

Kinetic Analysis of Snowboard Jump Landings

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INTRODUCTION: Today terrain parks are well utilized by the snowboarding population. Epidemiological data shows an increased injury risk associated with jumping. At present, the magnitude of the impact loads experienced during jumping, and potential moderating factors, are not well understood. Apart from a small handful of theoretical and experimental research projects (Bohm, Hosl, & Senner, 2008; Shealy & Stone, 2008) this aspect of snowboarding has been largely ignored. The aim the current study was to investigate the ground reaction forces (GRF) applied to snowboarders during on-mountain tabletop jump landings and to assess the effect of binding alignment on these measures.

METHOD: Seven snowboarders participated in this study. The test session involved 16 straight jumps over tabletop snow jumps, spread between two binding alignment conditions; symmetric external rotation of the feet of 24° and 6°. Kinetic data were collected at 1000 Hz using a snowboard force plate, mounted between the binding and board, beneath the front foot. All jumps were recorded using a standard digital video camera for qualitative assessment. Force and moment data were filtered with a low pass 4th order Butterworth digital filter at 100 Hz. Impact maxima, loading rates and impulse were calculated for all components of the landing GRF. Non-parametric Wilcoxon Signed Rank tests were used to identify between condition differences.

RESULTS AND DISCUSSION: As expected, the GRF loads applied at the feet during landing are of high magnitude. The mean front foot vertical impact peak during landing was 3.3 N/BW ($SD = 1.4$, range 0.84 – 9.0). Assuming equal distribution between the feet, the mean calculated COM acceleration peak (5.7 G) compares well with previously presented chest accelerations (3.7 G) measured on a slightly smaller jump (Shealy & Stone, 2008). Adjustment of binding alignment had an effect upon the way impact loads are applied to the snowboarder. As illustrated in Figure 1, the 24° condition had greater ($p < 0.05$) moment peaks and rates about the long axis of the foot, and medial excursion of the centre of pressure (COP) at the instant of peak compression. It is likely that these differences are caused by the position of increased external foot rotation, resulting in altered lower body kinematics. These findings may indicate an increased risk of twisting type ankle injuries for this binding alignment angle.

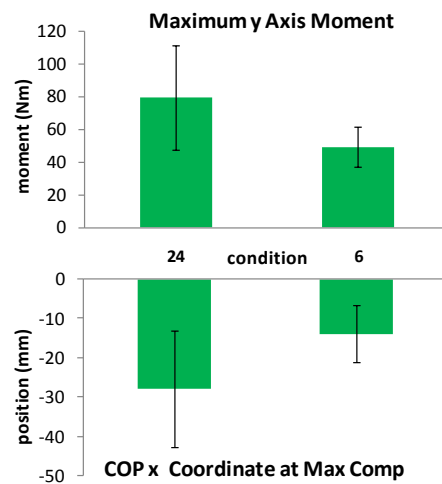


Figure 1 Maximum moment about long axis of the foot (y axis) and position of the COP at peak compressive loading (-ve x coordinate is medial)

CONCLUSION: Biomechanical descriptions of snowboard jumping will prove valuable in future development of injury prevention strategies. Further investigation into the effects of binding adjustment on kinematic and joint loading measures is planned for the near future.

REFERENCES

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