

CASE REPORT

Jane Moira Taupin,¹ M.A.

Hair and Fiber Transfer in an Abduction Case—Evidence from Different Levels of Trace Evidence Transfer

REFERENCE: Taupin, J. M., "Hair and Fiber Transfer in an Abduction Case—Evidence from Different Levels of Trace Evidence Transfer," *Journal of Forensic Sciences*, JFSCA, Vol. 41, No. 4, July 1996, pp. 697–699.

ABSTRACT: Levels of trace evidence transfer were examined in a casework context. A girl was allegedly abducted in a car and rape attempted by the accused, who denied any contact with the victim. Clothing worn by the victim and the accused, and the covers from the front seats of the car, were analyzed for trace evidence. Three types of corresponding fibers and four possible pathways of transfer were identified. Synthetic fibers similar to those composing the car seat covers were located on the victim's clothing, consistent with direct transfer. Secondary transfer was indicated by dyed brown human head-type hairs (possibly originating from the accused's wife) located on the seat covers and on the victim's clothing. Secondary and possibly tertiary transfer was indicated by pink synthetic material and associated fibers (possibly originating from the victim's mother) located on the victim's clothing, a car seat cover and the accused's clothing. Light microscopy, comparison microscopy, and cross-sectioning techniques were used. The multiple fiber matches and the differing pathways and levels of transfer increased the strength of the association between the accused and the victim. After the fiber evidence was led at the trial, the accused pleaded guilty, thereby affirming the value of secondary transfer evidence.

KEYWORDS: forensic science, criminal investigation, fibers, hairs, trace evidence, transfer, abduction

The value of fiber transfer evidence has been well accepted in the forensic community, but research has until recently concentrated on primary transfer. Lowrie and Jackson (1) investigated secondary transfer via clothing and seats, and concluded that seats may be more important in this type of transfer in that they are more likely to retain a reservoir of fibers. A study by Gaudette and Tessarolo (2) showed that secondary transfer of human scalp hair can and does exist in casework situations.

The study of secondary transfer, however, has usually focused on its role in contamination, especially when misinterpreted as

¹Forensic Scientist, Victoria Forensic Science Centre, Victoria Police, Macleod, Victoria, Australia.

Received for publication 22 June 1995; revised manuscript received 2 Oct. and 23 Nov. 1995; accepted for publication 23 Nov. 1995.

This case study was originally presented at the 12th Australian and New Zealand International Symposium on the Forensic Sciences, Auckland, New Zealand, November 1994.

evidence of direct contact and an incorrect association consequently made. The positive value of secondary transfer evidence has been considered in domestic animal hair transfer, but there has been a view that secondary transfer of human scalp hair exerts a negative impact on the value of human scalp hair as associative evidence (3). The following case study of *Queen vs Damevski* (Melbourne 1992) illustrates the value of secondary or even higher levels of transfer of human scalp hair and textile fibers in the casework context of associating an accused to a victim.

Case History

A Vietnamese girl was walking home after visiting her mother when approached by a man in a car. The sole occupant, a Caucasian, coerced her into the car on the pretext of being a police officer and requiring information. After a short drive, the driver stopped the car and attempted rape. During the struggle the victim saw a passing car and managed to escape and flag it down. The offender then left the scene, but the passing motorist was able to note the make, color and the first two letters of the registration number of the vehicle. The police quickly located the suspect as he had recently been released from prison for the rape of a Chinese girl in the same area. The suspect denied all knowledge of the victim.

The investigating police obtained clothing worn by the victim and the suspect, and the two car seat covers from the front bucket seats of the suspect's vehicle. These items were submitted to the forensic laboratory in separate, sealed bags. The history and subsequent analysis of the exhibits was monitored to assure contamination was prevented and guidelines followed as outlined by Grieve (4) and Robertson (5).

Methods

Fibers were removed directly from each exhibit using forceps. Loose, 'foreign' fibers were collected from the victim's clothing, the accused's clothing and the two car seat covers. Known exemplars were obtained from the fabric of the seat covers and the victim's scalp hair.

