

## A Helmet for Prevention and Mitigation of Spinal Column and Spinal Cord Injuries In Head First Impacts

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Head first impacts can cause some devastating injuries to the cervical spine. In the worst cases cervical spine fracture and injury to the spinal cord can occur leaving those afflicted paralyzed for life. Transportation accidents and sporting events are two of the most common situations for head first impacts and in many of these activities helmets are worn. Some examples are a hockey player going head first into the boards after a check from behind or a football player hitting another player head first during a tackle. Most think of the helmet as an engineered interface between the head and impact surface and are exploring whether its traditional role of head protection can be extended to include protection of the spine in headfirst impacts.

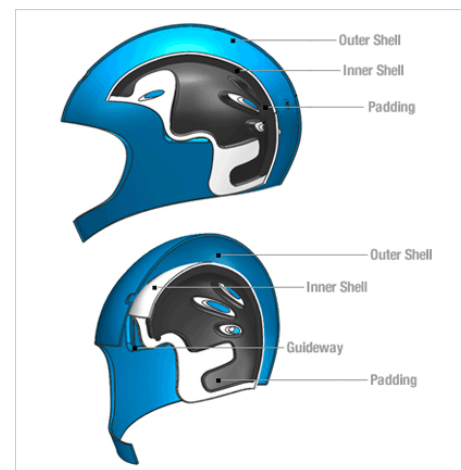
The human cervical spine is extremely flexible in multiple directions. It is in fact very seldom that our cervical spine will behave with a purely axial response to an axial load in a head first impact. Most times, the flexibility and posture of the neck combine with the location and direction of the force being applied to the head to cause the neck to bend and result in the head deflecting off the impact site without a neck fracture.

The spinal cord is one of the most sensitive and important structures in the human body. The cord contains thousands of nerves that connect organs and muscles in the lower body with the brain and cerebellum. There is much research being done to improve clinical outcomes from spinal cord injury but there is currently no definitive treatment or cure for it.

Existing helmet designs are effective when protecting against skull and brain injury using hard outer shells and internal padding, but they do not provide any additional protection against injury to the neck. The Pro-Neck-Tor helmet technology under development at the Injury Biomechanics Laboratory of The University of British Columbia in Vancouver, Canada has the potential to reduce some of the financial costs

and quality of life consequences associate with these injuries.

Pro-Neck-Tor makes use of a double-shell design with engineered mechanical guides connecting the two shells. During a head first impact, Pro-Neck-Tor guides the head along the surface, reducing the neck's need to stop the following torso, minimizing the loads on the neck during impact. Proof-of-concept tests using an instrumented mechanical head and neck model have demonstrated that Pro-Neck-Tor™ can reduce neck loads in head first impact.



### References:

Nightingale RW, McElhaney JH, Richardson WJ, et al. Dynamic response of the head and cervical spine to axial impact loading. *Journal of Biomechanics*;29:307-18.

<http://www.pronecktor.com/index.php?section=home>