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Joint loading on the lower extremities in skiing and snowboarding: methodological procedure

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To determine the loading on the lower extremities in skiing and snowboarding accurately, representative 3D kinematic and kinetic data has to be collected which serves as input data to calculate the loading parameters. The goal of this presentation is to give an overview and validation of the methodological procedures to collect and analyse these data.
3D kinetic data was collected with a mobile force plate (KISTLER). This device was placed between the binding plate and the binding for skiing and between the board and the binding in snowboarding. Kinematic data of both legs and pelvis were collected with five analogue cameras (50 Hz). The 3D marker positions were calculated with Simi Motion. Several tests validated the methods used to collect the kinetic and kinematic data. (Stricker et al., 2005; Klous et al., 2004). Further analyses of kinetic and kinematic data as well as the development of the inverse dynamic model were programmed in Matlab.
Validation of the mobile force plate shows accuracy comparable with laboratory systems. An error of 1-2% was found for 3D measured forces and an error of 1-5% was found for the determined torques (Stricker et al., 2005). In the 3D video analysis also a high accuracy was found. Error margins are in the range of 1-2 cm on a measuring range of 20 m. In the kinematic data analysis, in which the position and orientation of each of the segments was calculated, the error margins increased only slightly.
It can be concluded that the methods used in this project to collect and analyse the kinetic and kinematic data are sufficient and acute enough to use the collected data as an input for the inverse dynamics calculation.

Reference: *Klous M., Schwameder H., Müller E. (2004). Beitrag der 10. Tagung der ÖSG, 14-15.*
Stricker G., Scheiber P., Müller E. (2005). In: Book of Abstracts, 10th Annual Congress - ECSS, Belgrade.