

The Effects of Scavenging and Weathering on Fabric Damage

Sandra L Koch and Kc L Deaver
FBI Laboratory Trace Evidence Unit

Fabric damage cases often involve looking at cut/tear marks in clothing and attempting to make a determination as to what type of weapon may have produced the marks as well as if a particular weapon is consistent with having made such marks. Testing the method of damage through test cuts or test fires with the suspect weapon is the best method for determining whether or not a particular weapon or type of weapon may have caused the damage. In casework, there are additional processes that a damaged article of clothing may undergo before it is examined in the lab and those processes may be the cause for some of the differences seen between the test marks and the observed damage. This project is an attempt to reconcile some of those differences. Several clothing items were stabbed and shot, then the fabric damage was documented and sent out to two different universities where research is conducted on entomology and forensic anthropology so the normal decomposition processes and scavenging activity could be reproduced. Analysis conducted between the initial damage and the damage post-exposure, showed some alteration; however the effects of scavenging and weathering were not significant enough to preclude a determination of the type of weapon that produced the damage.

Fabric damage cases have been the subject of relatively few research projects yet can be critical evidence in some homicide or assault cases. Unless fibers from the clothing are actually found on the weapon, the conclusions reached are often ambiguous and will include other weapons or tools of similar size and shape in addition to the submitted knife as being consistent with the identified fabric damage. The purpose of this research was to determine if weathering

and scavenging activity can alter the cut/tear marks produced from gunshots or stabbings by the time the evidence gets to the laboratory.

Figure 1 below is an example of a stabbing case where several knives and screwdrivers were sent in for test comparisons to the fabric damage identified on the victim's shirt. Test cuts were made with the knives and screwdrivers and compared to the fabric damage identified on the shirt. Certain marks were determined to be consistent with knife marks while others were determined to be consistent with the fabric damage pattern produced by the screwdrivers; however the specific weapon was not able to be positively identified.



Photo 1 shows another fabric damage case which involved a body that was not recovered for a period of several months. The suspect in this case was a hunter and owned several dogs and raised wild hogs. The victim's body was found in a grain silo and the investigators speculated that there could have been raccoon activity inside. Questions arose as to if the

Photo 1:



damage could have been from a close contact gunshot or from scavenger activity, but the exact nature of the fabric damage could not be determined.

Based on the questions that arose from these cases, this study was developed to determine if these questions could be answered.

MATERIALS AND METHODS

This project was done in two portions; a baseline study of new shirts with fabric damage created in the laboratory and then placed on pigs for varying times over a period of one month at the Mosquito Research Laboratory associated with the Texas A&M Entomology department and a second portion utilizing worn shirts and pants placed outside for a longer period of time on human remains at the Forensic Anthropology Center at the University of Tennessee. Stab marks and gunshot holes were made in the clothing in the same pattern for all clothing items. The purpose of our study was to document any changes to the fabric damage that may occur due to the

Photo 2:



decomposition process or exposure to scavengers and insects attracted to clothed bodies left out in the elements or buried in shallow graves.

Materials and Methods - Texas A&M Portion of Project

Six plain 100% cotton T-shirts numbered #1 through Q6 were purchased and fabric damage was created in the lab utilizing the following weapons. A Ruger GP100 was used to shoot the following three types of ammunition in a line down the right side of each T-shirt at a distance of approximately 36”:

- A. Winchester 38 Special Super Match, 148 Gr. Lead Wad Cutter
- B. Blazer 357 Mag., 158 Gr. JHP (Jacketed Hollow Point)
- C. Sandia Die & Cartridge .38 Special, 158 Gr. Round Nose Lead Bullet

Each T-shirt was shot with the ammunition in an “ABC” order with the top shot being the Winchester 38 Special (A) at the right shoulder and the bottom shot being the Sandia Die & Cartridge .38 Special (C) towards the bottom of the shirt.

