Immediate and Transient Alteration in Brain Function Induced by Firearm Recoil

Jon Sinopoli
Burnt Hills-Ballston Lake High School Research Program

CNS 2017 ANNUAL MEETING
BOSTON, MASSACHUSETTS
OCTOBER 7–11, 2017

Introduction

Many investigations have been conducted to research the neurological effects high impact sports have on the brain. Shooting sports and firearms in general, have been neglected, with minimal, if any, research conducted on the effect that this high impact sport has on the brain.

Phase 1

The purpose of the first part of this study is to examine the force and acceleration of five different caliber firearms and to identify if these firearms can exert concussive forces.

In order to measure the amount of recoil from a firearm, a testing apparatus was designed and built (Figure 1). This design is unique because it is a solid steel structure; unlike other designs which used sliding rails (Canfield-Hershkowitz, 2013). To record data, a 5,000 pound military-grade force sensor, signal conditioner and Data Acquisition Device (DAQ) were used.

Collection of data was supervised by a National Rifle Association Range Safety Officer; double ear protection and safety goggles were used at all times. Data collection was conducted at a local range.

Figure 1: Apparatus Prepared for Testing

Results

Four of the five firearms tested, registered peak g-force accelerations above 75 g, the acceleration required to cause a concussion (Gever D, 2007) and up to 195.29 g. Firearms' peak accelerations were 65.59 - 195.29g.

Discussion

This data suggests that firearms can generate enough acceleration to cause a concussion without the reduction in acceleration caused by the human body.

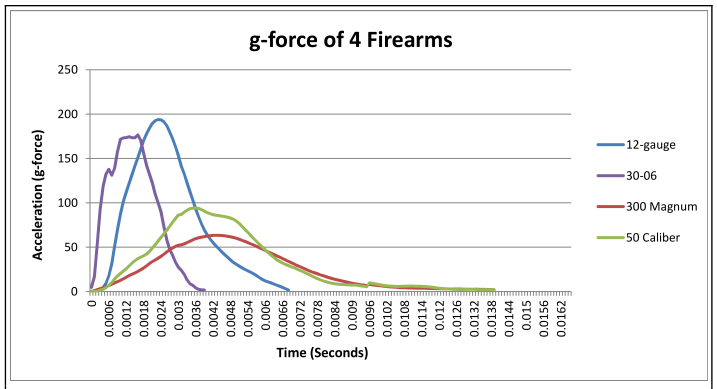

Figure 2: Average Acceleration of Each Firearm

Phase 2

Phase 1 determined there was enough force on the shoulder to cause a concussion. The purpose of Phase 2 is to investigate the acceleration that directly impacts the skull. To do this, a tri-axle accelerometer was placed noninvasively on an individual's head to record the acceleration of the skull, zygomatic and occipital bones.

Discussion

The .30-06 Caliber generated g-forces which are higher than those needed to cause a concussion (Gever D, 2007), 111.44 - 165.49 g. Current data suggests firearm recoil can translate as high as 200 g to the skull of an individual. In addition, if enough force impacts the skull, the brain can ricochet inside it, creating coups and contrecoups.

Results

Zygomatic Acceleration

The .30-06 Caliber generated the highest measurable zygomatic acceleration ~155 g.

Occipital Acceleration

The .30-06 Caliber generated the highest measurable occipital acceleration ~111 g.

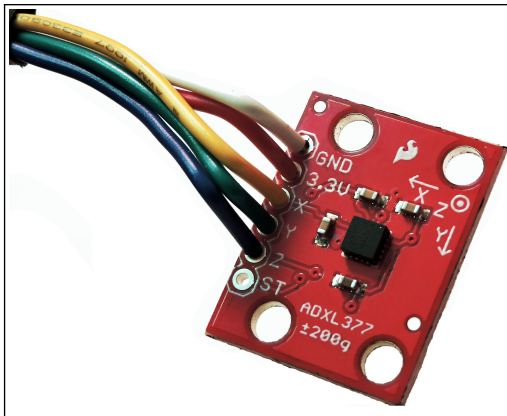

Figure 3: Tri-axle Accelerometer

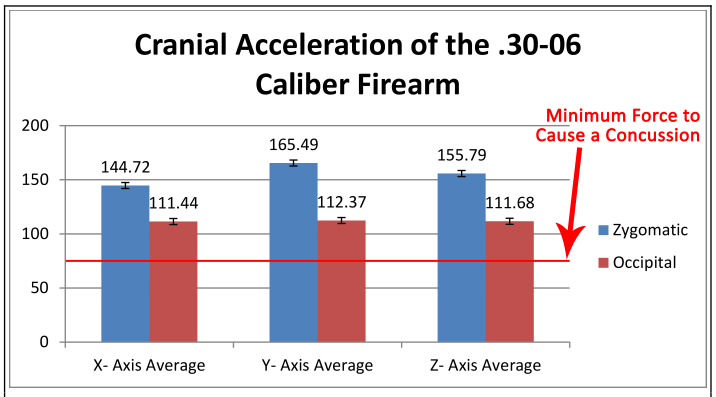

Figure 4: Average Cranial Acceleration of the .30-06 Caliber

Conclusion

Testing was conducted to determine if firearm g-forces on the shoulder and cheek-weld area were powerful enough to cause a concussion. Based on the 75 g range, firearms can cause concussions. Future studies should be conducted to compare accelerations and measure rotational forces with an array of accelerometers placed on the head.

For More Information Go To:

www.brainstudy.tech