DIRECT qPCR QUANTIFICATION OF UNPROCESSED FORENSIC CASEWORK SAMPLES

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The current short tandem repeat (STR) typing workflow for forensic case work samples involves sample collection, sample screening, DNA extraction, DNA qPCR quantification and STR amplification. Although very effective and powerful, this workflow still has room for improvements. For example, the screening assays in practice do not provide DNA related information and also do not work with touch DNA samples, which make up of the majority of the property crime samples. It is known that not all DNA samples have equal probative values. Considering the DNA backlog situation crime laboratories face today, an effective screening tool would be highly desirable. It would allow forensic scientists to prioritize the DNA samples so that the limited resources would be first spent on samples that would have better chances of producing informative STR profiles. qPCR assay does provide DNA quantity and gender information and would be an ideal screening tool. However, prior to quantification, sample extraction and purification is required. By the time a DNA sample is ready for qPCR quantification, time and resources have already been spent on samples that should have been given low priority or excluded from further processing if DNA quantity and gender information were known. To overcome this problem, a direct quantification technology has been developed to allow qPCR quantification of casework samples without the need for DNA extraction and purification. The key to a direct qPCR assay is the PE-Swab, a novel sample collection device. A small sample punch can be generated from a PE-Swab and placed in a qPCR reaction for quantification. After optimizing the punch size and the quantification software baseline setting, accurate DNA quantification can be obtained from a sample without the need to carry out DNA extraction and purification. Proof of concept studies were done with low level touch samples as well as blood samples. The PE-Swab also allows direct STR amplification of case work samples without the need for DNA extraction. Besides its potential as a screening tool, the direct qPCR assay can also be used to normalize the DNA input for a direct STR amplification reaction. The feasibility of the direct qPCR/ direct STR amplification workflow was demonstrated with touch DNA samples and blood stain samples.