts were bright blue and striations were not distinct under microscope.

Double casts were then made using Rio Grande® jeweler's wax. The wax was melted in an oven. When wax melted, molten wax was placed in cast still in metal bar. The bar was placed in the oven to allow wax to settle. Wax was added until entire cast was filled. The wax and bar were then allowed to cool. The wax bullet was then removed from bar and photographed under microscope.

The striations on each land and groove of the fired bullets were counted as well as the striations visible on the wax bullets.

RESULTS

The Mikrosil® and TRITECHFORENSICS Silicone Casting Material casts gave a negative image of the fired bullet (Figure 1) as shown in Figure 2. To make a cast in the same orientation as the fired bullet, jeweler's wax was used to make a double cast. The double cast wax bullet is shown below in Figure 4 with the corresponding bullet in Figure 3. Figure 5 shows the correlation between the same land of a wax bullet and a fired bullet. In table 1 the number of striations counted on each land and groove of a fired 9 mm bullet and its corresponding wax bullet are shown with the percent recovery of striations.

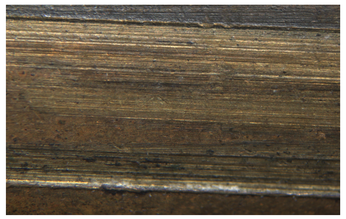

Figure 1: Land of fired .40 caliber bullet at 35x magnification.

Figure 2: Mikrosil casting of .40 caliber fired bullet from Figure 1. It is a negative image of the same land of the fired bullet.

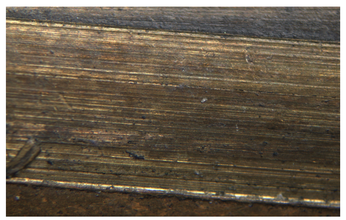

Figure 3: Land of 9 mm fired bullet at 35x magnification.

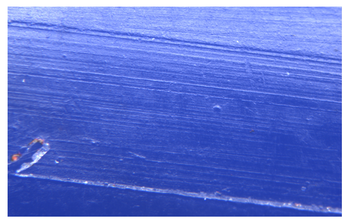

Figure 4: Wax bullet made from cast of 9 mm fired bullet from Figure 3. Same land showed in Figure 3.

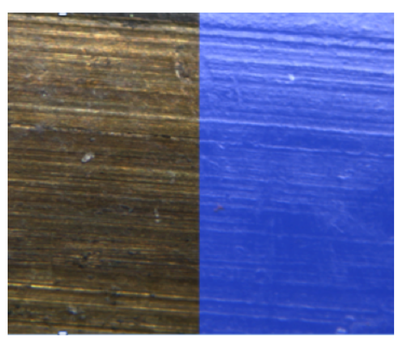

Figure 5: Combination of Figures 3 and 4 showing the correlation between the fired bullet and wax bullet.

NUMBER OF STRIATIONS				
		Fired Bullet	Wax Bullet	% Recovery
Land	1	92	79	86%
	2	100	85	85%
	3	95	79	83%
	4	99	74	75%
	5	80	81	101%
	6	89	72	81%
Groove	1	22	21	95%
	2	30	16	53%
	3	29	23	79%
	4	27	25	93%
	5	46	42	91%
	6	46	37	80%

Table 1: Results from counting striations on both fired bullet and wax bullet.

DISCUSSION

These results show that the wax bullet does retain the majority of the striations from the fired bullet as seen in Table 1. As seen in Figure 5, the striations can be matched between the wax bullet and the fired bullet. The Mikrosil® and TRITECHFORENSICS Silicone Casting Material casts were negative images of the fired bullets and could not be directly compared.

By freezing the metal bar, the occurrence of air bubbles was reduced and the quality of the cast was improved. This was most likely due to the longer drying time at the lower temperature. This allowed for the Mikrosil® to settle in the microscopic striations.

The bright blue color of the TRITECHFORENSICS material led to less than ideal photographs. The striations were not visible in the lighting of the microscope. The casts were sufficient to make wax bullets from, but the actual casts could not be properly examined.

The wax bullet lands and grooves were slightly smaller than the lands and grooves of the fired bullet. This may be because the Mikrosil® cast expands when the bullet is removed. To match the wax bullet to the fired bullet, the picture had to be expanded.

CONCLUSION

Silicone castings of fired bullets may be useful in creating a double cast for comparison. Since the silicone castings are negative images of the actual bullet they cannot be used for direct comparison. Double castings made with wax are temporarily useful to be used for comparison. The surface of the wax is easily scratched which destroys the striations. Mikrosil® and TRITECHFORENSICS Silicone Casting Material are both suitable to make casts of fired bullets. The method of using Mikrosil® had to be changed from the included directions. The material must be cooled to allow proper casting without air bubbles.

Further research needs to be done concerning bullet fragments and casting materials to see if striations can be recovered. Further research also needs to be done on a more permanent double casting material that will not be as easily destroyed as the wax bullets.

ACKNOWLEDGEMENTS

We would like to thank the Henry C. Lee College of Criminal Justice and Forensic Sciences in providing the materials needed for this research. We would also like to thank the University of New Haven for providing funding for this research through the Summer Undergraduate Research Fellowship.