The Movement Analysis of a Block Start

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Introduction

The block start is a foundational element in any high-level sprinter. The movements of the bock start require intense and focused actions that work within three body planes. According to Debaere and associates, the transverse, sagittal, and frontal planes are operational during the block start (Debaere et al., 2013). Within these planes, specific joint angles and velocities are achieved to create the powerful eccentric and concentric contractions of the block start. The ratio of eccentric to concentric contractions is determined by the changes in joint angle and velocity (Oatis, 2015). Examining the knee, elbow, hip, and shoulder joint angles, known as angular motion, allows assessment of block start quality. According to Oatis, angular motion can be defined as movement containing a vertex (Oatis, 2015). The sprint form illustrated in the block start contains relative and absolute joint angles (Oatis, 2015). For example, the hip joint creates an absolute angle in the horizontal and vertical reference planes. The hip joint also creates a common relative angle with the adjacent thigh.

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Phase 1- Loading the Blocks

- **Knee Flexion-** The first image display rear knee is flexion to an angle of approximately 62°. While the second image displays the front knee angle of 41°. These angles are relative to the size and foot length of each sprinter.
- **Scapula Depression-** Shoulder depression is important to assure that shoulders reach over the start line (Bezdois et al., 2019).
- **Elbow Hyperextension-** Elbow hyperextension accommodates for the tightness of the body in the blocks.

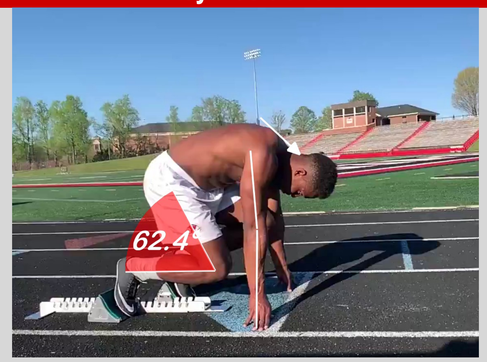
Phase 2- The Set Position

- **Knee Extension-** According to Bezdois and associates, the ideal rear knee angle is approximately 135°. The image provided shows an angle of approximately 141° (Bezdois et al., 2019).
- **Scapula Elevation-** Most of the individual's weight should be leaning forward, creating scapula elevation.
- **Elbow Extension-** Extension is achieved in response to the forward movement of body weight.

Phase 3- Unloading the Blocks

- **The Triple Extension-** As illustrated by the blue line, the subject creates full extension through the knee, hip, and ankle.
  - **Knee Extension-** According to Bezdois and associates, the front leg exhibits a proximal-to-distal peak angular velocity sequencing upon the first drive phase (Bezdois et al., 2019).
  - **Hip Extension-** This motion dominates the sagittal plane and can determine progressive motion performance (Kumala et al., 2016).
  - **Plantarflexion-** Plantarflexion is displayed at a relative joint angle of approximately 128°.
- **Scapula Adduction-** According to Otsuka and associates, after a gun signal, the arms and scapulae are the first to react by generating flexion (Otsuka et al., 2017).
- **Elbow Flexion-** Elbow flexion produces a relative joint angle of approximately 120°.
- **Dorsiflexion-** The ideal angle for dorsiflexion is 90° (Bezdois et al., 2019). Dorsiflexion produces the necessary muscle tension to spring into the next stride (Guillén-Rogel et al., 2017).

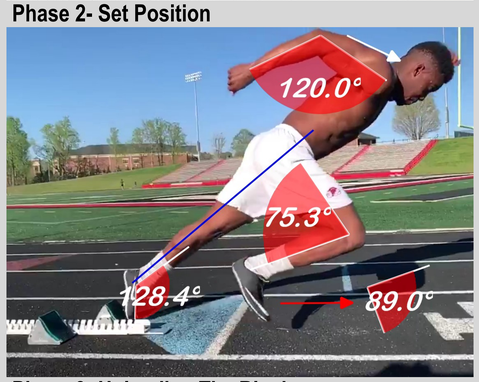
Key Positions



Phase 1- Loading The Blocks

Phase 1- Loading The Blocks (Continued)

Phase 2- Set Position



Phase 3- Unloading The Blocks

Key Position Drills

- **Tuck Jumps-**Many sprinters use tuck jumps before loading the blocks to fire muscle fibers and neurons to assure the ability to be explosive.
- **Box Step-Up's-**This drill practices knee flexion, one of the driving factors when unloading the blocks. Box step-up's help sprinters exhibit better posture to create longer strides.
- **Power Cleans-**Power cleans also execute the triple extension and allow sprinters to practice the movement and become more explosive.

Conclusion

In conclusion, the stages of a block start involve various body planes, relative joint angles, and muscle contractions to create the acceleration necessary in sprint races. Understanding what the ideal angles and mechanics are for the block start can determine the difference between a high-level or novice sprinter (Bezdios et al., 2019). Sprinting is biphasic motion with stages of contraction and relaxation. The ratio of eccentric to concentric contractions is determined by the change of joint angle and the change in velocity of those joint angles (Oatis, 2015). Examining the knee, elbow, hip, and shoulder joint angles, known as angular motion, allows assessment of block start quality. Overall, our subjects perform the block start exceedingly well and set themselves up to accelerate at a high level and maintain good sprint form.

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