CASE REPORT

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A Novel Application of Time Since the Latest Discharge of a Shotgun in a Suspect Murder

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ABSTRACT: The recently developed method for the determination of time since the latest discharge of a shotgun was applied to an unusual murder case. A man was killed by two shots from a shotgun, but the suspect maintained that he killed the man unintentionally and in self-defense, by shooting one shot from each of the barrels of a double-barreled shotgun at the same time. The laboratory investigation revealed that only one of the barrels was fired the last time the gun had been used. As the victim was hit by two shots, the conclusion was that both shots were fired from the same barrel, which means that the suspect had to reload his weapon between firings. The suspect was consequently charged with murder.

KEYWORDS: forensic science, time since discharge, solid phase microextraction, firearms, shotgun, GC-TEA, gas chromatography

The determination of time since discharge of a firearm is generally used for one purpose, namely, to estimate when the firearm was last used. In the case we describe here, the time of shooting with a shotgun was known. The method for determination of time since discharge was used here to decide if both barrels of the double-barreled shotgun were fired at the same time or if the two shots were fired using only one of the barrels.

Case Report

A man was killed with a shotgun. Two shots were fired and the victim was left to bleed to death at the scene of the crime. Forensic medical examination confirmed that the man had been hit by two shots from a shotgun and bled to death.

A suspect was arrested and admitted to the shooting, but maintained that he used the weapon in self-defense because the victim frightened him and threatened his life. The suspect claimed that his double-barreled shotgun was loaded with one shot in each of the barrels and that he fired both shots at the same time. He admitted manslaughter but not murder. The shotgun in the suspect's possession was sent to our laboratory for examination.

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Results and Discussion

The examination of the firearm revealed that the upper barrel was slightly corroded in the breech; neither of the barrels had been cleaned or treated with weapon oil or wax. Flakes of partially burned propellant were seen in both barrels. Since we recently completed a research project concerning the determination of time since discharge of shotguns (1), we decided to apply this new method to this particular case. The question was not when the shotgun was last used, because this was already known exactly (three weeks before the examination procedure carried out in our laboratory). Instead, the question was whether the shots were fired through both barrels at the same time (the last time the shotgun was used) or if only one of the barrels was loaded and used twice.

The solid phase microextraction (SPME) procedure for sampling of volatile and semivolatile compounds from firearm barrels was performed according to the method described previously (1). Fused silica fiber with an 85 μm polyacrylate coating was used in all the experiments. The coated fiber was exposed to the atmosphere inside the barrel for 20 min at a distance of 20 cm from the muzzle.

Two gas chromatographic (GC) systems for quantitative analysis of compounds adsorbed by SPME were used in parallel—the GC/TEA and the GC/FID system. The analytical conditions for the GC/TEA system were slightly modified—the initial temperature was set to 35°C instead of 60°C as in the original procedure. We used this modification in our current work on determination of time since discharge of firearms and spent cartridges for improved detection of the TEA2-peak (1). In shotguns, the TEA2-peak is usually quite strong, but in this particular case the firearm was not so recently fired and the intensity of the TEA2-peak is known to decrease with time since discharge.

The results of the SPME sampling from both barrels and using both analytical systems independently are shown in Fig. 1 (GC/TEA) and Fig. 2 (GC/FID). The GC/TEA system applied to samples taken from the lower barrel of the suspect's shotgun detected easily the broad TEA2-peak with a retention time of slightly more than 3 min, and in addition to this, some other unidentified peaks originating from the propellant used (Fig. 1, upper chromatogram). The sampling from the upper barrel did not detect any of these peaks (Fig. 1, lower chromatogram). The peaks detected in the lower chromatogram are only those originating from the SPME fiber itself and are observed in blank analyses. The absence of the TEA2-peak in the sampling from the upper barrel indicates that this barrel had not been used for a considerable

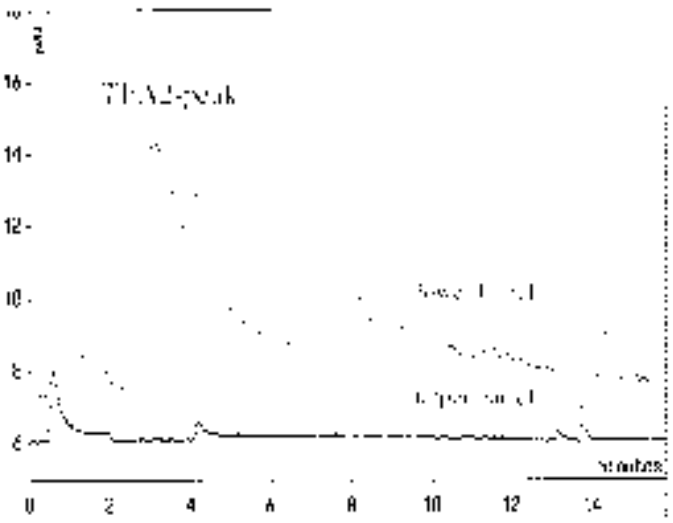

FIG. 1—*GC/TEA chromatograms obtained by SPME sampling from inside the shotgun barrels. The upper (dashed line) trace is for the lower barrel, the lower (solid line) trace is for the upper barrel. The broad TEA2-peak with the retention time of slightly more than 3 min is detected only in the lower barrel. Also, some of the other peaks detected in the lower barrel are missing in the sampling from the upper barrel. Smaller peaks with the retention times of about 4 and 14 min, respectively, originate presumably from the SPME fiber itself and are observed in blank analyses.*

period of time, much longer than three weeks. It should be mentioned here that the compound represented by the TEA2-peak has so far not been identified, but the peak can easily be measured and quantified. In this actual case, the shotgun ammunition was not known to us. No shell casings or wads were sent to our laboratory. Thus, both barrels might eventually be charged with different kinds of ammunition. But even for ''low residue'' types of ammunition the TEA2-peak is detected for a considerably longer time than three weeks in shotgun barrels.

