PROOF OF CONCEPT: USE OF RAPID DNA SYSTEMS IN DISASTER VICTIM IDENTIFICATION

Sheila Estacio Dennis, Yvette Rada, Desarae Harmon, Zoran Budimlija, Grace Axler-Diperte
NYC Office of Chief Medical Examiner, Department of Forensic Biology

Disaster victim identification (DVI) can be a very meticulous and lengthy process despite the number of casualties. This is especially true if DNA testing is part of the DVI process and is used to assist in the identification of victims. Processing and analyzing DNA samples from decedents or relatives can take several days. Rapid DNA typing systems eliminate this waiting utilizing a tabletop, self-contained, and automated instrument. Within the past few years, several companies have developed and improved such systems. These systems use a portion of DNA containing biological material, and produce a DNA profile. Rapid DNA systems reduce the time needed to process a DNA containing sample from days to less than two hours. In contrast, traditional methods of DNA profiling from cheek swabs require upwards of 10 hours and multiple laboratory personnel. The currently available Rapid DNA systems allow for DNA extraction, amplification, separation and genotyping analysis to be completed in less than 90 minutes, without analyst intervention. This represents a significant savings of time and personnel over traditional STR typing methods. Among the Rapid DNA instruments that are available, each generates a DNA profile in a similar manner but with varying sample capacity, run times, and cost.

Rapid DNA systems are particularly practical for disaster recovery and identification. Besides being fast, the systems are mobile, rugged, and simple to use with all consumables ready to use in a disposable format. With Rapid DNA systems on-site at a Family Assistance Center (FAC), DNA analysis of samples collected from family members can be processed and DNA profiles analyzed in a family pedigree chart.

Concurrently, if disaster recovery is occurring and a mobile morgue is set up, post-mortem samples can be collected on-site and processed immediately. Transport, sample tracking at the laboratory, and the requirements of multiple laboratory personnel, are eliminated. The DNA team at the mobile morgue can collect and process samples immediately. The profiles generated both from decedents and relatives can also be readily input into current victim identification program and kinship analysis performed as well.

The NYC OCME Department of Forensic Biology has evaluated two Rapid DNA systems for use in disaster victim identification: IntegenX's RapidHIT® Human Identification System and GE Healthcare Life Sciences (GE) and NetBio's DNAscan™ Rapid DNA Analysis™ System. Initial evaluations were conducted at the NYC OCME and the instruments performance was further evaluated in a full scale mass disaster exercise.

Preliminary evaluation with IntegenX's RapidHIT® involved cuttings and swabbings of various post-mortem tissue samples such as muscle tissue and blood stain cards using two of their instrument protocols which accommodate for high and low amounts of DNA. Preliminary evaluation with GE/NetBio's DNAscan™ involved off-board (or off-chip) testing of various sample types including cuttings and swabs from post-mortem tissues samples such as muscle tissue and cuttings from bloodstain cards. All sample types were extracted according to three different extraction procedures and quantitated using OCME's in-house SYBR Green quantitation assay in order to determine which extraction method gave the best DNA quality (least inhibition): the in-house OCME organic extraction, GE/NetBio off board with short digest, and the GE/Net Bio off board with overnight digest. These samples were then amplified using

Promega's PowerPlex® 16 system and analyzed using SoftGenetics® GeneMarker HID STR Human Identity Software v.2.6.0.

The RapidHIT® System for Human Identification and GE/NetBio's DNAscan™ Rapid DNA systems were evaluated on-site at the Family Assistance Center (FAC) and DNA unit of the mobile morgue during the Fifth Annual Regional Mass Fatality Management (MFM) Training, which occurred from June 2-6 2014 at Fort Hamilton Army Base in Brooklyn, New York. During the FAC exercise, reference samples were collected and processed from volunteers simulating family members; while 8 post-mortem muscle and 2 post-mortem blood samples, simulating recovered remains, were processed and typed in the DNA unit of the mobile morgue portion of the exercise on both instruments. Full-scale recovery implementation of the Rapid DNA systems was assessed and output data were evaluated based on their profile completeness, alleles called, and peak height balance.