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A Comparison of Ground Reaction Forces Determined by Portable Force-Plate and Pressure-Insole Systems in Alpine Skiing

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ABSTRACT

For the determination of ground reaction forces in alpine skiing, pressure insole (PI) systems and portable force plate (FP) systems are well known and widely used in previous studies. The purposes of this study were 1) to provide reference data for the vertical component of the ground reaction forces (vGRF) during alpine skiing measured by the PI and FP systems, and 2) to analyze whether the differences in the vGRF measured by the PI and the FP depend on a skier's level, skiing mode and pitch. Ten expert and ten intermediate level skiers performed 10 double turns with the skiing technique "Carving in Short Radii" as High Dynamic Skiing mode and "Parallel Ski Steering in Long Radii" as Low Dynamic Skiing mode on both the steep (23 °) and the flat (15 °) slope twice. All subjects skied with both the PI and the FP system simultaneously. During the outside phase, the mean vGRF and the maximum vGRF determined by the FP are greater than the PI ($p < 0.01$). Additionally during the inside phase, the mean vGRF determined by the FP were greater than the PI ($p < 0.01$). During the edge changing phases, the mean vGRF determined by the FP were greater than the PI ($p < 0.01$). However, the minimum vGRF during the edge changing phases determined by the FP were smaller than the PI ($p < 0.01$) in the High-Steep skiing modes of Experts and Intermediates ($p < 0.001$). We have found that generally, the PI system underestimates the total vGRF compared to the FP system. However, this difference depends not only the phase in the turn (inside, outside, edge changing), but also is affected by the skier's level, the skiing mode performed and pitch.

Key words: kinetic analysis, alpine skiing, accuracy, skiing mode, pressure insole

Key Points

- Typically, during the steering phases of the ski turns the total vGRFs measured by the pressure-insole system were lower compared to the portable force-plate system.
- However, in some skiing modes during the edge changing phase, the pressure-insole

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