C15 Interpretation of Evidence Resulting From a Stabbing Event Through Single Jersey Fabrics

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After attending this presentation, attendees will learn about the physical properties of common T-shirt fabrics, the effects of laundering, how these properties influence the residual damage after a stabbing event, and the problems associated with laboratory simulations.

This presentation will impact the forensic science community by providing information on the importance of background knowledge in textiles when assessing and re-creating clothing damaged in stabbing attacks.

Stabbing is the most common cause of murder in Australia, and knitted T-shirts worn next to the skin are popular garments. The beneficial evidence gained from textile examinations in forensic science is widely acknowledged. Simulation experiments are often required to test conflicting scenarios within a homicide inquiry because fabrics from the stab attack cannot be used for simulation testing. Substitute fabrics of similar fiber composition and physical structure are then investigated using a suitable underlying body simulant. It is usually assumed that the garment from the crime scene has previously been worn and has thus been laundered multiple times. Simulant fabrics must, therefore, be appropriately pre-conditioned prior to testing. This field of forensics is currently being investigated from both forensic and textile perspectives; however, there appears insufficient emphases on the details of the physical parameters and properties of fabrics.

This study considers the physical condition of a commonly worn single-jersey fabric damaged by a stabbing attack when it is described as “new,” “worn,” and “old.” The goal was not to present a standardized method for pre-treatment on all textile fabrics. A universal method for pre-treatment cannot be achieved since different textiles/garments have individual care procedures. A realistic Australian home-wash procedure was selected. To further degrade specimens to a level that cannot be achieved by simple domestic laundering, selected fabrics were subjected to a commercial stonewash. The intent was to identify how the physical condition of a fabric affected the residual damage inflicted by a stab penetration.

Knitted fabrics behave very differently from woven fabrics. Dyed and finished single-jersey fabrics were obtained from a local manufacturer. Pure 100% cotton knits of 140g/m^2 and 180g/m^2 were selected to determine if they behaved differently when stabbed with a given knife design and entry conditions. A 65%/35% blended polyester/cotton knit of 150g/m^2 was also evaluated.

Fabrics were laundered five times according to 5A of AS 2001.5.4-1987 and line dried between each cycle. All other fabric physical testing followed an appropriate Australian or International Standard method. The physical properties of the yarns, such as linear density, yarn twist, breaking strength, and elongation, were determined. For the fabrics, parameters such as mass per unit area, thickness, courses and wales, cover-factor, stretch and recovery, and bursting strength were determined. Dimensional stability and spirality of the knits were determined after laundering and stonewash pre-treatments. The fabrics were tested for their physical parameters and properties, in original state, after laundering, and after stonewash treatment.

One emphasis of this study has focused on re-creating the stabbing event. To produce realistic and consistent predictions, suitable human skin and tissue simulants were investigated. Due to its variability, the traditional porkbelly simulant was found to be unsuitable. Pickled kangaroo skin placed over 10% per weight Vyse ballistic gelatin was established as an acceptable representation of the human body. Kangaroo skin also shares similar fibrous structure and directional properties to human skin. A test rig was developed that enables reproducible penetration impacts at pre-determined energies. Experiments were conducted on knitted fabrics placed over the kangaroo skin and ballistic gelatin. They were stabbed using a 20cm kitchen knife, the blade of which impacted parallel to the courses, wales, and diagonally.

As the simulation model for a human body contains no blood, a simple blood-droplet absorbency test was also undertaken on the fabrics. Commercial fabrics are subjected to a number of finishing treatments which can remain on a garment after purchase. T-shirts often have a softener applied which dramatically affects their absorbency. Extractable matter was removed from the fabric before and after laundering to confirm the quantity of treatment. A modified droplet absorbency test using horse’s blood at 37±1°C determined the effects of laundering. Macroscopic and microscopic examination of the stabbed specimens revealed differences between the physical damage. These characteristics of damage were then compared to the physical parameters and properties of the fabric.

T-Shirt, Stab, Damage

 ** Presenting Author*