GLASS CUTS IN CLOTHING

Helen R. Griffin, Ventura County Sheriff's Department Forensic Sciences Laboratory, Ventura, California

ABSTRACT

Clothing damage observed in case work appeared to have been caused by forced contact with broken glass. Experiments were done to determine the characteristics of cuts in clothing caused when the wearer entered through a broken window. Clothing consisting of both synthetic and natural fibers in both knit and woven fabric was obtained. Cuts formed when the clothing was forced against broken glass were documented. It was determined that glass cuts in clothing can have characteristics indicative of multiple, shallow, sharp blades.

INTRODUCTION

Trace evidence examiners routinely examine clothing evidence for stains and damage as well as for the presence of trace evidence. In fact, although trace evidence can seldom be identified to a unique source, probative questions are often answered by how the evidence was deposited or how it has been damaged. To answer these questions, the forensic scientist must be aware of what to look for.

Although cuts made during stabbing and cutting events have been well documented (Chapter 4 of Forensic Examination of Fibres Second Edition (1) lists thirty-four references covering 1954 through 1998) there is limited documentation on slashing type cuts. Monahan and Harding (2) noted that slash cuts start and finish with a V shape in

which the cut yarns are sometimes interlaced with uncut yarns. The presence of uncut yarns can also occur in the middle of a slash cut (2). Taupin (3) noted that rolling a sand bag covered with cloth in broken glass resulted in discontinuous cuts and that the number of cuts depended on the number of shards or points on a broken bottle. In 2007, a book will be published with a chapter by this author discussing glass cuts in fabric (4).

HISTORY

In 1994, a homicide case involved a prosecution hypothesis that the defendant had broken into his girlfriend's home through a bedroom window and waited in hiding until she returned from work. The suspect's clothing was examined for glass fragments, which were recovered. These fragments proved to be similar to the broken window by refractive index measurements. Additionally, the pieces of the broken window were physically fit back together. The breakage started at a point on the window frame where a screwdriver had left marks on the exterior of the window frame. The direction of breakage (from the outside) was confirmed by the conchoidal marks on the edges of the broken pieces.

During the course of examining the jacket for glass fragments, it was noted that the lower portions of the right sleeve had multiple small cuts. These cuts were examined up to 40X magnification with a stereomicroscope. The jacket was a tight-weave cloth fabric and the cuts did not appear typical of knife or scissors cuts. Where cutting occurred, the fibers were cleanly cut. However, cutting occurred **only** on the surface yarns of the weave. Also, some yarns were skipped over and did not show any cutting. Intermixed with the cut fibers were pulled fibers. Further, two of the cuts were parallel and spaced

approximately 4 millimeters apart along their lengths (a simulation of these parallel cuts is shown in Figure 1).

Figure 1 shows parallel cuts in the surface of a woven fabric. Note that the cutting is also discontinuous.

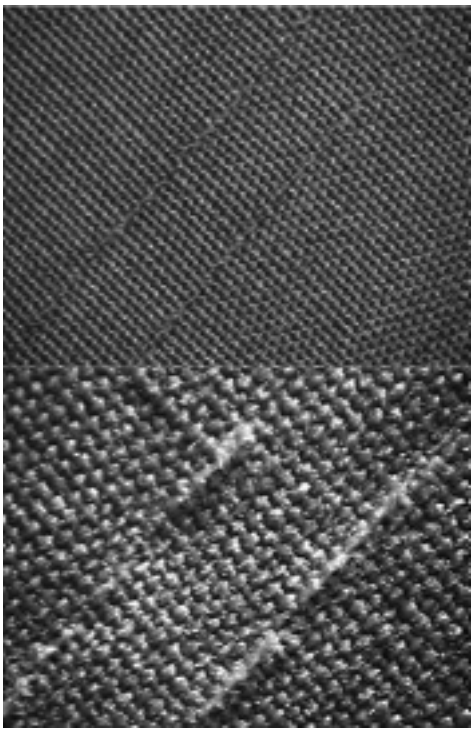

Figure 1 - Parallel cuts in woven fabric.

A number of these characteristics had previously been observed in cuts on clothing submitted from burglaries involving broken windows. Test cuts were made in an undamaged portion of the homicide suspect's jacket. A sharp knife blade, a dull knife blade, and freshly broken pieces of glass were used to make the cuts. The sharp knife cut cleanly through the entire weave even with very light pressure. The dull knife resulted in more tearing than observed in the damage to the right sleeve when light pressure was used. With heavy pressure the dull knife cut through all layers of yarns in the weave. The

broken glass made cuts similar to those observed in the damaged area of the jacket's right sleeve. This data was combined with the presence of glass fragments on the jacket similar to glass from the broken window. The evidence supported the hypothesis that the suspect broke the window, reached through to unlock it, and gained entry through it into the home.

