Consequences of motorcycle and car accidents on human cervical spine

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Abstract

Modelling researches concerning neck injury mechanisms acting during road accidents and their consequences for human life are presented in this paper. The investigations mainly focus on compression, flexion and extension injuries mechanisms. The interaction with environment, the human body behaviour (especially the head movement), inertial and external forces have a significant influence on type and scale of spine injuries. In order to analyse correlation between head movement and physical phenomena in the neck, two dynamical non-linear models were created using Working Model 2D professional system. The models allow to analyse movement in saggital plane. The first model of a motorcyclist was created to analyse neck compression injury mechanism in situation of falling down on the head and protecting role of helmets. Obtained results point out significant role of helmet and its kind in cervical spine protection. These data suggest that design process of helmet should assume construction carrying impact load on motorcyclist's arms. The second model of driver allows to examine flexion and extension mechanisms acting on cervical spine during head-on and rear car collision.
Research results of numerical simulations allowed to qualitatively estimate the most dangerous conditions for people falling down on the head during motorbike accident and for passengers during car accidents.

Keywords – neck injuries, road accidents, modelling, numerical simulations

1. Introduction

Cervical spine injuries can occur during road accidents, in rough contact sports, after a fall, or by hitting your head against a hard surface, such as when diving into a pool that is too shallow. These accidents can cause injuries that range from mild cases of neck pain, to injuries that can cause paralysis of the rest of the body below the level of injury or even death. The most serious cases of human spine damage are connected with penetration of broken bones into spinal cord canal.

The statistics estimate the number of traumas with injured spinal cord as 25-35 people per 1 million of population, and the half of it concerns cervical part. The most frequent reasons of spine injuries are road accidents [11].