B78 "Blood Brothers": A Case of "Identical Non-Twins"

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The goal of this presentation is to discuss the scientific, practical and ethical implications of clinical procedures, such as bone marrow transplants between relatives or anonymous donors, in human identity testing in forensic casework.

This presentation will impact the forensic community and/or humanity by increasing the success of clinical procedures and improved prognosis and life expectancy for patients undergoing bone marrow trans- plants brings in its wake scenarios that challenge the assumptions prevalent in forensic human identity testing. It is likely that this type of scenario will be encountered more often and essential that the forensic community be aware of the impact of such procedures on genetic profiling, such as the potential for alternate possibilities when a 'match' occurs.

On November 12, 2004, the Alaska Scientific Crime Detection Laboratory received a case involving the sexual assault of a 21 year old female. Short Tandem Repeat (STR) analysis, using the Promega PowerPlex® 16 multiplex amplification system, was performed on the fol- lowing items: vaginal swabs from the victim, a known blood sample from the victim, and a known buccal swab from the suspect. The genetic profile obtained from the sperm fraction of the vaginal swabs matched the genetic profile obtained from the suspect's buccal sample. The results were reported to the submitting agency and the genetic profile of the vaginal swabs sperm fraction was entered into the Alaska State Combined DNA Index System (CODIS). A subsequent database search yielded a high-strin- gency 13-locus match ('hit') to a genetic profile obtained from a convicted offender blood specimen already in CODIS.

When a CODIS 'hit' occurs, the laboratory routinely verifies that the convicted offender and the suspect in the assault case are the same person (or, occasionally, a set of identical twins) and the CODIS 'hit' is disposi- tioned as a conviction match. In this case, although the convicted offender and the suspect in the assault case were found to have the same last name, their first names, birth dates, and birthplaces were different. They appeared to be neither the same person nor identical twins, as the matching STR pro- files would suggest.

The next step was to eliminate the possibility of an analytical error or a mislabeled sample. Fortunately, the laboratory had a duplicate blood sample on file from the same convicted offender. This sample was typed with PowerPlex® 16 and Applied Biosystem's AmpFlSTR® Identifiler® multiplex PCR amplification kit. The vaginal swab sperm fraction was also typed with the Identifiler® kit, thus increasing the total number of matching STR loci to 17. Driver's license photographs and fingerprint cards of both individuals were also examined to confirm that these were two different individuals who were not identical twins.

With the possibility of one individual impersonating another during sample collection and the identical twin scenario ruled out, other explana- tions were considered to account for the identical DNA profiles. It was determined that the two individuals were biological siblings and that the convicted offender had received a bone marrow transplant from his brother, the suspect in this case. A buccal swab was then collected from the con- victed offender and typed with PowerPlex® 16. This genetic profile did not match the profile obtained from his blood sample, excluding the convicted offender as a possible source of the spermatozoa in the vaginal swab. The second STR profile for the convicted offender was also entered into CODIS.

The ramifications of the increasing success of clinical procedures and improved prognosis and life expectancy for patients undergoing bone marrow transplants should be considered with reference to forensic human identity testing. A successful bone marrow transplant will change the genetic profile of the recipient's blood with several possible consequences:

1. A bone marrow transplant recipient will have two different genetic profiles (unless the donor and recipient are identical twins). Therefore, both blood and an oral sample should be collected from such individuals for CODIS purposes.
2. A bone marrow donor and recipient can both be potential contrib- utors of a questioned bloodstain.
3. The presence of two different DNA profiles at a crime scene may not necessarily indicate that they were contributed by two different indi- viduals.
4. A suspect who has received a bone marrow transplant can only be eliminated from being the source of a DNA profile if the known reference sample is comparable to the questioned profile, *i.e.* blood to blood, or buccal to buccal, saliva or sperm sample.
5. Amelogenin results from an unknown bloodstain may not accu- rately reflect the gender of the contributor in cases where the donor and recipient are not gender matched.
6. Medical histories of the individuals involved in a case may not be known, and caution must be used in reporting conclusions, especially with respect to source attribution.

STR Analysis, CODIS 'Hit', Bone Marrow Transplant

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