

Importance of the Bicycle Helmet Design and Material for the Outcome in Bicycle Accidents

M. Fahlstedt¹, P. Halldin², S. Kleiven³

¹ Neuronic Engineering, School of Technology and Health
Royal Institute of Technology
Alfred Nobels Allé 10, 141 52 Huddinge, Sweden
e-mail: madelen.fahlstedt@sth.kth.se

² Neuronic Engineering, School of Technology and Health
Royal Institute of Technology
Alfred Nobels Allé 10, 141 52 Huddinge, Sweden
e-mail: peter.halldin@sth.kth.se

³ Neuronic Engineering, School of Technology and Health
Royal Institute of Technology
Alfred Nobels Allé 10, 141 52 Huddinge, Sweden
e-mail: svein.kleiven@sth.kth.se

ABSTRACT

Bicyclists is one of the road user group that are least protected in the traffic. In Sweden the bicyclists are the largest group of severely injured in transportation accidents where head injuries are the most common severe injury [1]. The most frequent used safety equipment among bicyclists is the helmet. Today's helmets consist of an energy absorbing liner and an outer shell. They are certified by vertical drop tests which are not a common loading of the head in real bicycle accidents. In addition to the current helmet testing standards, the performance of bicycle helmets have been tested with experimental and finite element (FE) studies [2, 3]. Still, little is known about the effect of helmet designs in real accident which could give valuable information for helmet standard organizations and manufactures. Therefore the aim of this study was to study the influence of helmet design on head injuries in different bicycle accident situations.

In this study a detailed FE head model [4] has been used together with a FE model of a helmet available on the market. The helmet's performance was evaluated in different bicycle accident situations. The evaluation of the protective effect of the helmet was done by comparing the 1st principal strain of the brain tissue and the stress of the skull bone.

The traditional helmet gave a significant reduction of the strain level in the brain tissue and stress level in the skull bone compared to not wearing any helmet. The reduction of the strain level was dependent on the bicycle accident situation. The alteration of the helmet design showed that more can be done to improve the protective effect of the helmet. This study highlights the need of a modification of today's helmet standard test which can lead to helmets with even better protective properties.

Keywords: bicycle accident, helmet design, head injuries, finite element simulations.

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