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Titel des Beitrags:
Technical possibilities for optimising the ski-binding-boot functional unit to reduce knee injuries in recreational alpine skiing

Abstract:
This review study focuses on knee injuries in recreational alpine skiing. The objectives of this study were (1) to provide selected knowledge derived from current and past knee injury epidemiology; (2) to outline the most important knee injury mechanisms; and (3) to review and discuss how modifications of the skiing equipment might alleviate the risk of knee injuries. This review represents the essence of a comprehensive research report and considers the content of more than 230 scientific papers, further "grey literature", patents, international standards and other publications. Knee injuries are the most frequent injuries in alpine skiing and their incidence rate remained high despite a decline of the incidence of other skiing injuries in recent years. Women have a higher knee injury risk, but age and tiredness appear not to be significant factors. Apart from the commonly described injury mechanisms "phantom foot" and "boot-induced anterior drawer" other more sophisticated injury categorisations are given. The ski radius, the ski length and the standing height on the ski may be relevant ski parameters. For the binding, the release mechanisms in different mechanical degrees of freedom, the impact tolerance and the maintenance frequency are discussed. In the ski boot, the height of the upper, the boot liner, the shaft stiffness, and the position on the ski may play a role. The biggest challenge, but probably also the biggest opportunity for a reduction of
knee injury rates seems to be the development of a mechatronic binding. The current strategies to develop these types of bindings are explained and illustrated by one example. Some of the possible parameters which may be essential for the necessary control algorithms are described. Finally, considerations regarding the strategic and operational implication of the analysed technical measures are given.

Stichworte: skiing; knee injuries

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