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Foot Strike Patterns of Runners at the 15-km Point During an Elite-Level Half Marathon

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ABSTRACT

Hasegawa, H., T. Yamauchi, and W.J. Kraemer. Foot strike patterns of runners at 15-km point during an elite-level half marathon. *J. Strength Cond. Res. 21(3):888–893. 2007.*—There are various recommendations by many coaches regarding foot landing techniques in distance running that are meant to improve running performance and prevent injuries. Several studies have investigated the kinematic and kinetic differences between rearfoot strike (RFS), midfoot strike (MFS), and forefoot strike (FFS) patterns at foot landing and their effects on running efficiency on a treadmill and over ground conditions. However, little is known about the actual condition of the foot strike pattern during an actual road race at the elite level of competition. The purpose of the present study was to document actual foot strike patterns during a half marathon in which elite international level runners, including Olympians, compete. Four hundred fifteen runners were filmed by 2 120-Hz video cameras in the height of 0.15 m placed at the 15.0-km point and obtained sagittal foot landing and taking off images for 283 runners. Rearfoot strike was observed in 74.9% of all analyzed runners, MFS in 23.7%, and FFS in 1.4%. The percentage of MFS was higher in the faster runners group, when all runners were ranked and divided into 50 runner groups at the 15.0-km point of the competition. In the top 50, which included up to the 69th place runner in actual order who passed the 15-km point at 45 minutes, 53 second (this speed represents 5.45 $m \cdot s^{-1}$, or 15 minutes, 17 seconds per 5 km), RFS, MFS, and FFS were 62.0, 36.0, and 2.0%, respectively. Contact time (CT) clearly increased for the slower runners, or the placement order increased ($r = 0.71$, $p \leq 0.05$). The CT for RFS + FFS for every 50 runners group significantly increased with increase of the placement order. The CT for RFS was significantly longer than MFS + FFS (200.0 ± 21.3 vs. 183.0 ± 16 millisecond). Apparent inversion (INV) of the foot at the foot strike was observed in 42% o all runners. The percentage of INV for MFS was higher than for RFS and FFS (62.5, 32.0, and 50%, respectively). The CT with INV for MFS + FFS was significantly shorter than the CT with and without INV for RFS. Furthermore, the CT with INV was significantly shorter than push-off time without INV for RFS. The findings of this study indicate that foot strike patterns are related to running speed. The percentage of RFS increases with the decreasing of the running speed; conversely, the percentage of MFS increases as the running speed increases. A shorter contact time and a higher frequency of inversion at the foot contact might contribute to higher running economy.