Evaluation of the RCB Baton

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Introduction

In Fall 2008, the Weapons and Equipment Research Institute (WERI) conducted a series of impact weapon studies. A number of batons were utilized in an attempt to create a model for matching an individual with the impact weapon that generates the greatest amount of force. The results of these preliminary studies were published in Law Enforcement Executive Forum (vol. 9, issue 1).

Shortly afterward, WERI was contacted by Peacekeeper Products International regarding testing of their Rapid Containment Expandable Baton (RCB). As part of our testing strategy, we purchased two batons (24” & 26”) for evaluation. Although RCB batons are identified in this study, all other products’ identifiers have been removed.

Prior Study

Our initial study utilized nine participants (five men, four women) to examine differences in energy outputs between genders. While there was a difference in the amount of energy generated, the rank order of batons remained the same. In other words, a baton that performed well for men also performed well for women. This was a surprise as it was hypothesized that women might require a smaller, lighter baton to perform effective strikes. Heavier batons tended to work well for both groups while larger end caps appeared to aid in this function. This study confirmed that force generated was a related to the length and weight of the baton. While larger test subjects were capable of generating larger force loads, smaller users still had better results with larger, heavier batons.

Methodology

The current study examined the kinetic energy output of impact weapons. The batons tested consisted of three straight batons and ten expandable batons of varying length and weight that had been evaluated in two prior studies. Two RCB batons were also added to this test pool of impact weapons.

This field study utilized four participants who were, prior to the data collection, trained in an impact weapon training course. Participants were taught the proper form and accepted law enforcement approved methods for delivering the strongest strikes possible, while instructors corrected deficiencies. At the conclusion of training, participants were invited to participate in data collection for this evaluation.

Each student was given a score sheet, which they maintained throughout the study. After being randomly assigned to a testing order, each participant would strike a testing target three times. To reduce the effect of fatigue, participants would move to the end of the rotation after each set of baton strikes. This created a rest period of 2-3 minutes between batons. Practice swings with each new baton were permitted to allow the user the opportunity to modify their grip or stance if necessary so as to be comfortable with the baton. The testing target was a training dummy with an accelerometer (force sensor) attached that measured the amount of G-Force (g) from the baton strikes. The force sensor provided measurements of maximum power through an LED readout, which allowed the researchers to create a rank order of impact weapon force. The data was collected into SPSS 15 (Statistical Package for the Social Sciences) and basic analysis was conducted.

Findings

As shown below in Table 1, baton force loads from the test subjects are presented with the mean and median scores as well as standard deviations. The rank order of impact weapon force for the previously tested batons remained relatively consistent with our initial findings (see Collie, Wargo, Berry, & Mesloh, 2009) although several small differences were noted.

Table 1. Baton Force Loads and Baton Features

	Features			Force	
	Length Closed	Length Open	Weight	Mean	Median
Wood	n/a	26.25	346g	13.38	13.75
Composite thick	n/a	26.50	566g	14.50	14.25
Composite thin	n/a	25.75	378g	12.63	12.25
Expandable 1	6.25	15.25	242g	8.63	9.00
Expandable 2	6.25	15.50	380g	8.13	8.50
Expandable 3ab	10.25	21.75	658g	13.25	12.25
Expandable 4a	9.50	22.25	538g	13.25	12.50
Expandable 5b	8.00	20.50	504g	11.00	10.50
Expandable 6b	10.00	25.75	598g	13.13	13.75
Expandable 7	9.75	26.00	576g	13.38	13.25
Expandable 8	8.50	20.50	450g	10.75	10.25
Expandable 9	9.25	20.25	574g	14.75	14.50
Expandable 10	10.25	21.00	634g	14.13	14.25
RCB 1	9.50	24.00	702g	16.25	17.25
RCB 2	10.50	26.00	760g	16.13	16.25

(A=Enlarged Striking Tip; B=Enlarged End Cap)

Our initial study indicated that straight batons, regardless of composition, outperformed all of the expandable batons in our test pool of impact weapons. It is hypothesized that many of these batons suffer from some degree of “give” in the joints linking the expanding sections which allows a substantial amount of energy to be lost. However, when the RCB batons were tested in this latest study, their performance exceeded those of straight and expandable batons. Physical examination of the RCB batons revealed virtually no “give” in the joints that would allow energy loss. It is likely that this efficiency of the locking mechanism coupled with its mass leads to greater energy transfer. As shown in figure 1, the RCB is considerably larger than the average expandable baton.

Figure 1. Size Comparison of RCB and Traditional Expandable Baton

The primary limitation of this study was the method by which the force data was collected. Utilizing an accelerometer attached to a striking target requires the sensor to be attached precisely in the same position for replication of data. As a result, there are variations in baton scores from study to study when the sensor is moved even a fraction of an inch. Despite these changes in force scores, the rank order of performance for the batons remained consistent between studies. This study was replicated through a second day of testing (scores not shown) with identical performance across all products. Consequently, the most important findings of this study are the rank order of the baton scores and the factors leading to them. Although length and mass were significant factors in predicting force outcomes, some degree of ergonomics played a part as well. Frequently, the user was able to predict outcomes simply by holding the baton and judging how well it “fit” them. The 24” RCB baton consistently scored the highest force loads while the 26” RCB scored a close second place. Interviews with participants indicated that the smaller RCB felt more “comfortable” and “controllable” than the larger model.

While personal preference toward the selection of an impact weapon should be factored into the selection process, basic physics dictate certain length and mass requirements for a baton to be effective. However, the development of a minimum baton standard is beyond the scope of this evaluation and the mission of the Weapons and Equipment Research Institute. The performance data of this study provides a starting point in the selection process by identifying those factors that have consistently predicted better force outcomes.