J Forensic Sci, Jan. 2003, Vol. 48, No. 1
Paper ID JFS2002241_481
Available online at: www.astm.org

CASE REPORT

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"The Story of Abraham, Isaac and Jacob" or "Am I My Brother's Keeper?"

ABSTRACT: Presented is a case report of a violent sexual assault where the DNA profile obtained from an item of evidence was compared to a suspect's profile. The profiles did not match, but the sharing of such a large number of alleles raised the suspicion that perhaps the real perpetrator was a blood relative of the suspect. The investigators requested a sample from the suspect's brother, and a match was defined. In an era of technological breakthroughs in the field of forensic DNA analysis, the importance of the scientist's attention to the evidence presented in each case is stressed.

KEYWORDS: forensic science, rape, STR typing, silver-staining, SGM Plus, brothers

The forensic science of individualization has advanced tremendously in the last two decades. Forensic science is on the cutting edge of developing technologies and none more so than the field of DNA analysis. Since its introduction on the forensic stage in 1985 by Dr. Alec Jefferys, DNA typing has proved itself to be invaluable as a tool in exonerating the innocent and bringing the guilty to justice. From VNTRs to PCR, from silver staining to multiplex fluorescent detection, and to the future vision of chips, the technology of DNA typing continues to progress (1,2).

Although these advances are exceptionally relevant, the role of the investigators and the scientists in solving crimes should not be minimized. Presented here is a case report that focuses on the fact that no matter how modern and well equipped a forensic lab is, the importance of the scientist's input in analyzing the evidence cannot be overlooked.

In this case report, we present a violent sexual assault on a small girl, where a wrongly accused suspect was sampled and tested. His DNA profile was compared with the profile obtained from a semen stain found on the little girl's pants. The DNA results from the pants and the suspect's sample showed a high level of allele sharing that helped point to the actual perpetrator.

Case Report

A five-year-old girl arrived home crying and visibly upset. She told her mother that a man tempted her to accompany him to a nearby building. In the deserted stairwell of the building, he lay her down, removed her pants and panties, and digitally raped her. He then masturbated and spilled his semen on her lower stomach and with his hand tried to insert his semen into her vagina.

Although the girl was unable to give an accurate description of the assailant, she was able to describe a pair of blue rubber flip-flops (beach sandals) that the man wore. The detectives searched the neighborhood for a possible suspect and received a tip about a mentally deranged person by the name of Isaac who was known to frequent the neighborhood. The police arrived at the suspect's home and requested the man to accompany them for questioning. In the home, they noticed a brother of the suspect wearing blue flip-flops as described by the young victim. Upon questioning, Isaac admitted to a number of the accusations, but his statement was not completely coherent and his version changed from interview to interview. He was confined in a mental institution while the investigation proceeded and was allowed out (accompanied by his younger brother, Jacob) either to appear in court or to be interviewed by the investigating officers.

Results

Buccal swabs from the victim and her clothes worn during the attack were the first items submitted to the Forensic Biology Laboratory for analysis.

A semen stain was located on the victim's pants by acid phosphatase screening (1,2). Although no spermatozoa were visualized microscopically, a test specific for the P-30 protein found in seminal fluid (3) provided a positive result, indicating the presence of seminal fluid on this item.

DNA was extracted preferentially from the victim's semen-stained pants and from her reference buccal swabs using the phenol-chloroform extraction method (4). The extracted DNA was then amplified by PCR using the CTT, FFV, and Gene Print silver III System (DDD) Kits by Promega (Madison, WI)(5). The amplified products were separated on 4% denatured polyacrylamide gels and defined by silver staining (6).

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Received 12 July 2002; accepted for publication 20 Sept. 2002; published 18 Dec. 2002.

