A47 Differential Mass Loss in Bullets From Frontal and Temporal/Parietal Bone Impacts

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Learning Overview: After attending this presentation, attendees will understand the potential for using mass loss in bullets as an indicator of which human skeletal element caused said deformation. Attendees will gain knowledge of the various factors contributing to bullet mass loss, including skeletal element, bullet type, distance, and velocity.

Impact on the Forensic Science Community: This presentation will impact the forensic science community through the development of an additional tool for reconstructing crime scenes. This information will be particularly useful in understanding cases in which bullets are recovered in the absence of human remains.

The effect of ballistic impacts upon bone tissue is a frequent topic of research within forensic anthropology. However, there is a dearth of research regarding the effect of ballistic trauma on bullet condition. There is limited systematic research dealing with the effect of differential bone density on bullet deformation, particularly concerning human skeletal tissue.

This study examines the differential deformation of .38 Special bullets fired into donated human heads as part of an experimental study on the effects of bullet type on head trauma. Ammunition utilized during the study included both Full Metal Jacket (FMJ) and Hollow Point Type (JHP) bullets, both of which were 130 grains in weight. Bullets were fired into the frontal bone and right temporal/parietal area. A total of 31 bullets were used for this analysis. The bullets were nearly evenly distributed between FMJ (n=16) and JHP (n=15). Bullets shot to the frontal bone numbered 18, while bullets shot to the temporal bone numbered 13.

Damage to each bullet was quantified as mass loss measured in grains. Bullets were weighed following recovery, and mass loss was measured as 130 grains minus the weight of each recovered bullet. The results were analyzed via univariate Analysis of Covariance (ANCOVA) through SPSS software.

Analysis of the mass loss exhibited substantially greater mass loss from bullets fired into the frontal bone than in those fired into the temporal. In the full sample, the mean average loss of mass for hits to the frontal bone was 10.448 grains, while hits to the temporal bone averaged 1.032 grains. This represents a mean average loss of approximately 8% for frontal bone hits versus 0.8% for the parietal/temporal. However, the standard deviation for frontal hits was substantially larger (15.588 grains) than the standard deviation for temporal hits (1.623 grains). Mass loss for bullets fired into the frontal bone ranged from 0–51.76 grains. By contrast, mass loss for bullets fired into the temporal bone ranged from 0–6.23 grains.

The relationship between loss of bullet mass, impacted bone, and bullet type were analyzed via univariate ANCOVA. The results for the full sample exhibited a significant relationship between mass lost and target bone on the skull (p=0.039). By contrast, bullet type (FMJ vs. JHP) exhibited no significant relationship with mass lost (p=0.429). The combined effect of target and bullet type exhibited no significant relationship (p=0.668).

The differential degrees of bullet mass loss between skeletal elements observed in this study suggest that this figure may be used as a metric for associating fired bullets with damage to skull elements of differing thickness. At lower levels of mass loss (>1.3 grains), distinction between frontal and temporal damage would not be possible, since the ranges of mass loss overlap at these levels. At greater levels of mass loss, bullets are more likely to be associated with hits to the frontal bone. In general, this supports the hypothesis that thickness has a significant influence on the degree of damage to bullets striking bone.

This study is limited to the effect of a single handgun caliber. Nevertheless, the results of this study will contribute to the available methodologies for forensic scientists for reconstructing crime scenes, particularly those involving situations in which bullets are recovered without associated human remains.

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Ballistic Trauma, Firearms, Forensic Anthropology