MATERIALS AND METHODS

A study was undertaken to determine the appearance of cuts in fabric making forced contact with broken glass.

Figure 2 shows the two part wooden frame used for the experiments. The frame was built so that it could be clamped around pieces of glass to simulate a window frame

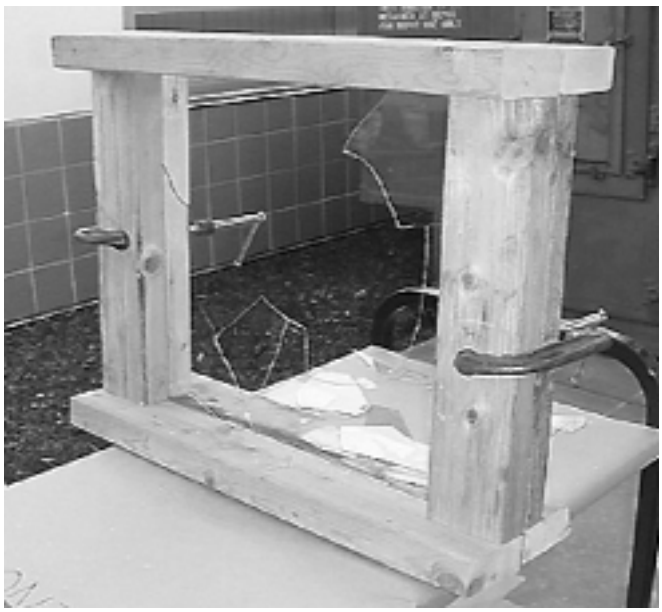

Figure 2 – Frame containing broken glass pane.

Articles of clothing were purchased from a thrift store. The clothing was selected to cover a range of fibers and fabrics - polyester/cotton weave, nylon weave, cotton denim, cotton knit, leather, and polyester/cotton knit. The clothing was free of damage prior to testing. Using safety precautions, each sleeve of each article of clothing was pushed through a freshly broken hole in a pane of glass (as shown in Figure 2). The clothing was then examined for glass fragments associated with the cuts. The cuts were examined up to approximately 100X magnification. The appearance of the cuts was documented. The cuts were photographed both with and without magnification as shown in figures 5, 6, 7, 9, and 10.

RESULTS

Pieces of broken glass under low magnification revealed thin, sharp blades as well as broad broken edges. A number of sharp blades were observed on a single broken glass surface. These observations are illustrated in Figure 3.

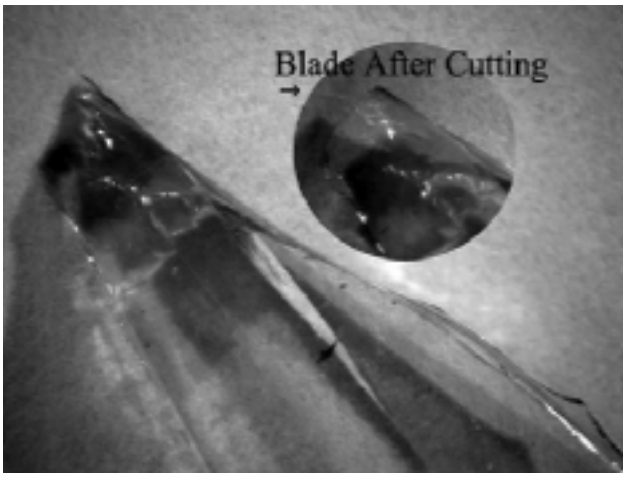

Figure 3 – Magnified view of a glass shard.

The inserted photograph in Figure 3 shows that only the thin, sharp portion of the glass blade was worn away during cutting.

Also, in the broken panes, there were often a number of broken shards around a central opening. This provided multiple cutting surfaces as shown in Figure 4.

Figure 4 – A broken tempered glass window.

No glass was found directly associated with the glass cuts made in the clothing. However, there were characteristics that were observed to be common to glass cuts in all of the clothing.

The broken glass routinely sliced cleanly through the surface yarns, while leaving the underlying yarns undamaged (Figures 1 and 5). The lower cut in Figure 5 shows cutting only on the surface. The cut is also discontinuous.

Figure 5 – Parallel, shallow cuts.

When all of the yarns were cut through except a few, the remaining yarns bridged the gap as illustrated in Figure 6.