Fibers were compared macroscopically and features such as length, color, coarseness and texture were noted. Individual representative samples were mounted on glass microscope slides and microscopic examination performed using a Leitz LABORLUX S at 100 and 200 times magnification. Structural characteristics such as pigmentation, presence of delustring agent or dye, cuticle scale pattern, hair roots if present, and diameter were recorded.

Cross-sectioning of the fibers was performed using the plate method (6) to determine the presence of dye, to obtain an indication of racial origin of the hairs and to assess the method of extrusion manufacture of the synthetic fibers. Cross-sections were photomicrographed using a Wild MPS12 microcamera, WILD MPS15 Semiphotomat with 1.0 camera back attachments and 4 × 5 Polaroid film.

Results

Representative foreign fibers collected from each of the exhibits were compared microscopically. Those fibers similar in macroscopic and microscopic characteristics were classified (Table 1).

The beige synthetic fibers were similar in macroscopic, microscopic and cross-sectioned features to fibers composing the car seat covers, which were imitation lambswool. These fibers appeared to be a mixture of two types of synthetic fiber and three dyes, indicated through cross-sectional shapes of smooth lima bean (white, grey, and yellow) and circular (grey and yellow). The beige synthetic fibers collected from the victim's cardigan and skirt were in the form of 'pills.'

The pink synthetic fibers and the brown dyed human head-type hairs could not be sourced to items submitted. The pink synthetic fibers collected from the victim's cardigan consisted of a piece of synthetic woven material of one ply yarn and loose, single fibers. The pink fibers collected from car seat-cover 'A' consisted of loose single fibers and a two-ply yarn. The pink fibers collected from the accused's jeans and the victim's 'T' shirt and skirt were loose, single fibers. All the loose, single pink fibers corresponded in macroscopic, microscopic and cross-sectioned characteristics. The fibers were uniform and circular in cross-section, similar in diameter and contained delustering agent. It was known that the victim's mother was a piece-work machinist, and it was postulated that her home was the origin of the pink material. Unfortunately an exemplar could not be obtained.

The victim's scalp hair was dark brown in color and varied in length to a maximum of approximately 19.0 cm. These hairs exhibited Mongoloid characteristics (circular cross-sections and heavy pigmentation). The brown dyed human head-type hairs from the victim's cardigan and both seat-covers varied in length to a maximum of approximately 37.5 cm and exhibited Caucasian characteristics (oval cross-sections and moderate pigmentation). It was postulated that the accused's wife was the source of this Caucasian hair, but an exemplar could not be obtained.

TABLE 1—'Foreign' fibers collected from exhibits, grouped and classified.

Exhibit	'Foreign' fibers collected and compared
1. From <i>Accused</i> A pair of jeans	Pink synthetic fibers
2. From <i>Victim</i> Cardigan	2 brown-dyed human head-type hairs pink synthetic fibers beige synthetic fibers
'T' shirt Skirt	pink synthetic fibers pink synthetic fibers beige synthetic fibers
3. From <i>Car seat covers</i> Cover A	9 brown-dyed human head-type hairs pink synthetic fibers
Cover B	12 brown-dyed human head-type hairs

Discussion

The pathways and levels of transfer were postulated for the three types of 'foreign' fibers detected. Secondary transfer was defined as the first indirect transfer of fibers after primary or direct transfer, taking place via an intermediary object, and may be followed by tertiary or higher transfer (4). In this context, hairs are included as fibers.

Figure 1 depicts an overall view in associating the accused to the victim. A possible pathway for the beige synthetic fibers illustrates direct transfer. Secondary transfer is indicated by a possible pathway for the brown-dyed human head-type hairs. Possible pathways for the pink synthetic fibers illustrate direct, secondary, and tertiary transfer.

Multiple fiber matches have been previously described in a casework context in associating the accused with multiple victims (7). The case of Queen vs Damevski reinforces the value of fiber transfer evidence in not only multiple fiber matches but in varying levels of transfer. The accused pleaded guilty on advice from his defense barrister immediately after the fiber evidence was submitted and the synthetic fibers examined by a defense expert during a stay of the trial.

