

Portability vs. Precedent: IMUs vs. 3D Motion Capture for Collecting Kinematic Data in Dancers

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ABSTRACT

The emergence of portable kinematic data collection systems (Inertial Measurement Units - IMUs) have become a potential alternative to 3D video motion capture systems for real-world application. However, there remains little research on the application of IMU technology for the evaluation of dancers' biomechanical movement. **PURPOSE:** To assess the validity of the Noraxon IMU system compared with the Cortex 3D video motion capture system for kinematic data collection during a sauté. **METHODS:** 10 healthy, advanced female dancers were equipped with both a Noraxon IMU (200Hz) system and reflective markers used with a 12-camera Motion Analysis system (Cortex, 250 Hz) for simultaneous data collection. Participants completed an independent After a 10-minute warmup, each participant performed one trial of 10 stationary sautés while barefoot, with feet in second position and arms in fifth position in time with music at 95 bpm. The middle 5 jumps of each participant's trial were processed and analyzed with Visual3D and MATLAB for the Cortex data, and through Noraxon's reporting system for the Noraxon data. All results were compared through SPSS with repeated-measures ANOVAs. **RESULTS:** A main effect of measurement system was found for peak joint angles in the sagittal ($\lambda(6,4)=0.009, p < 0.001$), frontal ($\lambda(9,1)=0.12, p < 0.001$), and transverse ($\lambda(9,1)=0.009, p < 0.001$) planes. Pairwise comparisons revealed significant differences in peak hip flexion, hip extension, knee flexion, knee extension, ankle plantar flexion, ankle dorsiflexion, hip adduction, knee adduction, ankle inversion, hip internal rotation, hip external rotation, knee internal rotation, knee external rotation, and ankle internal rotation. No significant main effect was found between measurement systems for sagittal, frontal, and transverse plane joint excursions ($\lambda(9,1)=0.12, p=0.253$). **CONCLUSION:** Significant differences in most peak joint angles indicate that Noraxon IMUs do not have strong validity for capturing absolute joint angles compared to 3D video motion capture. However, joint excursion measurements were similar, indicating that Noraxon IMUs may be valid for measuring the total amount of motion during a particular movement. Additional analysis is warranted for further understanding of this technology.