APPLYING INNOVATIVE DIP-STR MARKERS FOR THE ANALYSIS OF HIGHLY CHALLENGING CASEWORK DNA SAMPLES

F. Oldoni, V. Castella, D. Hall, Forensic Genetics Unit, University Center of Legal Medicine Lausanne - Geneva,

DNA samples collected at crime scenes can produce unbalanced mixtures where the DNA of interest remains hidden. The minor contributor can only be detected using conventional STR markers when it represents more than 5-10% of the total DNA or using Y-STRs when targeting a male DNA over high female background. To overcome such constraints, a novel type of genetic marker has been recently developed. This marker, named DIP-STR, allows targeting the minor DNA contributing as low as 0.1% and linking a trace to an individual, regardless of the gender. In this study we have investigated its contribution to highly challenging casework DNA samples.

Intimate and “touch” DNA samples collected either on victim or suspect involved in six sexual assault cases were explored. In the first case a contact trace recovered on the underwear of a sexually abused victim showed the male DNA in presence of ~1,000-fold excess of female DNA. Though full Y-STR profile of the suspect was reported, the PCR amplification of only 6 informative DIP-STRs enabled to obtain a likelihood ratio (LR) value over one million supporting the hypothesis that the suspect is the source of the stain rather than an unknown and unrelated person. In a second case the vaginal sample taken from the victim displayed the male DNA in presence of ~10,000-fold excess of the donor’s DNA. Seven DIP-STR markers targeting the suspect’s DNA produced an LR value greater than a billion in addition to his full Y-STR profile and supported the hypothesis that the suspect is the source of the stain rather than an unknown individual. Similarly, partial Y-STR profile and few informative DIP-STRs of the minor DNA of the suspect were reported for a contact trace recovered on the neck of another female victim. Interestingly, the DIP-STRs were also used to target the minor DNA of a female victim masked by the male DNA. Although few informative markers of the victim were detected on a contact trace collected on the suspect’s lower garment and a low LR value was obtained, the DIP-STRs represented the only piece of DNA evidence in support of the hypothesis that the victim is the source of the trace rather than an unknown person. Lastly, the amplification of informative DIP-STRs of two male offenders allegedly accused of sexual abuse on a child and inmate, respectively, enabled to rule them out as minor contributors from the intimate traces taken on both male victims.

These findings indicate that the DIP-STR markers are of valuable forensic utility to improve the analysis of highly challenging DNA mixtures, irrespective of an individual’s gender.