



### H18 A Comparison of Peak Sound Levels of Non-Contact and Contact Gunshots Into a Gelatin Block

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The goal of this study is to ascertain any difference between peak sound levels of contact and non-contact gunshots.

This presentation will impact the forensic science community by providing insight into whether or not a contact gunshot may reduce the auditory report of the gunfire.

Nearly all firearms create noise that is more than the 140 decibel level.<sup>1</sup> One author reported handgun and rifle sound levels at or near the muzzle ranging from 157 to 165 decibels.<sup>2</sup> A one-year retrospective review of suicidal contact gunshot wounds at the West Tennessee Regional Forensic Center, Memphis, TN, revealed 50 cases examined for either autopsy or external examination. Of those 50 cases, 5 cases included reported circumstances of an on-scene individual, other than the decedent, who reported that they did not hear the lethal gunshot auditory report.

This study will compare the sound levels of contact and non-contact handgun discharges for the calibers .22 long rifle, .38 special, and 9mm North Atlantic Treaty Organization (NATO) firearms fired into ballistic gelatin blocks. Many sound meters have a peak sound level limit of 130 decibels or less, thus testing of gunfire peak sound level at or near the muzzle requires high-quality, laboratory-grade sound meters with much higher decibel limits. The cost and availability of such sound meters could limit future duplication or expansion upon this study. Additionally, this study examines any difference in peak sound level versus highest possible peak levels; therefore, sound levels are obtained at a predetermined distance from the muzzle that does not overload an easily affordable, commercially available meter.

Peak sound level measurements were obtained utilizing a Dayton Audio® iMM-6 calibrated measurement microphone in combination with a sound level meter application from the National Institute for Occupational Safety and Health (NIOSH) installed on an Apple® iPhone® 6. The sound level meter application was programmed for NOISH standard, 80-decibel threshold level, C frequency weighting, fast-time weighting, and 3 decibel exchange rate. The 16" x 6" x 6", 10% clear ballistic gelatin block used meets the Federal Bureau of Investigation (FBI) protocol for testing terminal ballistics of human tissue. The hypothesis is that contact gunshots into a gelatin block will have lower peak decibel levels than non-contact gunshots into a gelatin block. The hypothesis is founded on the proposition that expanding gases will expand inside the gelatin block instead of outside the gelatin block, resulting in a lower peak decibel level. If the hypothesis is supported, it may explain why one-tenth of the suicidal gunshot cases in which an auditory observer was present did not hear the lethal gunshot.

This information may be useful in future death investigations and may be useful for medical examiners, medicolegal death investigators, law enforcement investigators, attorneys, and forensic scientists. The information from this project will better enable death investigators, medical examiners, and law enforcement officials to evaluate the validity of reports of circumstances surrounding and leading up to a death involving a contact gunshot wound.

#### Reference(s):

1. Stewart, M. Recreational Firearm Noise Exposure. *Audiology Information Series*. American Speech-Language-Hearing Association, 2017.
2. Branch, M.P. Comparison of Muzzle Suppression and Ear-Level Hearing Protection in Firearm Use. *Otolaryngology – Head and Neck Surgery*. 2011; 144; 6, 950-953.

#### Contact, Gunshot, Decibel