Comparisons between Systems to Measure Contact and Flight Times in Elite Race Walking

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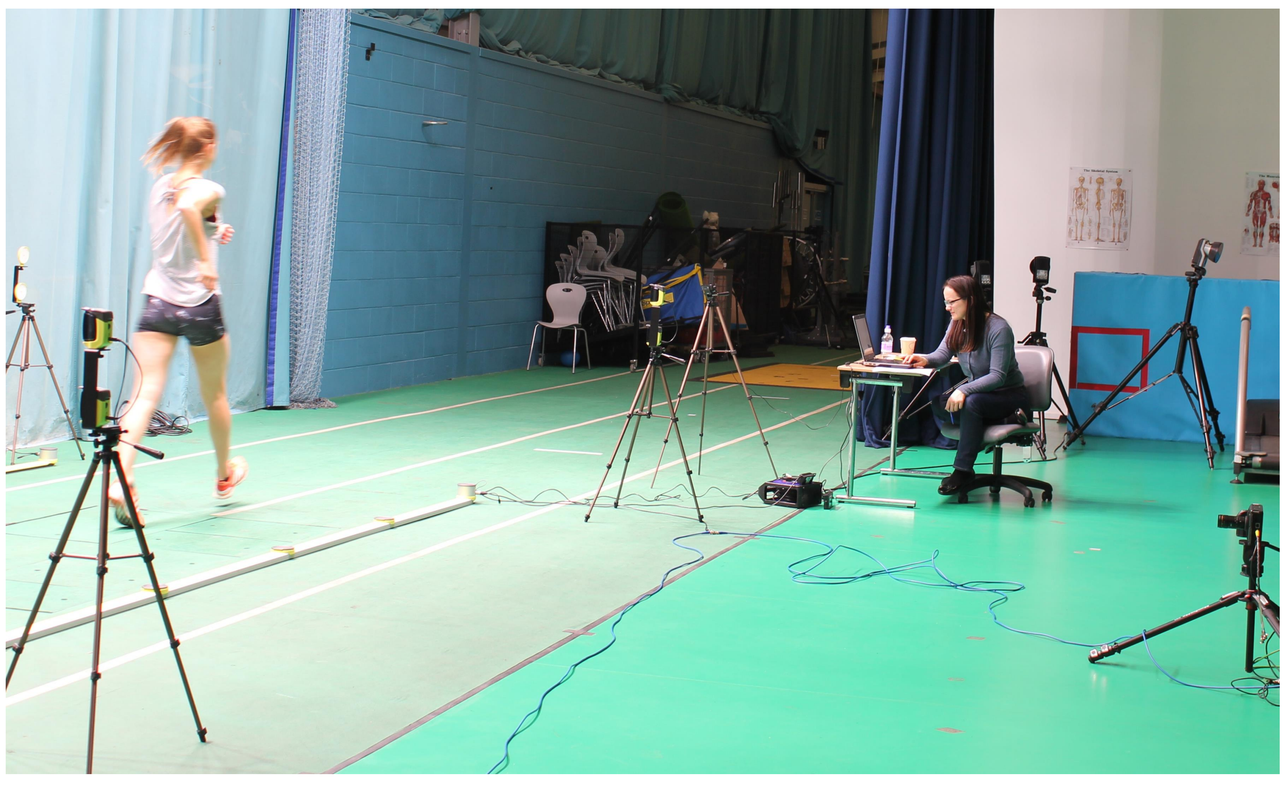
Introduction

Race walking is an Olympic event dictated by a rule that states that no visible loss of contact with the ground should occur and that the leg must be straightened from first contact with the ground until the 'vertical upright position' (IAAF Rule 230.2). The measurement of flight times during race walking is therefore of great interest to coaches, athletes and judges. Given the importance of flight time measurements, using a valid and reliable system is critical in determining the actual duration of flight time as part of a training programme or sport science support. The aim of the study was to compare different methodologies used to measure contact and flight time in race walking.

Methods

11 male race walkers (1.77 m (± 0.06), 64.4 kg (± 4.7)) and 7 female race walkers (1.68 m (± 0.10), 56.7 kg (± 11.0)) participated. 15 of the athletes had competed at the 2016 Olympic Games or 2017 World Championships. The men race walked down an indoor track at 11, 12, 13, 14 and 15 km/h, whereas the women's trials were at 10, 11, 12, 13 and 14 km/h. Contact and flight times were measured using three adjacent 900 x 600 mm Kistler force plates (1000 Hz), 5 x 1 m strips of an OptoJump Next system (1000 Hz) and a Fastec high-speed camera (500 Hz). Results from the OptoJump Next system were extracted using five settings based on the number of LEDs that needed activating (contact begins after_contact ends when), and were annotated as 0_0, 1_1, 2_2, 3_3 and 4_4. The force plate values were considered the criterion values and measurements were assessed for reliability using Intraclass Correlation Coefficients (ICC) and 95% limits of agreement (LOA: bias ± random error).



Results

	Video	0_0	1_1	2_2	3_3	4_4
Contact						
ICC	.991	.967	.982	.995	.960	.874
95% CI	.952 - .996	.066 - .992	.566 - .995	.993 - .996	.400 -.988	–.071 - .969
LOA bias (s)	.004	–.011	–.008	.000	.011	.024
LOA RE (s)	.010	.010	.010	.010	.015	.015
Flight						
ICC	.973	.841	.902	.983	.843	.558
95% CI	.839 - .990	–.121 - .953	.296 - .967	.977 - .988	–.103 - .953	–.125 - .850
LOA bias (s)	–.004	.012	.008	.000	–.011	–.023
LOA RE (s)	.008	.014	.013	.008	.014	.018

Discussion

The OptoJump Next system provided results similar to those of the gold standard force plates, with the 2_2 setting the most reliable. Users of the OptoJump Next system should therefore note that adjusting the settings of the device (from 0_0, the most likely default setting) might be necessary to achieve the most accurate results. The high-speed video recordings also provided very good reliability although the time-consuming nature of video analysis means the OptoJump Next system is better suited to providing immediate results.

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