G3 Evaluation of a Novel Tagging and Tissue Preservation System for Human Remains

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The goal of this presentation is to describe a new, easy-to-use, barcode-based tissue collection, preservation and body tracking system, which might prove instrumental in the containment of mass fatalities such as aircraft accidents, war-related accidents, environmental disasters (e.g., earthquakes, hurricanes, floods), terrorist bombings, or mass murders.

This presentation will impact the forensic community and/or humanity by simplifying the use of this tissue collection and body tagging system, as well as the convenience afforded by working in an ambient temperature environment without the requirement of a refrigerator/freezer or any other additional device, while maintaining DNA integrity for a long period of time, representing potential benefits for the forensic community.

Tissue preservation is a critical issue in forensic investigations where human remains are collected for DNA analysis. The maintenance of a forensically sound chain of custody is also a critical part of field as well as laboratory practice. Low ambient temperatures and rapid recovery of human remains are ideal conditions to ensure successful DNA analysis. However, such conditions are rarely met in disaster areas, which are often encountered in geographically remote regions of the world. The new eartag system TypiFix™ works simply by pushing a clamp-like applicator. By

operating the loaded applicator a tissue sample is punched out by a collection stud and automatically introduced into a self-sealing sample container. In the tightly sealed sample container, the tissue and its DNA are preserved through desiccation by molecular sieve beads consisting of sodium-aluminium-silicate. The ear-tag and sample container are preprinted with the same identification number as well as a barcode. They are attached to each other until the sample is introduced in the sample container. Through this simultaneous barcoding of the remains and the tissue sample at the point of recovery, sample switch is excluded.

A feasibility study was conducted to determine the usefulness and the limitations of this device in a forensic setting and to evaluate the effect of long term storage of tissues in the sealed TypiFix™ container on DNA analysis using short tandem repeat (STR) methodology. Ten bodies were selected for this study (time since death 3 - 25 days). Tissue sampling with simultaneous tagging was performed at the interdigital fold between the thumb and the index finger of either hand using the TypiFix™ applicator. Samples were stored at room temperature and processed at 2 weeks and 6 months after collection. Using a special extractor clamp provided by the manufacturer of TypiFix™, the bottom of each sealed sample container was removed and dry tissue samples were transferred to 1.5 ml eppendorf cups. The tissue samples were subjected to DNA extraction using the QIAamp DNA Mini Kit (tissue protocol, Qiagen Inc., Valencia, CA). Quantification of human genomic DNA was determined using real-time PCR (ABI PRISM® 7000 Sequence Detection System) and the Quantifiler™ Human DNA quantification kit (Applied Biosystems). Autosomal STR analysis was carried out with 1 ng of genomic DNA using the AmpFLSTR SGM Plus PCR amplification kit. All analyses were performed in accordance with the manufacturer's instructions.

On average 8 ± 5.7 Ig DNA (mean ± SD) were purified from each sample. The success rate of STR genotyping after 2 weeks and 6 month was 100%. DNA profiles after six months of storage were identical to those obtained after two weeks.

Currently, the most commonly used method of preserving tissues for subsequent DNA analysis is freezing. Very few alternative approaches have been developed to preserve soft-tissue samples at room temperature. Using the described system keeps the collection costs low, provides fast and reliable DNA samples from a large number of individuals in a short time, and ensures a forensically solid chain of custody from the point of recovery in the field to the DNA analysis in the forensic laboratory.

The collection of tissue-samples for DNA analyses can easily be achieved under field conditions. In case of mass fatalities it enables investigating authorities to collect numerous specimen for DNA analysis and simultaneously label the remains. Barcodes can be manufactured according to customers' needs. The system is fail-safe and fraud-proof. The specimen container is contamination-proof since only the single-use parts come in contact with biological materials. The tissue sampling for DNA analysis is possible without the need to refrigerate or freeze samples. According to the manufacturer, tissues stored over 4 years

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in the TypiFix™ system are still suitable for amplification of long fragments by PCR.

Therefore the TypiFix™ system provides a new, reliable and useful tool for the recovery and simultaneously labeling of human remains and tissue samples in mass fatalities.

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