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Assessment of Motorcycle Helmet's Chin Bar Design Criteria with Respect to Basilar Skull Fracture Using FEM

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Statistical studies showed that the chin bar of full-face helmets is the region with the highest number of impacts. In an Australian research fifty percent of severe impacts took place to the front of helmet and forty percent of these resulted in Basilar Skull Fracture (BSF). There are two standards, which include some criteria for helmet's chin bar, the first one is Snell M2005 and the second one is ECE 22.05. These standards have developed some methods for testing the chin bar in order to protect the head from facial impact during motorcycles accidents, but it seems that the standards have to consider head and neck injuries simultaneously, in order to prepare reasonable criteria for chin bar design. This work has utilized finite element method in order to compare the Snell M2005 and ECE 22.05 criteria for chin bar design with respect to the injuries at the base of the skull. In the first step, the helmet model has been used individually in order to simulate the chin bar test for both standards. In the next step, the dummy model has been coupled to the helmet in order to simulate the response of the body, especially the head and neck, to the facial impact. Finally, the results obtained from dummy model simulation have been utilized in order to assess which standard could provide better criteria for BSK. The simulations are performed with LS-Dyna and the focus of the assessment is about the injuries at the intersection between skull and spine.