Each T-shirt was also stabbed twice on the left side with both of the following single and double edged knives:

- A. Carson Design M16-032, U.S. Pat. 5.596.808, Taiwan (Single Edged)
Blade was 13/16” wide, 3 3/8” long, and a blade and handle length of 8 1/8”
- B. Colts’ 62316, Hartford, Conn. U. S. A. (Double Edged)
Blade was 7/8” wide, 6 5/8” long, and a blade and handle length of 11 3/4”

The T-shirt’s were stabbed in an “ABAB” order with the Carson Design M16-032 (A) beginning at the top left and followed by the Colts’ 62316 (B) toward the bottom left.

The fabric damage produced on each T-shirt was examined, photographs taken, and all the stabbing cut/tear marks and gunshot holes found on the T-shirts were measured and documented. Each T-shirt was then wrapped individually and given a unique identifier (#1-6) and packaged and mailed to Dr. J.K. Olson at Department of Entomology at Texas A&M University in College Station TX.

At Texas A&M, each T-shirt was placed on a pig carcass and placed out at various dates and times at the Mosquito Research laboratory (Bldg. 1043, Texas A&M University, West Campus, Agronomy Road, College Station, TX 77843-2475). The dates, times, and treatments of the carcasses were as follows, with the carcass number corresponding to the T-shirt number:

Table 1: Placement of shirts

#1 210-220# Wild Boar Hog	Set out at 0600 on 02/28/07	Placed on lawn and exposed to sunlight, with no shade during the day.
#2 210-22# Wild Boar Hog	Set out at 0600 on 02/28/07	Placed out next to insect rearing shed on west side of Bldg 1043. Shaded during the early morning and late afternoon.
#3 15-20# Male Piglet	Set out 03/06/07 at 1100 hrs.	Placed in the attic of Bldg 1043
#4 20-25# Male Pig	Set out on 03/21/07 at 1430 hrs.	Placed in trunk of car in parking lot of the TAMU Urban & Structural Entomology Center Car exposed to direct sunlight all day long when there was no cloud cover.
#5 65-75# Male Pig	Set out on 03/25/07 at 1400 hrs.	Placed in a sealed Cardboard box in a heavily shaded area of the mosquito research lab lawn area
#6 65-75# Male Pig	Set out on 03/28/07 at 1000 hrs.	Placed under an inverted flat-bottomed "johnboat" located on a concrete patio lab at the northwest corner of Bldg 1043. Boat exposed to direct sunlight for most of the day when it was not cloudy.

All of the T-shirts were removed from the respective pig carcasses on the afternoon of Monday, 2 April 2007 (ca. 1600 hrs.). The T-shirts were each wrapped individually and mailed back to the authors (SLK, KLD) at the FBI Laboratory.

The T-shirts were then examined in the Trace Evidence Unit of the FBI laboratory. Each T-shirt was observed, photographed, and any holes found on the T-shirt were measured and documented for comparison to the original measurements and photographs.

UT Portion of Project

Two used white button down long sleeve shirts, a pair of used khakis, and a pair of used jeans were subjected to the same fabric damage in this portion of the project. Their information is as follows:

- #7 Meeting Street® Collection, 16 ½, 32/33, 80's 2-Ply Pinpoint Oxford, 100% non iron combed cotton, Made in Hong Kong
- #8 Towncraft®, 15 1/2 , 32/33, 65% Polyester 35% Cotton, Made in Taiwan
- #1 (Pants) David Taylor, 60% Cotton 40% Polyester, 32x32, RN 15863, Assembled in Dominican Republic
- #2 (Pants) Zena Jeans, 100% Cotton, RN 49628, 13, Made in Columbia

The same Ruger GP100 gun and ammunition as used in the Texas A&M portion of the study was also used to shoot in a line down the right side of each shirt and pair of pants for the clothing sent to the University of Tennessee. Each shirt and pair of pants was also stabbed twice on the left side with both of the single and double edged knives.

