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Video Measures of Running Ground Contact Times and Vertical Ground Reaction Forces

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Ground contact time (GCT) and vertical ground reaction force (VGRF) are key variables with regards to running performance, metabolic rate, and musculoskeletal stresses. However, there are few field-based methods with acceptable accuracy to quantify these variables in comparison to a laboratory force plate standard. The development of commercially available high-speed video cameras (HSC) may provide a cost-effective method for determining these variables during over-ground running. **PURPOSE:** To validate video-based measures of GCT and VGRF compared to a laboratory force plate. **METHODS:** 20 subjects (13 males, height = 1.76±0.07m, mass = 78.0±9.0 kg; 7 females, height = 1.65±0.07m, mass = 68.3±9.4kg) volunteered and provided written informed consent. One HSC (Apple iPad Pro 9.7) filming at 240 Hz was placed at three standardized locations around the laboratory force plate. The HSC captured the point of ground contact on the force plate as subjects performed three running trials at different self-selected speeds (jog, run, sprint), with two minutes recovery between each trial. Velocity was measured with an automatic timing system (Free Lap), and GCT and VGRF were directly measured using an in-ground laboratory plate (Kistler 5691A) collecting at 1000 Hz. Video-based calculations of VGRF were based on GCT and equations of projectile motion. **RESULTS:** In comparison to the force plate, the HSC had a mean absolute error of 3.2%±2.2% (R^2=0.97) for GCT and 10.7%±5.2% (R^2=0.85) for VGRF. **CONCLUSION:** A commercially available HSC filming at 240 Hz can accurately determine GCT during over-ground running, but caution is warranted when using the proposed method to calculate VGRF.