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3.12 Fabric / Textile Damage

3.12.1 Introduction

Textile items are occasionally submitted to the laboratory for examination to determine if the item has been damaged. Different types of damage (tear, cut, burn, etc.) may be distinguished through examination. Information as to the possible implement causing the damage and the manner in which it was caused may also be determined. Information from these examinations may corroborate a crime scene scenario, refute particulars in crime scene scenario and/or assist with determination of death in decomposed bodies.

Terminology:

Fabric Terminology

Fabric - an assembly of fibers or yarns that has a substantial area in relation to its thickness

Fibers - the smallest unit in the construction of a fabric

Knits - series of interlocking loops

Non-woven fabrics - bonding or interlocking of fibers, or both, accomplished by mechanical, chemical or solvent means

Selvedge - the outer finished edge of a fabric

Thread - generic term that means a textile yarn in a general sense

Weaves - sets of yarns interlaced at right angles in established sequence

Yarn - groups of fibers twisted together to form long strands

Additional Textile Damage Terminology (in addition to those listed below)

Abrasive damage - caused by the material rubbing against another surface

Animal damage - bite marks and other severance produced through the jaws and feet of an animal

Cut - Severance with neat edges produced by a sharp instrument

Heat damage - damage may range from minor (slight scorching) to combustion

Hospital-type damage - created by medical personnel in order to examine patient - most often caused by scissors and tearing

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Microbial damage - Irregular damage to material, most often seen in burials

Nick - small cut or notch, sometimes at an end of a cut

Pilling - small balls of fibers formed by friction

Planar array - ends of fibers or yarns line up in the same plane

Puncture - hole produced by blunt implement in thrusting action

Simulation - an experiment designed to reconstruct a proposed scenario as accurately as possible

Slash-cut - cut produced by implement cutting along material, which may or may not penetrate the fabric. These are frequently seen with surface cuts at one or both ends.

Snippets - short segments of yarn created if a knit fabric is cut at an angle to the thread direction

Stab-cut - cut produced by penetration of an implement through the material

Stoppages - created by scissors in the opening and closing action

Tear - Severance caused by the pulling apart of a material leaving ragged or irregular edges

Tensile failure - fracture of the textile through pressure, especially in ropes and webbing

Tufts - collection of snippets or loops of yarn from a knit

Wear and tear - damage caused to garments in the course of everyday wear, such as matting of yarn ends and pilling

3.12.2 Safety

Waste generated by this method should be disposed of according to written laboratory procedures.

Biohazard precautions should be taken, if applicable.

3.12.3 Preparations

Forceps, stereomicroscope, foam and/or gelatin block, camera

3.12.4 Minimum Standards and Controls

See instrument-specific minimum standards and controls.

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3.12.5 Instrumentation

SEM-EDS

3.12.6 Procedure or Analysis

The following is a guideline for the scientist. Specific cases may require more or less analysis.

1. Obtain background information if possible
2. Conduct a visual examination of the textile.
3. Record damage (location and "original" appearance of the damage on the textile should be photographed)
4. Examine the damage in detail:

Assessment and Descriptions of Damage

The following observations/recordings may be made during visual examination of a damaged textile:

Appearance of Severance

Length - The distance (along the line of severance from point of entry) or the displacement (measure severance from end to end in a straight line) of a cut can be recorded.

Distortion - Uniformity of the interlacing looping points has been disturbed with respect to the rest of the fabric. Wales, courses, warp or weft yarns may be permanently moved apart, stitching is strained; loops are elongated or shortened in neighboring stitches to accommodate the new configuration. Best practice is to record where the distortion is located.

Curl - Curl is often seen in knitted fabrics that have been cut. The fabric rolls onto itself. To examine the severance, the cut should be gently flattened and curl noted. _

Shape - The severance can be straight, curved, angled, etc. A drawing or photo will aid in documentation

Secondary cuts - Small cuts which are close to, but separate from, the primary or major severance and which may have been formed during penetration or withdrawal of the knife.

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Body fluids - Can be an indication as to the age of the cut. The presence and location (ends or edges) of body fluids should be noted. The presence of body fluids on and around a cut probably indicates the cut occurred at time of stabbing. However, the absence of bodily fluids around a cut does not necessarily mean a prior or post cut.

The following terminology is used when describing severance in a damaged textile:

Appearance of Edges

Unraveling - These are long floats of yarns which have moved out of their original positions.

Isolated threads - The thread is across the severance action but has not been cut through. Thread may be laying parallel, perpendicular or 45 degrees with respect to the severance.

Planar array - The ends of fibers or yarns line up in the same plane. All fiber ends lie within the same plane at any angle to the yarn axis, and the yarn retains cohesion through twist.

Ragged - Term refers to the macroscopic appearance of the severance. Edges are irregular and do not appear clean, typical in tears.

Steps - Term refers to microscopic appearance of severance. The cut follows a prime direction and 'steps' down across the knit fabric. Yarn ends are clean cut but are not necessarily parallel to the direction of the severance.

Ruptured ends - Yarns are not in planar array. The fibers are of a variety of lengths and may, but need not, be splayed out.

Splayed out - Description for beard' or 'brush' like fibers at the end of a yarn indicating a tear

Clean cut ends - Where the end of the severance is still exhibiting planar array w/minimal distortion and/or ruptured ends

Not clean cut ends - Where one or both ends of the severance have ruptured ends and/or distortion

5. Documentation may be made via notes, sketches, film and/or digital images.

6. It may be necessary to conduct simulation experiments

- a. Ensure original appearance of textile or use comparable textile as a substitute if necessary
- b. Simulate damage
- c. Document simulated damage on textile

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7. Observations

- Sharper blades typically produce neatly cut yarns.
- Blunter blades may pull on yarns, causing distortion and increased fraying.
- Tears typically have an appearance of 'beard' pointed yarns (splayed out) viewed at the microscopic level.
- Cuts typically have an appearance of clean yarns viewed at the microscopic level.
- Blades with serrated edges may produce distinctive characteristics along edges.
- Directionality of knife blade may be exhibited in a stab cut.
- Slash cuts may exhibit starting and ending points and non-continuous cuts in fabric.
- Scissor cuts may exhibit stoppages or 'steps' in fabric.
- Puncture damage may exhibit irregular holes in fabric.
- Abrasive damage may result in thinning of material, even holes and fraying.
- Discoloration of yarns, melted fiber ends, irregular edges, and/or presence of globs on fiber ends may indicate heat damage.
- The appearance of small puncture-like holes in fibers may be the result of insects.
- The appearance of planar array along the edge of severance is indicative of a cut.
- A cut produced by a single edge knife typically has one clean end and one not clean end.
- A cut produced by a double bladed knife typically has both ends clean.
- A cut produced by a single edge serrated blade typically has ends that are not clean.
- Unraveling of hems and seams, snags, and/or pilling may be signs of normal wear and tear.

12.3.7 Interpretations, limitations and conclusions

a. Due to a variety of factors it is not always possible to determine the cause of damage on a textile. Some possible interpretations may include, but are not limited to the following. :

Tear

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Cut
 Heat
 Animal/Microbial damage

b. The type of implement causing the damage (eg., single edge bladed knife, double edge bladed knife, ax, ice pick) may be indicated from the fabric damage.

12.3.8 References

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