The shirts and pants were examined prior to leaving the FBI Laboratory, photographs taken, and all cuts and tears measured and documented. Each item was then wrapped individually and given a unique identifier, packaged and mailed to Dr Murray Marks at the Forensic Anthropology Center at the University of Tennessee. These items of clothing were placed on donated bodies for longer periods of time than those sent to Texas A&M. Scavenger activity is being monitored and once the clothing is collected and returned to the FBI Laboratory, the fabric damage will be compared to the documented damage produced in the lab.

RESULTS - A&M Portion of Project

After being exposed to the decomposition process, the shirts were reexamined to compare the shape and size of the cut/tears from the stabbings and the holes from the gunshots. Overall the similarities in size were apparent; however, the shape of the fabric damage showed some variation. The appearance of the holes from the gunshots became more defined; however, table 4 shows little difference in the actual measurements. Additional small holes appeared around the stab marks. This may be attributed to insect activity, stretching of the shirts and/or from

Photo 5: Shirt 2 stab #4 before

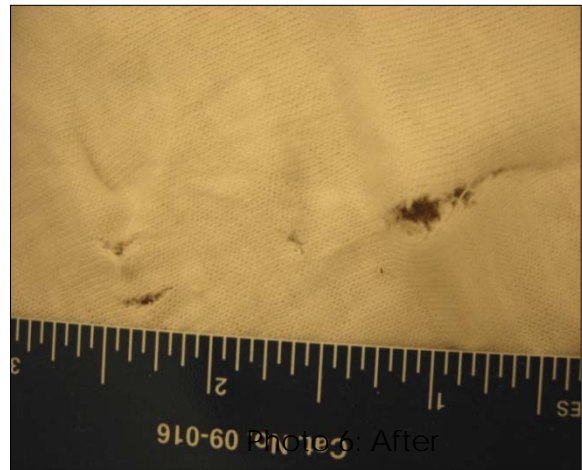


Photo 6: Shirt 2 stab #4 after

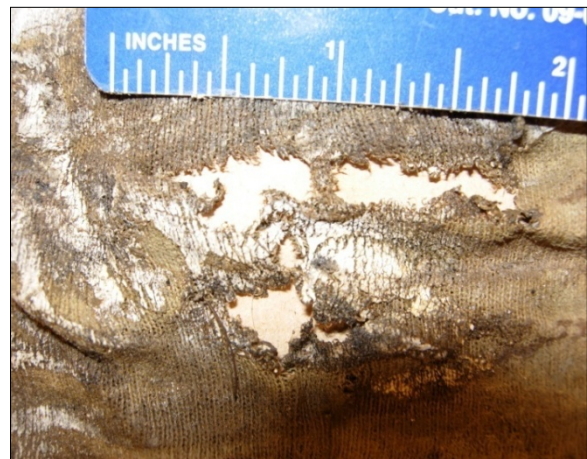


Table 2: Shirt 2 stab #4 measurements (in inches)

Shirt 2- Before	5/8	1/8	1/16	1/8	1/4
Shirt 2- After	1 3/4	1 3/4	3/4	1/8	

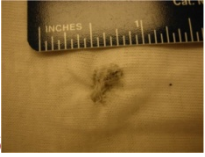













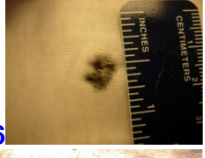





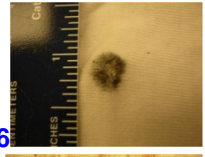





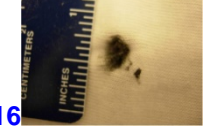
two holes becoming one. The measurements of the stab-damaged areas, notated as 1 through 5 (A-D refer to additional cut/tear marks created in the stabbing process), pre- and post-exposure for all six of the shirts are contained in Table 3. The measurements of the bullet damaged areas pre- and post- exposure for all six of the shirts are contained in Table 4.






