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Exploring the of air

David Hynd, Head of Biomechanics at TRL, reflects on the company's recent study carried out for BE into the effectiveness of air jackets in protecting riders from crush injuries

Like other sports, Eventing has its risks. However one area that's often deemed as particularly dangerous is cross country.

Over recent years there have been a number of fatalities resulting from horses falling on riders during the cross country phase at Events. British Eventing figures reveal that between July 2013 and June 2014, there were 45 falls on

British Eventing cross country courses in which the horse was caused to somersault by the way in which it impacted the fence.

Not only can these falls put the rider at risk from injury when hitting the ground, but in the worst case scenario they can result in the horse falling on the rider involved, causing death or serious injury. In fact, in 2013/14, 16 of these falls resulted in serious injuries and one sadly resulted in a fatality.

Questions have been raised about the potential of air jackets in preventing injuries and fatalities in such scenarios, with many calling for air jackets to be made compulsory. Similar to the airbag in a car, existing air jackets are designed to inflate and offer protection when the rider falls from a horse. However, their effectiveness at protecting against injuries from a horse falling on a rider is less well understood.

To help understand the issue further and to identify a

better way to safeguard riders, TRL recently completed a study for British Eventing to establish the effectiveness of air jackets in protecting against crush injuries. The study sought to understand both the protective capacity of existing air jackets and the forces applied by a falling horse, so that a suitable test procedure for protective equipment can be developed.

PUTTING AIR JACKETS TO THE TEST

A series of controlled tests were performed at the equestrian surgical facility at the Bristol Veterinary School, using both the BETA 2009 Level 3 horse rider body-and-shoulder protector that is currently mandatory for cross country Events, and also an existing air jacket.

Tests involved dropping an equine cadaver onto a Hybrid III crash test dummy in both scenarios and measuring the chest deflection, which is a standard measure used to predict the risk of serious chest injury. Such injuries could include: minor laceration of the aorta, major laceration of other major chest arteries or an unstable rib cage following multiple rib and sternum fractures, leading to suffocation if not treated promptly.

The horse cadaver was sourced from a rescue centre and was euthanised by the Bristol Veterinary School for medical reasons prior to the tests, as part of the facility's normal operations. The drop height was 1.2m above ground level and the pre-mortem mass of the horse was 487kg. The dummy was supported on a matrix of 123 load cells in order to measure the forces applied by the horse and

provide data that could be used to develop a horse surrogate for future testing.

Results from the tests showed that the air jacket slightly reduced the compression of the dummy's chest and subsequently the predicted risk of severe chest

Below: Load cell wall, showing the array of 123 load cells, and the Hybrid III crash test dummy wearing a body protector and air jacket positioned on the load cell array prior to testing



FURTHER INFORMATION

The latest fall data report from the 2014/2015 season will be in our next issue, landing on 29 December

effectiveness jackets

injury fell from 94% to 81%. This means that it could have a beneficial effect in reducing the likelihood of severe injury from a horse falling on a rider. However, there is still a high probability of riders sustaining a severe injury, even when wearing the air jacket. So while the air jacket may provide some safety improvements, it is unlikely to prevent fatalities should a horse fall directly on a rider.

One element not measured in the study was whether the air jacket protects the rider in the initial ground contact prior to crush loading from the horse. If so, then there could be a benefit in that the horse would be less likely to land on an injured, and therefore weakened, rib cage. This may particularly be the case with partial crush loading, where the horse doesn't fall as directly or severely on to the rider as investigated in the study.

MOVING FORWARD

Improving safety of riders has been high on the agenda for a number of years, and as with other biomechanical areas, TRL research has played a prominent part in any improvements. The latest research study revealed that while air jackets may have some safety benefits, fatal and serious injuries are still highly likely to occur should a horse fall directly on to a rider.

Although the results provide an initial indication of the effectiveness of air jackets, there are a number of areas that require further exploration. The dummy used in the tests represented the average height and weight of a 45 year old male, so results may vary for riders of different statures and ages. For example, risks may be slightly lower for younger riders, but substantially higher for older riders, due to the fact that bone condition changes with age. So there may be combinations of loading condition and rider for which this design of jacket is unable to offer meaningful protection.

It should also be remembered that these tests involved one loading condition, with a relatively low drop height. The exemplar horse cadaver was also relatively light in comparison with a typical Eventing horse; a heavier horse or greater fall height would be expected to increase the risk of severe chest injury. ✦

