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Numerical simulation in biomechanics – a forensic example

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Abstract

The paper presents an example of a forensic application of biomechanical methods including numerical simulation with human body models. By means of a case study of an unwitnessed lethal fall the course of the biomechanical forensic reconstruction is demonstrated. The traces available at the place of finding and the injuries of the victim are the facts that the analysis is based on. The ultimate expected result of the biomechanical analysis is the assignment of all available traces and the explanation of the event. The injuries observed in the described case were partly typical fall injuries, but there were also some injuries that could not be prima vista assigned. The police investigation at the place of finding also brought to light some facts that could not be satisfactorily explained at first. By using numerical simulation, additional information was obtained that enabled us to explain many aspects of the case that could not have been analysed otherwise. Numerical simulation offers objective and quantitative data enabling a far more exact analysis of the studied event – the kinematical as well as dynamical parameters of the human body and its interaction with the surroundings structures can be studied and even the human body's internal forces can be analysed enabling thus an accurate injury prediction. All the important unknown parameters (initial conditions of the simulated event, i. e. body position, body orientation, initial velocity etc.) can be easily varied so that all the possibilities can be taken into account. Another very important asset of this method is its powerful visualisation capability that enhances the understanding of the studied events even for persons without extensive biomechanical knowledge. The major limitation of numerical simulation at the moment is the lack of muscle activity; the models represent only a totally passive human body so far.

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