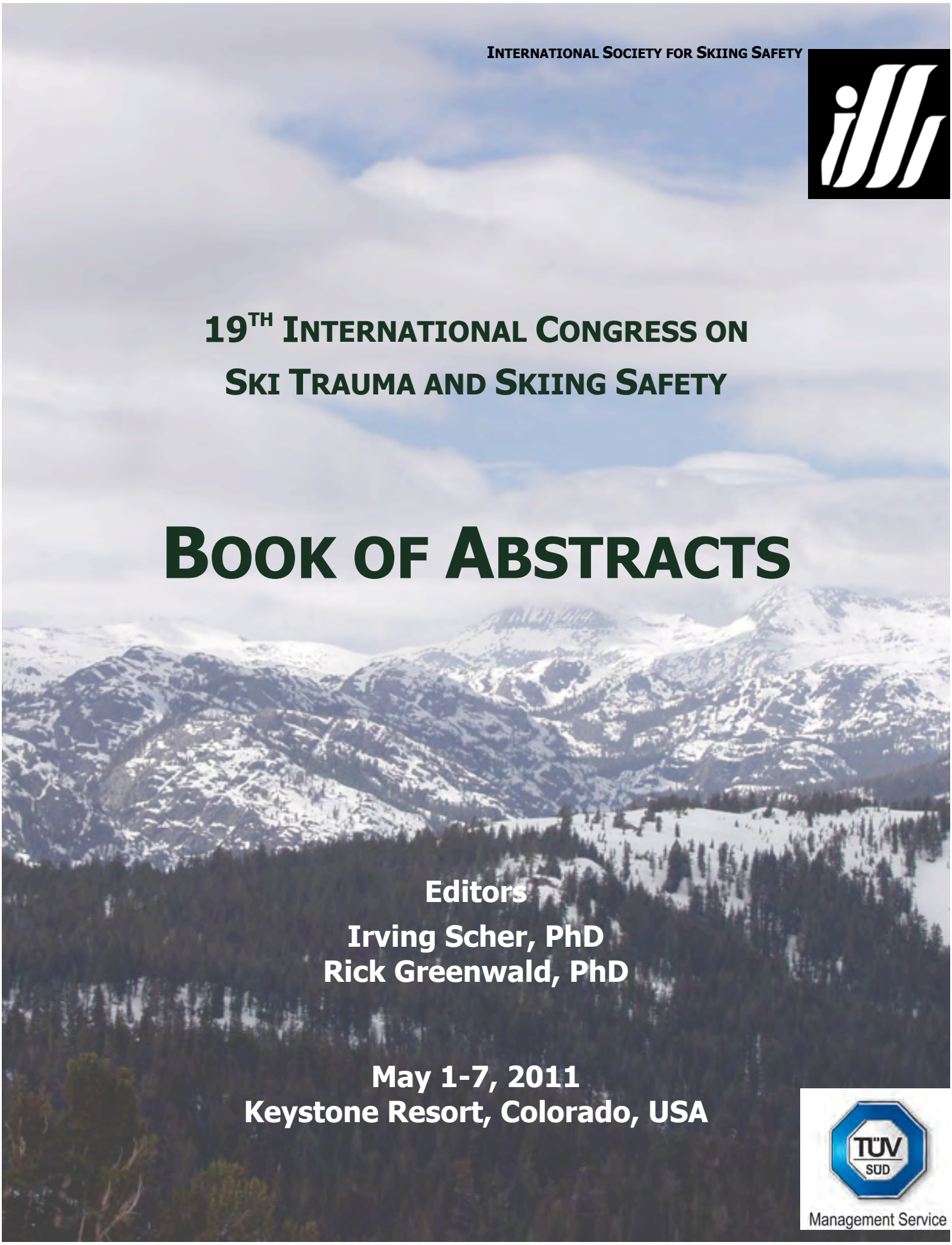
The effect of boot shaft flexibility on ankle, knee and hip coupling during mogul skiing

Kersting, Uwe G.; McAlpine, Paul; Kurpiers, Nico

Published in:
Book of Abstracts of the 19th International Congress on Ski Trauma and Skiing Safety, 1-7 May 2011, Keystone, CO, USA

Publication date:
2011

Document Version
Publisher's PDF, also known as Version of record



INTERNATIONAL SOCIETY FOR SKIING SAFETY

19TH INTERNATIONAL CONGRESS ON SKI TRAUMA AND SKIING SAFETY

BOOK OF ABSTRACTS

Editors

Irving Scher, PhD
Rick Greenwald, PhD

May 1-7, 2011
Keystone Resort, Colorado, USA

TÜV SÜD Management Service

Book of Abstracts of the 19th International Congress on Ski Trauma and Skiing Safety

Editors Irving Scher, PhD
Rick Greenwald, PhD

Preface

The International Congress on Ski Trauma and Skiing Safety is a biennial meeting of the International Society for Skiing Safety and brings together the top researchers in the field of snow sport safety. The mission of the organization is to identify, understand, and address current health related issues in snow sports, in order to reduce the likelihood of injury. The 2011 congress will provide an opportunity for researchers and experts to explore topics relevant to snow sport safety, including ski area management, terrain park and jump safety, safety equipment for skiers and snowboarders.

