

CASE REPORT

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DNA Profiling of Trace Evidence—Mitigating Evidence in a Dog Biting Case

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ABSTRACT: A young girl was the victim of a severe dog attack. An animal, suspected of having caused the attack, was later impounded for investigation. Microclots of blood, recovered from the dog's fur, were analyzed by STR DNA. Results showed that this blood was not related to the biting. Other forensic evidence—hairs, fibers, and odontology—failed to connect a particular animal to the attack. The implications of these findings for the dog and its owners are discussed as well as other forensic methods for resolving such cases.

KEYWORDS: forensic science, trace evidence microclots, polymerase chain reaction, short tandem repeat, DNA, dog bites

The close proximity of humans to domestic animals has inevitably resulted in a large number of humans being bitten by dogs (1). Such bites can be fatal due either to the severity of the bite (2) or the transmission of an infectious agent (3). Dog bites can also transmit non-fatal diseases (4) or can leave permanent injury or scarring.

We present a case in which a six-year-old girl was attacked by a large, light brown dog. A passerby managed to separate the dog from the girl, after which, the dog ran away. The victim was taken to hospital suffering from multiple bites on one arm and on the scalp. In addition to the bites, her arm was found to be broken as a result of the attack. No other person, including the passerby, was reported to have been injured in the attack. Shortly after the attack, a number of individuals arrived at the scene.

Based on reports of eyewitnesses, investigators located a ten-month-old Neapolitan mastiff dog (Mastino Napoletano) which they believed could have been responsible for the attack. The owners of the dog stated that there were other dogs in the area similar to theirs and claimed that it was one of those that had injured the girl. Still, their animal was impounded for medical and forensic examinations.

The clothes of the victim, the clothes of the man who assisted her, and the collar of the Mastino Napoletano were submitted to our

laboratories for examination. A reference dog hair sample, collected by a veterinarian who combed the entire suspect animal, was also sent. Neither the investigators nor the veterinarian observed blood on the dog's coat.

Materials and Methods

A4 size sheet tapings were taken of the clothes of the victim and the clothes of the individual who assisted her. Hairs and fibers on these tapings as well as the reference dog hairs were examined by stereomicroscope. Two types of particles adhering to the reference dog hairs were observed. Type I particles (Fig. 1) were of a dark, reddish-brown color and generally appeared to be attached to one side of a hair. By contrast, Type II particles (Fig. 2) were lighter in color and were considered to be surface dirt. Type I particles were subjected to the Kastle-Meyer (K-M) test (5), a presumptive test for blood.

DNA was organically extracted (6) from four Type I particles teased from the dog hairs. The extracted DNA was amplified at the CSF1PO, TPOX, THO1, F13A, FESFPS, and vWA loci using the Promega Geneprint™ Multiplex systems. The STR PCR products were separated on a 4% denaturing polyacrylamide gel and silver-stained (7). Subsequently, a blood sample was obtained from the bite victim. DNA was extracted, amplified, and profiled as above.

Results

A positive reaction for the presumptive test for blood (K-M) was obtained on a Type I particle separated from the reference dog hair. Material sampled from the dog collar (including the buckle) did not react in the K-M test.

DNA from the four microclots (Type I particles) from the reference dog hairs was profiled at all six of the PCR STR loci. The profiling obtained at the F13A, FESFPS, and vWA loci are shown in Fig. 3. The DNA profiling of the blood of the bite victim did not match the profile from the microclots.

Five canine hairs were identified by microscopy from the tapings taken from the victim's clothes; none had microclots of blood attached. Dog hairs were not present on tapings from the clothes of the individual who assisted the girl. Finally, no fibers, that could be compared with the victim's clothing were found in the reference hair sample combed from the dog.

A forensic odontologist was consulted with regard to the bite marks sustained by the victim. In this case, he determined that he could not carry out a meaningful examination.

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FIG. 1—A microclot of blood attached to the shaft of a hair sampled from the suspect dog. Scale bar = 50 microns.

