B42 Enhance the Power of Discrimination of Semen Identification by a Combination of Microfluidic Chips and Erase Kits

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The goal of this presentation is to overcome the problems of the differential extraction method by using the microfluidic chip technique combined with the Erase Sperm Isolation Kit (combination method).

This presentation will impact the forensic science community by reducing the interference of female DNA in the isolated sperm DNA and enhancing the power of discrimination in the semen identification.

A key point of forensic examination is how to effectively locate sperm in sexual assault case evidence. Practically, the differential extraction method was applied to isolate male DNA from the mixtures of sperm and epithelial cells; however, this is a time-consuming and less effective process. Currently, the Erase Sperm Isolation kit, a commercially available reagent, hydrolyzes cell-free female DNA before extraction of sperm DNA to reduce contamination of female DNA in isolated sperm DNA. Additionally, the microfluidic chip technique can separate sperm from the mixtures of sperm and epithelial cells according to the differences of density, size, and settling rate between sperms and epithelial cells.

The goal of this study was to overcome the problems of the differential extraction method by using the microfluidic chip technique combined with the Erase Sperm Isolation kit (combination method). Five semen samples and two buccal swabs were collected from adult men and women, respectively, as were two mixtures prepared with the ratios of sperm and epithelial cells of 1:1 and 1:3, respectively. These mixtures were stored at room temperature for 1, 3, 7, and 14 days, then their DNA profiles were analyzed. The combination method presented excellent results — the ratios of complete Short Tandem Repeat (STR) DNA profiles (15 loci, without female DNA interference) of sperm DNA were approximately 80% and 60% in the 3 and 14 days, respectively, whereas the results using the differential extraction method were less than 30%, accompanying more than 60% of interference of female DNA, in all time periods. These data indicated that the combination method can greatly decrease the female DNA interference in STR DNA profiles. The effectiveness of the combination method with nine forensic specimens that were positive for semen stains was also examined. The data of STR DNA profiles revealed that interference of female DNA was observed in only one case; however, only two cases were obtained in the complete STR DNA profiles. The possible reasons may that the amounts of isolated sperm DNA were too small to obtain the complete STR DNA profiles. In contrast, sperm DNA isolated by the differential extraction method presented high interference of female DNA (seven cases), and only one case of STR DNA profile was complete (15 loci, without female DNA interference). Taken together, these results suggested that the combination method can greatly reduce the interference of female DNA in the isolated sperm DNA and enhance the power of discrimination in semen identification.

Semen Identification, Microfluidic Chip, Differential Extraction

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