



Executive Summary

Security Devices International Inc. (SDI) Blunt Impact Projectile

July 16th, 2012

On June 02, 2012 testing was conducted on the 40mm Blunt Impact Projectile (BIP). The purpose of the CRT Less-Lethal impact munition testing protocol is to determine relative safety, effectiveness, and injury potential of launched less-lethal impact projectiles. This testing protocol includes the evaluation of accuracy, precision, consistency, muzzle and target energy, impact energy density, and effective range of the device. This testing model has been proven to reliably predict the wound profile and blunt trauma of human volunteers that have been subjected to a number of less-lethal impact munitions.

Testing was comprised of three phases:

Phase One-Preliminary Evaluation

- Accuracy, consistency, and maximum range established on static targets
- Capture wound profile in ballistic media (MBM ballistic soap)

Phase Two-Ballistic Media

- Establish injury potential with 10% ballistic gelatin
- Two standoff distances: 10 feet (~3m), 35 feet (~10.5m)
- Bare and covered with 3mm neoprene (skin simulant)
- Intrusion and impact size on gelatin measured
- Evaluation of the round post-firing

Phase Three-Human Exposure

- 6 Volunteers –BIP, 1 Volunteer-Exact Impact (Blue nose)
- Similar target area on all subjects
- Ultrasound of pre and post wound areas
- Documentation of wounds for 72 hours
- Comparison to wounds of other products



BIP Rounds as Received



Phase One-Preliminary Evaluation

Testing took place on May 31, 2012. As part of the preliminary evaluation, BIP rounds were fired from a bench rest with a single-shot Defense Technology 40mm launcher with an EO Tech, model 552 optical sighting system.

- Three rounds were fired at a standoff distance of 35 feet (~10.6 m) into a static target to establish accuracy and precision. The impact pattern of the three rounds was within acceptable limits (~3" -7.5 cm accuracy) when compared to similar impact rounds. Three rounds were fired at 80 feet (25 m) and demonstrated approximately 6"-8" (15cm-20cm) drop from point of aim. Three rounds were fired at 150 feet (45 m) and demonstrated an approximate 2-3 feet (~1 m) drop from point of aim. Maximum range testing was not explored further.

- Three rounds were fired at a standoff distance of 10 feet (~3 m) into bare Maki Ballistic Media (MBM) to simulate the wound profile of the BIP round into human tissue. The displacement volume of the cavity left in the MBM was measured for the BIP round and the control rounds: Exact Impact Defense Technology 40mm round (6325 Blue Nose) and the CTS (Combined Tactical Systems) 4557 40mm round.



From Top: CTS 4557 , SDI's BIP and eXact iImpact fired into MBM at 10 feet

Volume Displacement and Depth

MBM Disruption	Avg. Width	Max Depth	Approx. Volume
CTS	50 mm	35 mm	39 cm ³
BIP	55 mm	28 mm	41 cm ³
eXact Impact	47 mm	23 mm	22 cm ³

Importance

The volume displacement/potential allows a static representation of the wound profile. This test serves only to estimate round performance prior to Phase-Two testing and is not considered scientific due to sample size.

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Phase Two-Ballistic Media

Phase-Two of the CRT evaluation of less lethal impact munitions was based on testing protocols developed by the International Wound Ballistics Association (Fackler, et. Al.). The protocol specifies the use of properly calibrated 10% ballistics gelatin to simulate bullet effects on human tissue. Calibration is based on temperature of the gel block and penetration of a standard .177 caliber BB to a certain depth at a certain velocity. This testing method was adapted by CRT LL for slower and larger less lethal impact rounds by utilizing slow motion video on both bare and covered (3 mm neoprene) 10 pound blocks of 10% ballistic gelatin. Interpretation of the video along with thorough documentation of the disruption to the media after impact offers valuable clues as to round performance. The testing was conducted at two distances: 10 feet (~3 m) to simulate “worst case scenario” deployment and 35 feet (~10.5 m) to simulate a standard deployment range.