The GC/FID system detected a number of peaks corresponding to various combustion products formed on shooting in both barrels (Fig. 2). There is, however, a significant difference in the chromatographic profiles obtained on sampling from the lower and the upper barrel, respectively. The groups of compounds with higher volatilities, like those at the retention times around 10 min, are clearly more pronounced in the sampling from the lower barrel compared with the result for the upper barrel (the amount of the compounds with the retention times around 15 min is about the same). Because relatively more volatile compounds escape from a barrel more rapidly with time after discharge, the interpretation of the results in Fig. 2 is that only the lower barrel was used the last time the suspect shotgun was fired. The various volatile and semivolatile compounds detected in the shotgun barrels were identified by gas chromatography/mass spectrometry (GC/MS) (1). The vast majority of these compounds are not present in propellants and have thus been formed on burning of propellant and/or cartridge. Phenol, naphthalene, indene, quinoline, and indol are some of the more volatile compounds identified by GC/MS, whereas acenaphthylene, fluorene and phenanthrene are some of the less volatile compounds. All shotgun ammunition gives the same kind but not the same amount of these peaks.

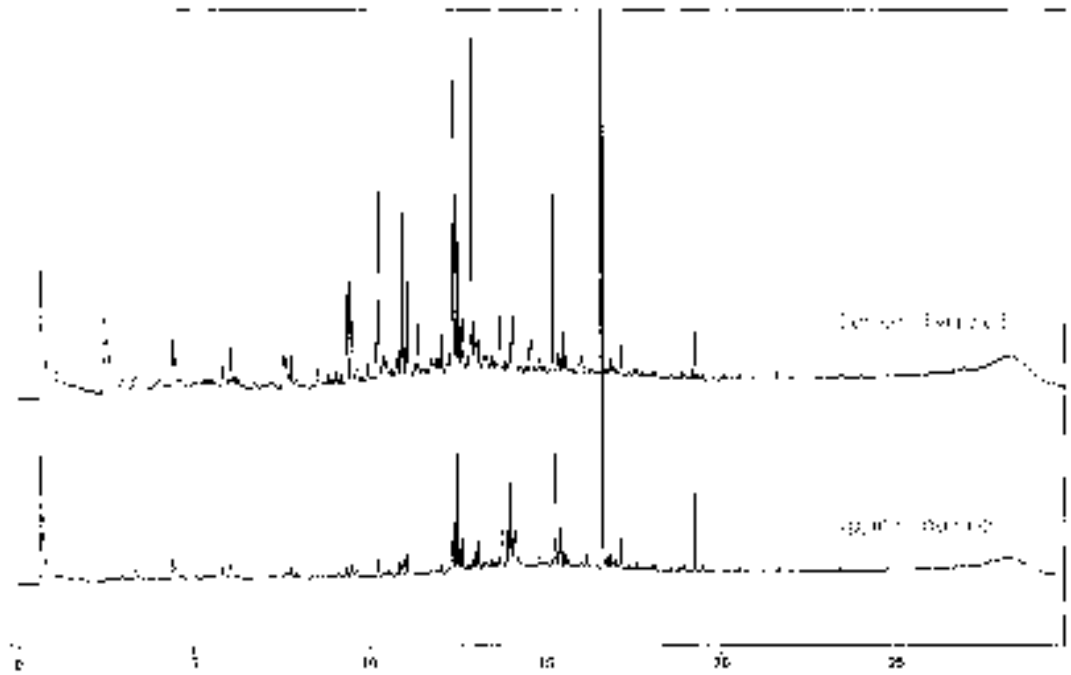

FIG. 2—*GC/FID chromatograms obtained by SPME sampling inside the upper and the lower barrels of the suspect shotgun. Clear differences in the relative concentration of the more volatile compounds (e.g., peaks detected at the retention times of 10 min or less) compared with the less volatile compounds (e.g., peaks with the retention times of about 15 min) between these two barrels can be seen. This can be seen, although neither of the barrels had been fired recently (the laboratory investigation was performed more than three weeks after the crime was committed).*

A combination of the results from the two analytical systems employed leads to the following conclusion. Both barrels of the suspect shotgun contain some deposits from shooting. The latest shooting with the lower barrel of this shotgun was, however, performed on a later occasion compared with the latest shooting with the upper barrel. Because the victim was hit by two shots, both shots must have been fired from the same barrel—the lower barrel. This means that the suspect had to reload his shotgun between making the two shots he fired (one witness actually stated that he heard two shots within approximately 1 to 2 min). He was thus not acting in self-defense and in a confused state, and was consequently charged with murder.

Reference

1. Andrasko J, Norberg T, Ståhling S. Time since discharge of shotguns. J Forensic Sci, 1998;43(5):1005–1015.

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