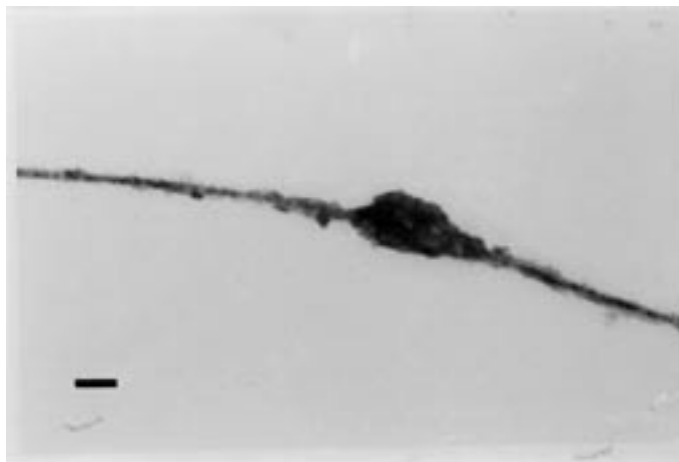


FIG. 2—Surface contamination surrounding the shaft of a hair sampled from the suspect dog. Scale bar = 50 microns.

Discussion

In this case, trace evidence, in the form of blood microclots in hair, was recognized with the aid of a stereomicroscope. Subsequently, DNA profiling of the trace evidence excluded the bite victim as being the source of this blood. Our ability to profile the trace amount of biological material had an important bearing on the outcome of the case. The exclusion by DNA profiling, precluded possible serious legal and/or financial consequences for the owners of the animal.

The owners of the dog were, however, charged with negligence for not having properly restrained their animal. Although their dog was not implicated in the mauling of the girl, eyewitnesses reported seeing the animal unattended in the area following the attack.

Finally, the identification of the blood from the dog's fur as having originated from a source other than the girl, prevented the animal from being put down (destroyed). Instead, by court order, the dog was not returned to its owners, but rather taken by authorities to be trained for service in the canine corps.

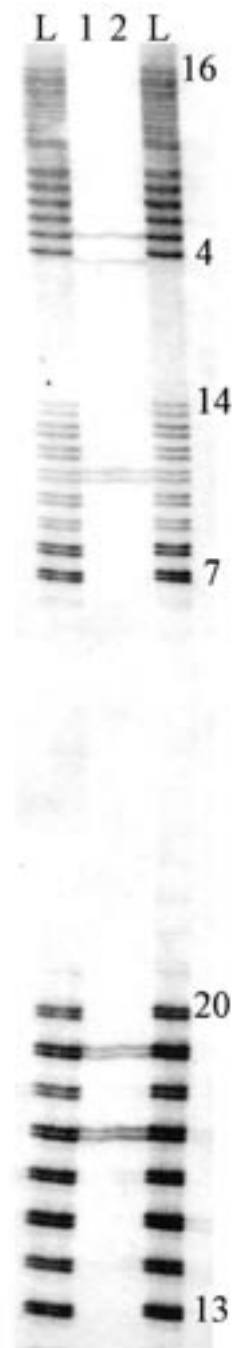


FIG. 3—Silver-stained DNA profile of Type I particles at the simultaneously amplified STR loci F13A, FESFPS, and vWA (from top to bottom). Lanes 1,2:F13A 5-3.2, FESFPS 11-11 and vWA 19-17. L:allelic ladder. The numbers to the right of each ladder represent the number of repeat units in the allele at each locus.

Conclusion

There are a number of approaches in identifying a dog suspected of having inflicted a bite on a human. These are as follows:

- 1) Dog hairs may be found on the victim's clothing. Microscopic examination, followed by mitochondrial DNA analysis (8,9), may help to include or exclude an animal.

- 2) Dog saliva or blood left on the victim's clothing or skin may be a source of nuclear DNA (10) or mtDNA (11).
- 3) Fibers from the victim's clothing may be transferred to a dog's fur.
- 4) Odontological analysis of bite marks may provide conclusive evidence in identifying a particular animal (12).
- 5) Blood of the victim may be found in the fur of the suspected animal. Blood in trace amounts, as we found, may also assist in resolving some dog bite cases.

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