Data from the impact of the BIP into the ballistic gelatin was obtained for 25 rounds. Analysis of the data demonstrated that the round consistently struck the face of the gelatin orthogonally (90 degrees) and with similar intrusion depths. Separation of the nose section from the base upon impact was observed for several rounds. The disruption and maximum penetration depths of the ballistic gelatin were within acceptable limits when compared to similar less-lethal munitions of this type.

Importance

The results obtained from the 10% ballistic gelatin method combined with data compiled from other tissue simulants such as Maki Ballistic Media (MBM) allows accurate predictions of wound profiles in human targets. These testing methods have been validated when compared to the wound profiles from human effects studies over the last seven years.

Accuracy/Precision

The area of impact is intentionally designed to be small for this type of round. The target surface of the gelatin was approximately 9 cm x 15 cm (135 cm²). All shots were fired from a bench rested position by a highly qualified marksman. Accuracy and precision determinations were made based on the round striking a majority of that surface. Slight impacts were classified as a miss. As the testing progressed, misses were attributed to either a slight variance of the round or changes in chamber pressure due to residue buildup. After each logged “miss” the bore of the launcher was cleaned.



Phase Two-Ballistic Media, Bare



BIP Fired into Covered (3 mm Neoprene) 10% Ballistic Gelatin

Phase Two-Ballistic Media, Covered

Average values of data collected from ballistic gelatin

After each round was fired into the ballistic gelatin disruption/intrusion into the gelatin was photographed and logged to establish wounding potential. Velocity measurements were not captured for all of the fired BIP rounds due to an equipment malfunction, but enough were obtained for a sufficient sample size. Data for both tested ranges:

Importance

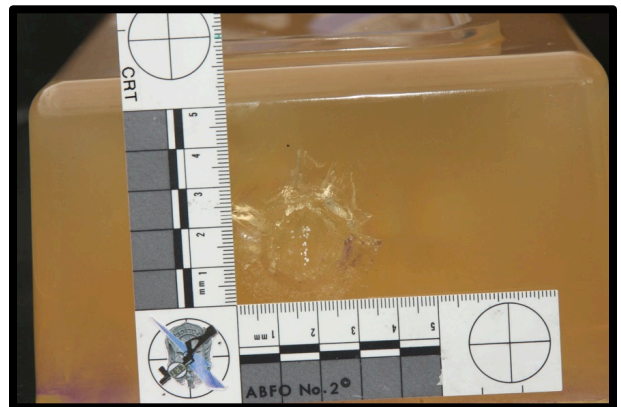
Based on previous testing using the CRT LL protocol, the intrusion must be less than 7 cm into bare gelatin, and less than 1 cm into covered gelatin to pass safety protocols for wound/injury potential at both 10 feet (~3 m), and 35 feet (~10.5 m) ranges.

Phase-Two Post Firing BIP Measurements

Importance

Wound/injury potential is determined by energy density of the projectile. For less-lethal munitions energy density is controlled by four factors: velocity, weight, construction and size of the impact surface. It is crucial that the BIP round remain intact as it impacts. The less the round fragments, the more material can impact the surface efficiently, increasing effectiveness.

If the round increases surface area (expands) on impact then less injury will occur (decrease depth of energy dispersal), and more sensory nerves on the skin surface will be stimulated (pain reception).



