



C35 Assessment of Extended Range Electronic Projectile Impact Injury Potential Using Cadaveric Testing

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After attending this presentation, attendees will be familiar with a recent human cadaveric test series that was executed to assess the impact injury potential of the newly designed XREP (eXtended Range Electronic Projectile).

This presentation will impact the forensic science community by providing an assessment of human impact injury potential from a shotgun round with an electronic charge. The results from this study are useful in assessing the effects of the XREP impact velocity on human tissue and in identifying superficial wounds as a result of XREP deployment.

The XREP was designed as a wireless electronic neuromuscular incapacitation (NMI) electronic control device (ECD) self contained within the XREP projectile. Utilizing NMI, it is intended to neutralize a threat up to 100 feet away as it is deployed from a 12-gauge shotgun. It is not intended to produce significant impact injuries such as significant blunt trauma or for the cartridge to penetrate the skin. As with any kinetic energy munition, design variables such as mass, velocity, and impact cross-sectional area must be considered to reasonably minimize potential penetrating or blunt impact injuries. During the design process, extensive experimentation is necessary to minimize unintended injuries. This paper presents the results from a recent evaluation of blunt trauma and penetration potential of the XREP design via a series of human torso cadaveric tests.

Two male cadaver torsos were obtained. The torsos were frozen postmortem, were not chemically preserved, and were completely thawed prior to usage. The stature and mass of the two cadavers were 68 inches and 165 pounds and 72 inches and 165 pounds. A nitrogen powered air cannon was used to fire the XREP rounds throughout the study. This air cannon consisted of a pressure regulator and gas reservoir arranged to propel the experimental device through either a smooth-bore or rifled-bore shotgun barrel. A range of cannon firing pressures and corresponding pre-impact velocities were utilized. These values were designed to replicate velocities that would be obtained by firing the XREP with a conventional shotgun. A total of 43 shots impacted the torsos, including 12 shots on the posterior aspect of Torso 1, 14 shots on the anterior aspect of Torso 1, and 17 shots on the anterior aspect of Torso 2. Impact areas included the ribs and abdomen. Two tests were fired at a range of 15 feet and all of the other tests were fired at 1.5 feet. Pre and post-test photographs were taken and high-speed video was recorded at locations orthogonal to and oblique to the impact location. Pre and post-test magnetic resonance imaging (MRI) and computerized tomography (CT) images were obtained. Post-test internal examinations were performed by dissection.

The measured and calculated XREP pre-impact velocities from the test series ranged from 230 to 315 feet-per-second (fps). The majority of the shots fired were at a cannon pressure of 300 pounds-per-square inch (psi) and resulted in pre-impact velocities averaging 251 ± 6 fps (ranging from 244 to 257 fps) for the rifled barrel and 265 ± 11 fps (ranging from 234 to 280 fps) for the smooth barrel. In 42 of the 43 shots fired, the XREP impacted the torso and its nose section did not penetrate the skin, resulting in superficial wounds only. Internal examination of these 42 shots revealed that the XREP barbed electrode tips penetrated through the skin layer and into the superficial fat. At most, the XREP electrodes

penetrated through the skin and fat and punctured superficial muscle tissue as there was no evidence of penetration through the peritoneum on the deep surface of the muscle layer. On the remaining shot it was observed that the nose section of the XREP separated prematurely in flight which then exposed the smaller diameter chassis to impact with the torso. That shot in particular was fired at the closest range at the highest cannon pressure, and was directed to a relatively fatty portion of the abdomen lateral to the umbilicus. It penetrated the abdominal wall and lodged inside the torso. Separation of the nose section had been previously noted to occur in air cannon firings but not in shotgun firings. In the study, no rib fractures or other bony fractures were observed with any of the shots. When the XREP remained intact to point of contact, there was no evidence of blunt impact trauma or electrode penetration through the abdominal, thoracic or the retroperitoneal wall based upon external observation, imaging, and internal examination.

Blunt Impact, Kinetic Energy Munitions, Human Injury