Head part 2

11. SUNY Head Impact Testing: Problems With the Study

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Dummy Neck Biofidelity

Biofidelity refers to how accurately a device or model represents actual human response. For example, how accurately does a crash dummy head impacting a propeller guard underwater represent a human head impacting the same propeller guard underwater?

The particular crash dummy used, a Hybrid III ATD (Anthropomorphic Test Dummy) was well known for having a neck spring several times stiffer than a human neck, making the impacts seem more severe than they really were.

Mike Scott, primary researcher even acknowledged this problem in a preliminary report, "*In axial compression mode, the Hybrid III neck is stiffer than human cadaver preparations which may lead to an overestimate of the neck forces developed by these contacts*." The neck is in compression when the guard passes over it and pushes it down as it did in each of the tests conducted.

All mention of neck biofidelity issues were removed from the final version of the paper.

Don Kueny once president of OMC and a participant in the SUNY testing later testified in court. Kueny testified he had heard the Hybrid III dummy did not have biofidelity in this area (the neck) because the anthropomorphic dummy's neck was four or five times stiffer than a human neck.

Numerous technical papers before and after the SUNY testing focused on biofidelity issues of the Hybrid III ATD crash dummy's neck in axial compression.

In the 1991 SAE Transactions paper, "*The Influence of End Condition on Human Spine Injury Mechanisms*" researchers found the Hybrid III neck form was 10.2 to 50.3 times stiffer than the human cadaver cervical spine depending on the imposed end condition. CONTINUED TOP MIDDLE

Hedge Words & Phrases

The conclusion section of the Head Impact paper is full of hedge words and phrases, This is an indication the authors cannot positively get behind their findings, instead they use hedge words like "maybe" or "might".

The six paragraph conclusion of the version of Scott's Head Impact paper published in the SAFE journal includes the following hedge words and phrases: "may become", "may mitigate", "most likely produce", "if", "may occur", "the probability", "may cause", and "may produce" leaving the reader wondering what if anything they really concluded.

Dummy Neck Biofidelity Continued

Mike Scott along with three Biodynamic Research Corporation (BRC) researchers that worked on the SUNY head impact project published an SAE paper in 1993 titled, Comparison of Human and ATD (Anatomical Test Dummy) Head Kinematics During Rearend (automobile) Impacts.

When your car is rear ended, your arms, legs, and torso are quickly pushed forward by the seat, leaving your head back where it was before the collision which can result in whiplash. Rearend impacts basically throw your head to the rear like it was pushed to the rear by the propeller guard at SUNY.

The conclusion of the paper above reads, "*The motion of the human head and neck appears to be much more complicated than the Hybrid III's head and neck motions in low-speed readend impacts, not a surprising finding when one considers the more complex anatomical structure of the human head and neck compared to the Hybrid III's. Preliminary results indicate that the Hybrid III would probably not be a good human surrogate for evaluating whiplash injury potential in low-speed rearend impacts with delta V's (changes in velocity) in the range of 4.0 kph to 8.0 kph as the ATD's head and neck kinematics are dissimilar to the human's.*"

BRC researchers including Mike Scott published a Society of Automotive Engineers (SAE) paper in 1993 saying the Hybrid III neck did not replicate the human neck when quickly moving to the rear as it did in the SUNY tests. BRC's 1993 SAE paper was even cited by experts in 1998 evaluating the new Bio-RID test dummy purposefully designed for use in rearend collisions.

Despite knowing the Hybrid III neck did not replicate human necks when the head is moving to the rear as it did at SUNY, BRC published the head impact paper in SAFE Journal in 1994.

Mathematical Human & Outboard Model

Biodynamic Research Corporation (BRC) had a computer model for simulating underwater impacts where the motion of the struck object is planar i.e. like a neck rotates to rear vs a glancing partially sideways blow simultaneously rotating the neck to the rear and to the side).

The authors report, the model was validated by simulating the ten strikes to the center of the forehead at Position A, Tests #1 - #10 of the SUNY head impact testing.

A review of the parameters used in the simulations shows the BRC model used the parameters for the Hybrid III dummy (not those of a human), including the dummy's neck axial stiffness of 3,000 pounds per inch.

Comparing results of underwater crash dummy impacts with computer simulated impacts verified the computer model reasonably represented underwater impacts of Hybrid III crash dummy heads. However, it proved nothing about human impacts.

More Problems With the Study

1. No testing was performed without a propeller guard for comparison.
2. The crash dummy was not designed to be impacted, especially not from the front. It was built for testing restraining systems in car frontal collisions.
3. The crash dummy was being used far outside of its intended purposes at SUNY. This would have required use of cadavers to verify its response represented the response of a human body. We identified ten biofidelity issues or points to be verified in addition to the neck stiffness issue, yet no cadavers were used.
4. The study and subsequent technical papers were overseen by and paid for by Mercury and OMC lawyers.
5. The resulting technical paper went through multiple edits with the final version looking more favorable to the industry's viewpoint and including more Snyderisms.
6. The study said the leading edge of the guard was blunt, but it was only 5/16 inch wide and the impact occurred underwater. Comment: the resistance of a human body in water makes slightly dull edges impacting the body more likely to cut than they would above the water.
7. The Marine Corps previously rejected the use of 5/16 wire on this guard in favor of 1/4 wire to reduce drag which would have been less stiff on impact.
8. Multiple statements in the final report are directly from Dick Snyder's review of the proposed article.
9. Biofidelity issues at SUNY included neck stiffness, rubber skin, inflating the dummy's chest, neck, and head making them stiffer, and changes in neck stiffness due to water temperature. Biofidelity issues lead to misleading or false outcomes.
10. The way SUNY calculated the impact of "added mass", the mass of water that moves when a segment of the body moves, was not verified.
11. Absolutely nothing was proven concerning blunt trauma.
12. Biofidelity is meaningless when you are not striking heads in the way they are struck in real life.

80% of Underwater Impacts Occur at Normal Operating Speeds

This Snyderism made its way into the 1989 NBSAC report and is repeated in the Head Impact study. See our 1989 NBSAC Part 5 poster pie chart showing this statement to be false. Over 70 percent of 2009 BARD reported propeller accidents occurred at or below 15 mph.