Comparisons between Systems to Measure Contact and Flight Times during Treadmill Race Walking

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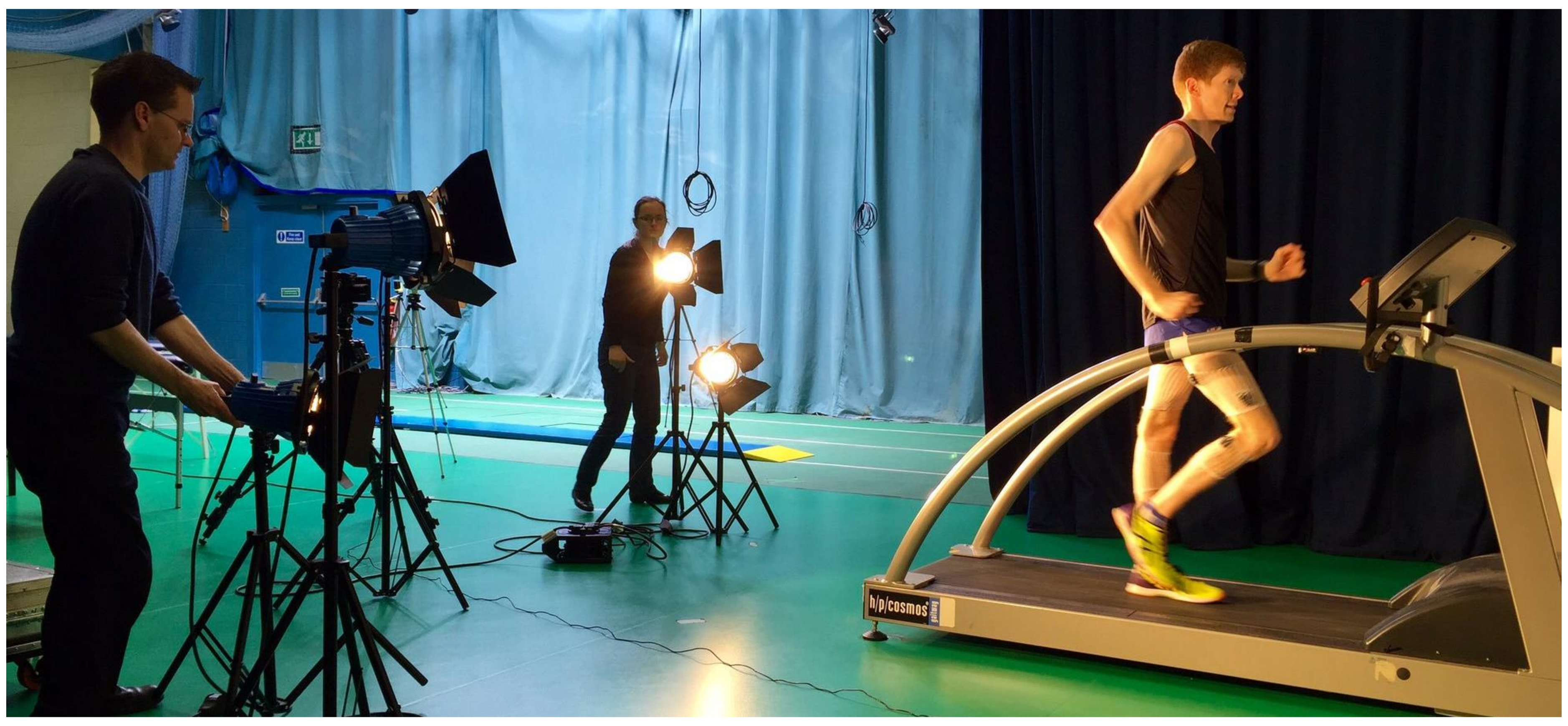
Introduction

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 on a treadmill.



Methods

11 male world-class race walkers (1.77 m (± 0.06), 64.4 kg (± 4.7)) and 7 world-class female race walkers (1.68 m (± 0.10), 56.7 kg (± 11.0)) participated. The men race walked on an instrumented treadmill 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 for each trial using two in-dwelling Kistler force plates on the treadmill that recorded vertical ground reaction forces (1000 Hz) from both feet and temporal data, a 1 m strip of an OptoJump Next system (1000 Hz) placed on the treadmill 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	.975	.979	.965	.820	.773	.655
95% CI	.967 - .980	.968 - .985	.857 - .985	–.091- .967	–.153- .935	–.128 - .894
LOA bias (s)	–.002	–.004	.008	.021	.031	.042
LOA RE (s)	.022	.019	.020	.024	.029	.032
Flight						
ICC	.916	.938	.879	.552	.452	.308
95% CI	.882 - .934	.921 - .962	.435 - .957	–.182 - .886	–.140 - .779	–.097 - .665
LOA bias (s)	.002	.003	–.009	–.021	–.032	–.042
LOA RE (s)	.020	.017	.019	.021	.025	.027

Discussion

The OptoJump Next system provided results similar to those of the gold standard force plates, with the 0_0 setting the most reliable. Users of the OptoJump Next system should therefore consider this setting (which is the default setting) along with others such as minimum flight time and contact time (typically the default is 10 ms) to achieve the most accurate results when using a treadmill. The high-speed video recordings also provided very good reliability but it was occasionally difficult to subjectively identify contacts with this method. Therefore, the Optojump Next system is better suited to provide more immediate results when collecting treadmill data.

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