Female crash test dummy can reduce injuries

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Women are twice as likely as men to suffer whiplash injuries when hit from behind. Nevertheless, the crash test dummy used for testing is based on the average male. Chalmers researcher Anna Carlsson has now produced a prototype for the first crash test dummy in the world to represent the average female.

The majority of all whiplash injuries occur at benign velocity changes – below 25 kilometres an hour. Even though women are at much greater risk, whiplash protection systems are primarily adapted to men.

"I hope that my research will lead to improved whiplash protection for

both women and men when they are hit from behind in a collision. From a national economics perspective, it would be advantageous to adapt car protection systems to suit women as well," says Anna Carlsson, who recently defended her thesis at Chalmers.

Women's bodies move faster in a collision

In order to produce a model for a female crash test dummy, Anna Carlsson tested women getting hit at very low speeds and acceleration in order to assess how an average-sized woman's body moves when hit from behind in a collision.

The researchers then developed a computational model of a female crash test dummy, which they named EvaRID (RID = Rear Impact Dummy). The model is now available for purchase. On the basis of the mathematics model, the researchers produced a prototype for a crash test dummy with female proportions.

The average sized female rear impact prototype dummy, BioRID50F. Credit: Dr Steffan Datentechnik

The dummy was then subjected to eight crash tests in regular car seats. The results were compared to a male dummy. When hit from behind, the female crash test dummy demonstrated generally higher acceleration and quicker motion than the male dummy. Car seat backs do not yield backwards to the same extent when a woman is hit, which means women experience an earlier and more powerful forward rebound.

The neck has a slight curvature when we sit in a normal position. When hit from behind, however, the body is pushed forward by the backrest while the head lags behind, resulting in the neck becoming s-shaped before the head and neck subsequently rotate backwards. The next motion is the body being propelled forward into the seatbelt. This entire course of events takes about half a second. Good whiplash protection reduces injuries, but statistics indicate that the current protection in general is 30 percent more effective for men than for women.

Crash test dummy development has reduced injuries

"If we can lower the forward acceleration for both women and men during collisions, we can also significantly lower the risk of injury. One way of doing this is to manufacture a seat that yields backwards in a collision. Another way is to allow the upholstery padding to absorb the energy, meaning the seat frame does not move," says Anna Carlsson.

Volvo and Saab have been exceptionally good at producing whiplash protection. Anna Carlsson believes their success is due to BioRID, which is the male crash test dummy they developed at the end of the 1990s in cooperation with Autoliv and Chalmers. The BioRID crash test dummy is currently used all over the world and the risk of injury has been reduced by around 50 percent in the best car seats.

"Injuries can be further reduced by producing a female size dummy and by adapting car protection systems", says Anna Carlsson.

She hopes that she will be able to continue developing the female crash test dummy, which at this stage is still a prototype. She would also like to develop biomechanical limit values for women since the existing ones are adapted to men.

"Since the research indicates that women generally run a higher risk of sustaining injuries during car accidents, we need to separate the statistics and injury criteria for men and women."

More information: Thesis: publications.lib.chalmers.se/c … ex.xsql?pubid=156181

Watch films of rear impact sled test and simulation: www.mynewsdesk.com/se/pressroo … /chalmers/video/list

Provided by Chalmers University of Technology