The International Society for Skiing Safety is pleased to present the Book of Abstracts of the 19th International Congress on Ski Trauma and Skiing Safety (ISSS 2011) held at Keystone Resort, Colorado, USA, from May 1-7, 2011.

Sachiko Yahashi Award

The International Society for Skiing Safety founded an award to be given for outstanding research presented at each International Congress on Ski Trauma and Skiing Safety. During the meeting in Keystone, Colorado, USA the Sachiko Yahashi Award will be given to the young investigator who presents the best paper. The winner will be identified during the meeting and will receive a cash prize and a plaque.

The effect of boot shaft flexibility on ankle, knee and hip coupling during mogul skiing

Uwe G. Kersting*, Paul McAlpine, Nico Kurpiers

***Center for Sensory Motor Interaction, Aalborg University, Denmark**

Department of Sport and Exercise Science, The University of Auckland, New Zealand

KEY WORDS: freestyle skiing, ground reaction force, joint loading

INTRODUCTION: Soft ski boots were not very well accepted by the skiing community in the past. This may be due to the fact that the boot fulfils several functions for the skier of which control is probably of high importance. It may therefore be important to be very specific about the type of modification used and the type of skiing this modification is applied to. Mogul skiing consists of bending and straightening the legs in order to absorb the moguls appropriately whilst retaining snow contact. However, the range of movement for that squatting task is highly restricted by the stiff ski boot and the athlete is forced to bend in an awkward backward position (Schaff & Olbert, 1996). The purpose of this study was to test the effect of a modified ski boot on lower extremity kinematics and loading of the ankle, knee and hip joints during mogul skiing.

METHOD: Nine male mogul skiers (20.9 ± 6.92 y) of the German national freestyle team participated in the study. A custom-built mobile six degree-of-freedom force measurement device and a high speed camera system (Simi Motion) were used for collection of all components of GRF and 3D marker data in the field. The collected data were used as input to a 3D full body musculoskeletal model (Anybody Technology) to calculate lower extremity joint kinematics as well as net joint moments, muscle and joint forces at the joints of interest.

RESULTS: The ski boot modification allowed for a greater range of flexion-extension movement at ankle and knee joints resulting in a more forward positioning of the centre of mass with respect to the ski. Joint moments, joint and muscle forces were generally reduced in amplitude (Fig. 1). Specifically at the instant of maximum external force when approaching a mogul dramatic changes were seen in some skiers. Perception questionnaires demonstrated that the shoe modification was well accepted.

DISCUSSION: This specific boot modification increased ranges of movement and significantly reduced knee joint loading. All skiers reported a positive effect on their control in this particular situation which is likely to be caused by just increasing flexibility in a specific direction. It needs to be investigated what the implications for changes in other equipment components may be when using such boots.

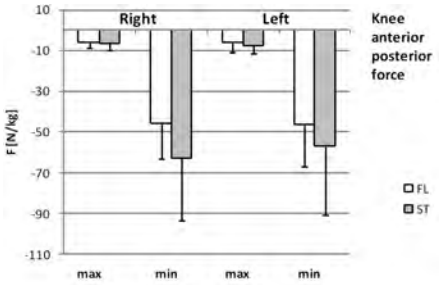


Figure 1: Anterior-posterior force at the tibial plateau; including muscle forces.

CONCLUSION: Boot modification allows for a reduction of knee joint load in specific skiing situations. If this applies to other types of skiing or to the general skiing community remains to be confirmed. This line of research offers new insights and will allow to assess effects of equipment developments in skiing.

ACKNOWLEDGEMENTS

We greatly appreciate the contributions of Peter Spitzenpfeil and Veit Senner, TU Munich, as well as the help of the AnyBody Research Group, Aalborg University.

REFERENCES

Schaff, P. & Olbert, W. (1996). Der Einfluss der Sprunggelenksbeweglichkeit auf die Plantarbelastung beim Buckelpiste-Skifahren. Sportorthopaedie - Sporttraumatologie, 1.