The shape of extrusion manufacture of the synthetic fibers and number of types were identified through cross-sectional shape, but the chemical composition of the pink synthetic fibers and the beige synthetic fibers were not identified. Consequently, this study illustrates that fiber transfer examination solely using optical techniques may carry a sufficient level of proof to induce a confession, particularly when multiple fiber matches occur. The pink synthetic fibers and dyed hair did not have known exemplars, but this did not preclude those fibers as being of considerable evidential value. The hairs and synthetic fibers were analyzed using the same techniques, simplifying the examination and subsequent explanation of results to the court.

While the exhibits were seized several hours after the abduction and after eight hours in respect of the offender's clothing, the number of foreign fibers collected indicates that transferred fibers may persist and can be valuable evidence in a casework situation. The finding that secondary transfer can be more important in contacts between clothing and horizontal surfaces than in contacts between clothing (8) is partially supported by this case. The large number of transferred fibers collected from the seat covers agrees

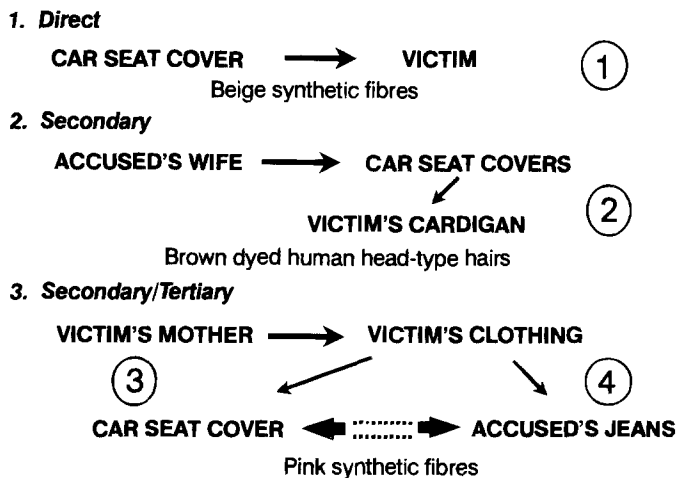


FIG. 1—Possible association of accused to victim via fiber transfer. (Note: "victim's mother" also alludes to the house of the victim's mother.)

also with findings (1) that seats are likely to retain a pool of fibers. In addition, while the issue of contamination should always be considered, the value of secondary and higher transfer should not be overlooked in trace evidence examinations.

Finally, this study illustrates that fiber transfer evidence may and will be especially useful in cases where no biological fluids are available, such as assault cases where no blood is shed or rape cases where there is no ejaculation.

References

- (1) Lowrie CN, Jackson G. Secondary transfer of fibers. *Forensic Sci Int* 1994;64:73–82.
- (2) Gaudette BD, Tessarolo AA. Secondary transfer of human scalp hair. *J Forensic Sci* 1987;32:1241–53.
- (3) Suzanski TB. Dog hair comparisons: purebreds, mixed breeds, multiple questioned hairs. *Can Soc Forensic Sci J* 1989;22:299–309.
- (4) Grieve MC. Fibers and their examination in forensic science. *Forensic Science Progress* 1990;4:44–125.
- (5) Robertson J, editor. *Forensic examination of fibers*. New York: Ellis Horwood, 1992.
- (6) Brunner H, Coman BJ. *The identification of mammalian hair*. Melbourne: Inkata Press, 1974.
- (7) Deadman HA. Fiber evidence and the Wayne Williams trial (conclusion). *FBI Law Enforcement Bulletin* 1984;13:10–19.
- (8) Pounds CA, Smalldon KW. The transfer of fibers between clothing materials during simulated contacts and their persistence during wear: Part III—A preliminary investigation of the mechanisms involved. *J Forensic Sci Soc* 1975;15:197–207.

Address requests for reprints or additional information to
Jane Moira Taupin
Victoria Forensic Science Center
Victoria Police
Forensic Drive
Macleod, Victoria
Australia 3085