Impact Pattern of BIP on Covered (3 mm Neoprene) 10% Ballistic Gelatin

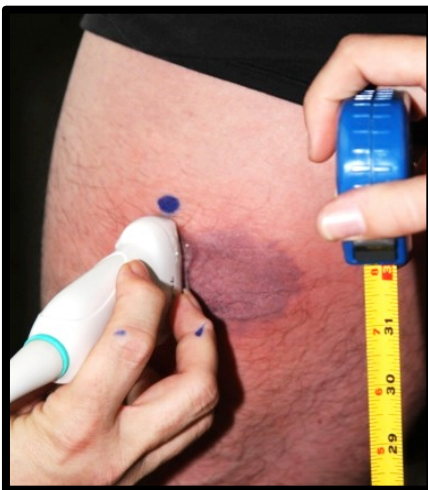
Phase Three-Human Effects Testing

Seven subjects were utilized to test and evaluate the effects of the BIP for comparison to the data collected in Phases One and Two. The lateral thigh region was selected as the target area for purposes of safety, specifically avoiding the chest area or boney prominences. The density of the muscle tissue in the thigh area generally produces consistent wound profiling.

The target region of each subject was ultrasonically scanned before and after the exposure to the impact rounds. The subjects were designated A-G and their height and weight was recorded. The scanned area was marked and measured from the subject's foot to maintain consistent targeting between all seven subjects. The wound areas were scanned to document the injury depth and extent of the wound inflicted from the projectile impact. Most subjects were clothed over the impact site, but two were exposed with bare skin only.

Ultrasound and Measuring of Target Area of the Subjects

Phase Three-Human Effects Testing



Importance

The human effects testing serves as a practical example of the potential injury inflicted when this round is deployed in the field. Phase Three testing also helps to further validate the CRT LL testing protocols. Additionally, data collected from the subjects' ultrasound scans combined with photos of the wounds over time will help to gain further understanding as to exactly how the BIP and other impact munitions effect the body (ultrasound interpretation requires further study and data will be released at a later date).

Ultrasound and Measuring of Target Area of the Subjects

Phase Three-Human Effects Testing

Subject A-Wound photos - Wound Progression



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Conclusions

The purpose of the CRT Less-Lethal impact munition testing protocol is to determine relative safety, effectiveness, and injury potential of launched less-lethal impact projectiles. Since 2003, this testing protocol has included the evaluation of many aspects and qualities of a less lethal tool to ensure the success of its deployment. Based on experience, training, and scientific testing, CRT LL, Inc. testing protocols serve to compare the tested product to previously evaluated devices that are currently available on the law enforcement market. This testing model has been proven to reliably predict the wound profile and potential injury of human subjects that have been exposed to a number of less-lethal impact munitions. The testing model, however, cannot predict every possible outcome when applied in a real-life scenario.

Phase One

The BIP projectile was within acceptable norms for accuracy and consistency during preliminary examination and testing. The BIP did tip as it impacted the MBM (ballistic soap) increasing disruption, but the wound profile was within acceptable ranges when compared to control rounds. Accuracy appeared acceptable out to 25 meters. Extended/Maximum range testing of the round was not explored further at this time.

Phase Two

The BIP projectile fired into ballistic media (gelatin and soap) served to predict relative performance and injury potential. The BIP was within acceptable limits for accuracy and precision at the two ranges tested, 10 feet (~3 m) and 35 feet (~10.5 m).

The intrusion of the BIP into the bare and covered 10% ballistic gelatin was within the acceptable maximum limits for safety (wound/injury potential) when compared to less-lethal products with a known outcome.

The nose of the BIP expanded consistently upon impact while remaining largely intact adhering to tolerances for energy density. The BIP projectile was within acceptable norms for total weight and velocity (energy).

Phase Three

The profile and progression of the wounds of all six test subjects exposed (thigh region) to the BIP were within acceptable tolerances, with the exception of *Subject G*, who performed heavy exercise soon after exposure (resulting in greater than normal ecchymosis to the area). None of the subjects required medical attention nor suffered long term effects from the BIP round.

Based on the data obtained from the three-stage evaluation, including wound interpretation from human effects, the Blunt Impact Projectile (BIP) **passed** the CRT LL testing protocol for accuracy, consistency, relative safety and effectiveness.

CRT provided recommendations to the manufacturer in order to improve overall performance and effectiveness when the product is applied in the field. SDI has since complied to all recommendations made by CRT.