TABLE 1—*Summary of DNA results for item, the three brothers, and victim at nine STR loci.*

	TH01	TPOX	CSF1PO	D13S317	D7S820	D16S539	vWA	FESFPS	F13A
Item	6,9	8,11	10,12	9,9	8,10	8,8	16,17	10,10	7,7
Isaac	6,9	8,11	10,12	9,9	8,10	8,11	18,18	10,10	7,7
Jacob	6,9	8,11	10,12	9,9	8,10	8,8	16,17	10,10	7,7
Abraham	6,9	8,8	10,11	9,9	8,10	11,11	Not tested	Not tested	Not tested
Victim	7,9	8,9	11,12	9,12	8,12	10,13	17,18	10,11	6,15

TABLE 2—*STR analysis results using the AmpFℓSTR SGM Plus multiplex for item and the two brothers Isaac and Jacob.*

	XY	D8	D21	D18	D3	vWA	D16	D2	D19	TH01	FGA
Item	XY	10,13	27,28	14,14	14,17	16,17	8,8	19,19	15,15.2	6,9	25,27
Isaac	XY	12,13	27,28	14,14	14,15	18,18	8,11	19,26	13,15.2	6,9	24,25
Jacob	XY	10,13	27,28	14,14	14,17	16,17	8,8	19,19	15,15.2	6,9	25,27

Following a court order, a blood sample was obtained from the suspect, and DNA analysis was carried out as described above. At this point, by chance the DNA results were recorded in such an order as to raise the attention of the forensic scientist working on the case. CTT testing was done first and provided a match at all three loci. DDD, the second PCR triplex done, provided a match at 5 out of 6 alleles. The third triplex, FFV, showed a two out of three loci match (Table 1). From the results of the DNA analysis, it was obvious that the present suspect had made a false confession and was being wrongly accused. It was also strikingly apparent that there was an exceptional similarity between the profile obtained from the victim's pants and that of the deranged suspect. The question was proposed statistically as to the probability of such a random coincidence, compared to the probability that this profile originated from a blood relative of the suspect.

The ratio between the probability that the item could have originated from a brother (for example) of the suspect, to the probability that the item originated from a random person from the Israeli Jewish population (7) was calculated and yielded a likelihood ratio larger that 54,000.

Armed with this statistical support, the forensic scientist contacted the investigators and requested they provide reference samples from Isaac's two other brothers. The oldest brother, Abraham, provided a sample and was immediately eliminated through DNA comparison. Isaac's younger brother, Jacob, who had diligently accompanied his brother to all appearances at the courthouse or police station and who showed great support and sympathy for his emotionally disturbed brother, was not a likely suspect according to the detectives. He was at the time in active army service and had no known prior criminal record. The detectives were reticent to ask yet again for another sample fearing that the family had been traumatized enough. A sample was finally collected from Jacob and a 1 in 5×10^9 match probability was obtained, taking into consideration any sub-population effects (8,9). The collective DNA results are summarized in Table 1. Jacob consequently confessed to committing this crime and is presently awaiting sentencing.

Discussion

The story of Abraham, Isaac, and Jacob was solved by an ounce of luck and a pound of observation. By luck, the first suspect found, although wrongly accused, was the subsequent link to finding the actual perpetrator. The results of the DNA analysis comparison suggested that although the original suspect was not the actual source of the semen stain, he was possibly related to the attacker. Interestingly enough, it was also a strike of luck that this case was undertaken when our forensic laboratory was not using the most up-to-date technology. The similarity between the two profiles (item versus Isaac) was emphasized by the results obtained from the three silver-stain STR triplexes employed. (A complete match at CTT, followed by a five out of six match at DDD, and finally a four out of six match at FFV.)

The semen stain from the victim's pants, along with the reference samples from the two brothers, Isaac and Jacob, have since been amplified using the AmpFℓSTR SGM Plus kit for eleven loci (Perkin-Elmer Applied BioSystems) (10) and defined by capillary electrophoresis on the ABI CE 310 system using the GeneScan and Genotyper 2.5 software as part of an internal validation study. Results are presented in Table 2.

Although there was a match at three of the eleven loci and allele sharing at an additional six loci, the striking similarity between the two profiles as shown from the silver-stain results was less apparent.

In conclusion, one of the main roles of a forensic scientist is to assist in investigations by analyzing biological evidence found at crime scenes and to compare it to DNA from known reference samples. It is infrequent, yet highly satisfying when the scientist can assist from the other direction and point the investigators in the direction of the perpetrator of the crime. The scientist should always keep in mind that, although his work may have a routine nature, attention and consideration of all the elements of evidence are essential.

Acknowledgments

A note of appreciation is extended to Dr. Renee Vorhaus for her constructive comments in the preparation of this manuscript.

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