

AAN 66th ANNUAL MEETING ABSTRACT

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Abstract Title: Comparison of Common Football Helmets in Preventing Concussion, Hemorrhage and Skull Fracture Using a Modified Drop Test

Press Release Title: How Well Do Football Helmets Protect Players from Concussions?

Objective: Current football helmets do little to protect against concussion.

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Background: Helmet effectiveness is traditionally measured through linear drop-tests, using an apparatus approved by the National Operating Committee on Standards for Athletic Equipment (NOCSAE). The result is helmets are optimized to protect against skull fractures, visible bruising, and other focal effects. However, biomechanical researchers have long understood that rotational forces, as opposed to linear forces, provide the major driving force for serious brain damage. Furthermore, current consensus states that in order to sustain a concussion i.e. mild traumatic brain injury, rotational, angular, and/or lateral forces must act directly on the head, or be transferred to the head by other parts of the body resulting in rotation of the cerebral hemispheres around the upper brainstem. Helmets provide little protection against these forces and as a result generations of football and other sports participants are under the assumption that their brains are protected by their investment in headwear protection.

Design/Method: We devised a reasonable modification to the standard drop test system, incorporating a crash test dummy head and neck, to generate a more realistic impact. Miniature sensors installed at the center of the surrogate head are used to measure linear and rotational responses to repeated 12 mile per hour head impacts. Using this system, we conducted 330 tests to measure how well ten popular football helmet designs protect against traumatic brain injury.

Results: Our results, calculated as a percent reduction compared to an unhelmeted baseline condition, show that leading football helmets reduce the risk of skull fracture by 60-70% and reduce the risk of focal brain contusion by 70-80%. Alarmingly, we learned that football helmets, on average reduce the risk of traumatic brain injury by only 20% and those that offer the least protection are among the most popular on the field.

Conclusions: While football helmets provide excellent protection from linear impacts--those leading to bruising and skull fracture--they offer little or no protection against rotational forces, a dangerous source of brain injury and encephalopathy. Protection against concussion and axonal injury is especially important for young players, including peewee, high school and college participants, whose still-developing brains are more susceptible to the lasting effects of trauma.

Study Supported by: BRAINS, Inc., a Research and Development company based in San Antonio, Florida, focused on biomechanics of traumatic brain injury.