Athletic Sprint Start Biomechanics
Investigations into the relationships between three dimensional starting technique, first step width and performance

av

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Akademisk avhandling

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Opponent: Aki Salo
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Abstract:

The block and early acceleration phase plays a very important role in the overall outcome of athletic sprint events. During this part of the race it is commonly observed that sprinters use a lower-body technique that involves the swing leg crossing medially in front of the athlete followed by wide steps. These wide initial steps give the impression that the legs are flailing out to the side. Some coaches believe that this action could be inefficient and thus should be curtailed. However, there is limited knowledge about this movement pattern and its relation to performance.

Therefore, the overall aim of this thesis was to help elucidate from a biomechanical perspective a) the fundamental underlying kinematic and mechanical basis to this technique and b) how both performance and muscular contributions to propulsion would be affected when step width was restricted.

A cross sectional study design was used to examine specific kinematic and kinetic variables from 11 competitive sprinters (9 male, 2 female) performing maximum effort 15 m sprint starts. Three-dimensional kinematics, ground reaction force and electromyographical data were recorded from the block phase to the end of the 1st stance phase. Each athlete performed five trials with their natural technique and five trials inside a 0.3 m wide lane. A 15-segment, full-body model and a 37 degrees of freedom full-body musculoskeletal model were created and used to calculate relevant variables/parameters. Normalised average horizontal external power was used as the performance measure.

A combination of pelvis list and rotation (but not hip adduction) was found to be coupled with the thigh of the swing leg moving medially during the single push phase. In the unrestricted width trials, pelvic list range of motion and medial impulses correlated positively with step width but step width was not found to be related to performance. When step width was restricted, a more forward pointing normalised average ground reaction force vector was seen but lower body muscular contributions to acceleration were reduced and no immediate improvement to performance was found.

The primary kinematic reason behind the lower body posture the sprinters adopt during the block phase whereby the swing leg moves medially in front of the body is caused by a combination of three dimensional pelvis rotations rather than simply hip internal rotation/or adduction of the swing leg. Trying to reduce pelvic range of motion or minimising the flailing leg motion is unlikely to lead to an improvement in performance. Therefore, the notion that this technique is inefficient, was not supported by this study.

Keywords: sprint start, step width, biomechanics, performance, angular momentum
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