A62 Internal Ballistics: Temperature Analysis of a 9mm Firearm With Thermal Imaging Camera

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After attending this presentation, attendees will learn about the internal ballistics of a Glock 9mm semi-automatic handgun. More specifically, they will learn about the thermal environment inside of the chamber immediately following discharge of the weapon.

This presentation will impact the forensic community by presenting a novel experiment to accurately study the internal ballistics of a semi-automatic firearm and determine the temperature to which a shell casing and DNA are exposed to during firing. The data that is acquired will also be used to study the likelihood of genotyping DNA that is exposed to similar temperatures as those in the chamber.

Attendees of this presentation will learn about the internal ballistics of a Glock 9mm semi-automatic handgun. More specifically, they will learn about the thermal environment inside of the chamber immediately following discharge of the weapon. Recently there have been multiple studies, including a companion study to this experiment, which is attempting to transfer, extract, and genotype DNA from spent shell casings. It has previously been thought that the heat of firing destroys DNA rendering it useless for analysis. This study analyzes the thermal environment to which the touch DNA on bullet shell casings is exposed to upon firing. After extensive research and communication with multiple ammunition manufacturers and law enforcement agencies, it was determined that the temperature that a shell casing is exposed to during firing is not available or published.

This presentation will impact the forensic community by presenting a novel experiment to accurately study the internal ballistics of a semi-automatic firearm and determine the temperature to which a shell casing and DNA are exposed to during firing. The data that is acquired will also be used to study the likelihood of genotyping DNA that is exposed to similar temperatures as those in the chamber.

A study was performed using five different brands of ammunition, each 115 grain 9mm Luger. Each brand was tested using a 9mm Glock semi-automatic handgun. Temperatures were taken of the chamber, with the slide of the gun locked back, both before and immediately following firing using an Evolution 5200 thermal imaging camera (MSA manufacturer). Temperature readings were recorded for each brand of ammunition after single firings and multiple burst firings to observe the transfer of heat to the metal components of the firearm, mainly the chamber. Two thermal imagers were used at the same time to read the temperatures so that an average and standard deviation between the two instruments could be determined. Also, Heat Sensor Labels by Ladder Technologies were cut out and adhered to the bullet cartridge. Upon firing, the heat sensor indicates if the metal was exposed to temperatures in excess of 300 degrees Fahrenheit. The results of the heat sensor tests will be compared to the thermal imager data to discuss the amount of time it takes for the heat inside the chamber area to dissipate, and the accuracy of this experiment.

Upon obtaining significant temperature data, a study will be performed to observe the effects of the temperatures inside of the chamber on control DNA samples. Samples, 1 to 5µL in size containing epithelial cells of known concentration suspended in PBS will be pipetted onto a metallic surface that is set to the temperature recorded in the chamber area of a fired weapon. The samples will be immediately swabbed off of the surface using a double swabbing technique, extracted, quantified, and genotyped using a 5 STR miniplex developed for a companion study to observe the likelihood of obtaining DNA from surfaces that have been exposed to high temperatures for only a fraction of a second.

Internal Ballistics, Firing Temperature, Touch DNA