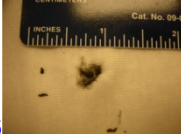



Table 3: Measurements of fabric damage from stabbing cut/tears (measurements in inches)

SHIRTS	1	2	2A	2B	2C	2D	3	3A	3B
1-Before	15/16	1 1/4	1/4	1/8			1 3/16		
1-After	2	1 1/4	1/4	1/8	1/4	1/8	2 1/8	3/8	1/8
2-B	1 5/16	5/8	1/8	1/8	1/8	1/16	1 5/8	3/16	
2-A	1 1/4	1 3/4	7/16	7/16			1 1/4		
3-B	1 1/2	1 9/16					1 1/4	1/8	
3-A	1 3/4	1 3/4					1 1/2		
4-B	1 5/16	1 9/16					1 3/4	9/16	3/8
4-A	1/2	1 9/16					1 7/8	9/16	1/2
5-B	1 1/4	1 3/8	3/16				1 3/8	1/2	
5-A	1 1/4	1 7/8	1/4				1 1/2		
6-B	1 5/16	3/4					9/16		
6-A	1 1/2	1	1/4	1/16			5/8	3/8	5/16

SHIRTS	4	4A	4B	4C	4D	4E	5	5A	5B
1-Before	1 7/16	1/16							
1-After	7/8	3/8	1/4	3/8	3/16	1/8			
2-B	5/8	1/8	1/16	1/8	1/4				
2-A	1 3/4	1 3/4	3/4	1/8					
3-B	5/8	3/8	3/8	5/8					
3-A	1/2	1/2	3/4	3/4					
4-B	1/2	1/16	3/16						
4-A	9/16	1/4							
5-B	9/16						7/16	1/16	3/16
5-A	3/4	1/2							
6-B	5/8								
6-A	3/4	1/8	1/8	1/16	1/4	1/8			

Table 4: Gunshot hole Measurements (in inches)

SHIRTS	Top	Middle	Bottom	
1-Before	 5/16	 1/4	 3/16	
1-After	 1/2	 7/16	 5/16	
Diff		3/16	3/16	1/8
2-B	 3/8	 1/4	 3/16	
2-A	 11/16	 9/16	 1/2	
Diff		5/16	5/16	5/16
3-B	 7/16	 5/16	 3/16	
3-A	 3/8	 1/2	 3/16	
Diff		- 1/16	3/16	0
4-B	 1/4	 5/16	 3/16	
4-A	 1/4	 3/8	 3/16	
Diff		0	1/16	0
5-B	 1/4	 5/16	 3/16	

5-A			
Diff	3/8	1/8	0
6-B			
6-A			
Diff	1/4	- 1/16	1/16
			- 1/16

CONCLUSION/DISCUSSION:

Overall there were some changes in the cut/tear lengths but we found that it was predominantly that the edges and the shape of the cut/tear marks became more defined through exposure. There are indications that the insect activity may have produced some of the small 1/8" and 1/4" holes that had not been present prior to exposure to the decomposition process as well as enlarging or linking some cut/tear marks that had previously been separated. For the cut/tear marks made from single edged blades, the characteristic V shaped notch found as a result of only one side having a blade cutting through fabric was visible and had not deteriorated. This is an important feature when doing comparisons in stabbing casework and in identifying a potential weapon type.

The items of clothing sent to the University of Tennessee Forensic Anthropology Center have been placed outside for an extended period of time in an area where raccoon scavenging has been recorded in the past. This portion of the project is continuing and we hope to present the results of our analysis of that clothing at the 2008 AAFS Meeting in Washington, DC.

References:

Taupin, Jane M, Franz-Peter Adolf and James Robertson “Examination of Damage to Textiles” *Forensic Examination of Fibres* J. Robertson and M. Grieve Eds., Taylor & Francis Forensic Science Series, Philadelphia, PA, 1999, pp65-87.

FBI Laboratory Fabric Examination Protocols

Monahan, Debbie L and HWJ Harding “Damage to Clothing – Cuts and Tears” *Journal of Forensic Sciences*, Vol. 35, No. 4, 1990, pp901-912.