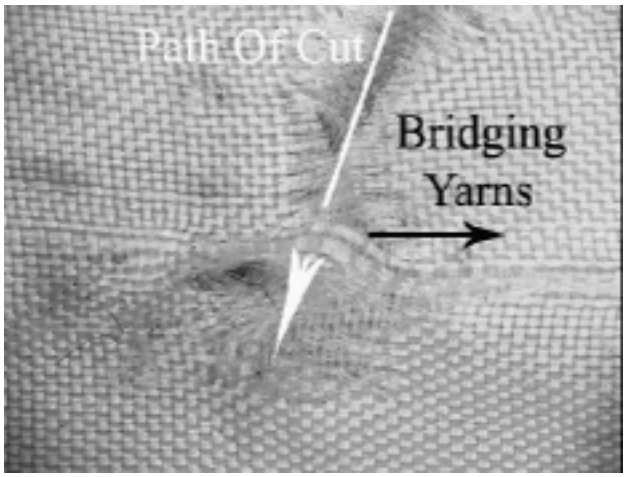

Figure 6 – Cut yarns bridged by uncut yarns.

Figure 7 illustrates the occurrence of parallel cuts in leather. Parallel cuts were often seen and occurred in all of the fabrics examined.

Figure 7 - Parallel cuts.

Although cuts occurring in multiple directions were observed in the study, the formation of small pieces of fabric cut away from the clothing has only been observed in a pair of nylon weave pants from a robbery where the suspect was found guilty and there was evidence from multiple sources against the suspect (see Figure 8). During the commission of the robbery of a jewelry store, a teller shot one of the two suspects. The suspects made a quick exit by breaking a tempered glass window in a back door. The injured robbery suspect wore a pair of nylon weave jogging pants. The damage to the pants had the common characteristics of glass cuts, but also had small pieces of fabric cut away from the pants. Figure 8 shows the multiple directions of the cuts that resulted in the formation of small pieces of fabric.

Figure 8 – Multiple cuts.

In addition to the glass cuts in the pants, a pocket was formed between the outer shell and the lining. Cubes of tempered glass with the characteristics of the broken glass in the jewelry shop door were located in this created pocket.

An added feature in the leather was the formation of small tags at the end of some cuts. As the blade cut through the leather it gouged out a small strip of fabric that was loosely adhered to the end of the cut.

Figure 9 – Leather tag.

Although the broken glass produced cuts in the clothing, it also produced tears. Figure 10 illustrates the lack of distinctive characteristics in tearing caused by broken glass.

Figure 10 – Glass tear in knit fabric.

CONCLUSIONS

The cuts observed in clothing that has been forced through a broken window can have characteristics indicative of multiple, shallow, sharp blades.

Multiple cutting appears to occur due to the presence of multiple cutting surfaces both on single shards of glass and on multiple shards of glass. Since the blades are often aligned in one plane, the multiple cutting can result in parallel cuts.

Shallow cuts appear to occur due to the depth of the actual cutting edge being narrow, after which the blade width quickly broadens. The cuts are often discontinuous, possibly due to the glass becoming dull, re-breaking, and forming new blades.

Freshly broken glass has razor sharp, thin blades capable of forming very cleanly cut fibers. However, broken glass also has broad surfaces that can catch fabric and result in tearing. Rapid changes in the direction of the cutting have been observed in slash cuts made by glass. Since the blade, target, or both can be moving while the cut is being formed, the multiple cuts formed can result in small pieces of fabric being cut away.

In most cases each damaged area on an article of clothing damaged by broken glass, taken individually, could be made by something other than glass. However, the combined properties of all of the damage present can sometimes be very convincingly linked to broken glass. Combining information on clothing damage with the presence of glass that could be from a point of entry or exit from a crime has definite probative value.

Acknowledgements

The author would like to thank the Washington State Patrol and Ventura County Sheriff's Department for providing the facilities and time to do this study. Thanks to Val Copeland

for assistance with the initial portion of this study. Thanks to Geoff Bruton for editing suggestions.

REFERENCES

1. Taupin, J.M., Adolf F.P., and Robertson, J. Examination of damage to textiles, Forensic Examination of Fibers, Second Edition, J. Robertson, M. Grieve (Eds.), Taylor & Francis, London, 1999.
2. Monahan, D.L. and Harding, H.W.J. Damage to Clothing – Cuts and Tears. Journal of Forensic Sciences 1990; 35(4): 901-912.
3. Taupin, J.M. Testing conflicting scenarios – a role for simulation experiments in damage analysis of clothing. Journal of Forensic Sciences 1998; 43(4): 891-896.
4. Blackledge, R.D. Forensic Analysis on the Cutting Edge. Wiley-Interscience, 2007.