CROSS VALIDATION OF A FIGURE SKATING BLADE INSTRUMENTED TO MEASURE FIGURE SKATING IMPACT FORCES.

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Competitive figure skating requires a vast amount of athleticism with an artistic touch. Skaters spend hours each day on-ice mastering jumps, spins, and footwork. The high workload may be related to overuse injuries, which are very common in figure skating, especially at the elite level. To better understand the relationships between on ice training and injuries, it is important to understand the loading patterns acting on skaters.
Purpose: To validate an instrumented figure skating blade that is designed to measure impact forces while skating. **Methods:** Seven subjects (Age: 21.3±2.8 yrs, Ht: 166.9±2.5 cm, Mass: 64.7±7.9 kg) performed 20 landings each onto artificial ice while landing on the instrumented blade from heights of 17.5cm, 25cm, and 33cm. A custom instrumented blade calibrated to measure in forces in Newtons (N) was used to measure impact forces (1000Hz) during landings. These forces were compared to forces obtained while subjects landed on AMTI force plates located underneath the artificial ice surface. Boot angle (250Hz) and force plate data (1000Hz) were collected using Vicon Nexus. Custom LabVIEW programs were used to determine peak force, loading rate, impulse, and the correlation between the blade force data and the force plate data. Paired T-tests were used to compare peak force, loading rate, and impulse between the blade and force plate data. Alpha = 0.05. **Results:** Correlations between the blade force data and force plate data were good to excellent: mean r (±SD) = .86 ± 0.08. No significant differences were found for peak force and impulse between the blade and force plate data. Peak force means (±SD) were 1353.7 ± 352.2 N for the blade and 1361.2 ± 309.7 N for the force plate ($p=.86$). The means (±SD) for impulse were 44.99 ± 21.2 Ns for the blade and 48.1 ± 17.7 Ns for the force plate ($p=.125$). Loading rate, calculated from impact to time of peak force, was significantly higher ($p = 0.0004$) for the blade data (28.88 ± 22.8 N/ms) as compared to the force plate data (9.77 ± 7.5 N/ms). **Conclusion:** The custom instrumented blade is a valid tool for measuring peak forces and impulse during landings. Current research is focused on increasing the gain of the instrumented blade to improve loading rate accuracy.

Supported by US Figure Skating, Sports Science and Medicine Grant 2011