

Biomechanics of Sports

Biomechanical Terms and Concepts

Identifying Sprinting Technique Pt 1

April 27, 2020



Lesson: April 27, 2020

Objective/Learning Target: Identify and apply the concepts of Sprint Technique.



Warm-up Activity:

1. What is gait and how is it defined?
2. List as many joint movements as possible that occur during sprinting!



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Instructions: Read the information listed below. Answer the supporting questions and identify key landmarks in the gait cycle.



2. What defines sprinting?

Firstly, before delving into the details of the analysis method, we need to have a common understanding of what defines 'sprinting'. What any discussion pertaining to 'sprinting' is truly referring to is running at maximal or near-maximal speeds. The overarching aim of sprinting is for the performer to propel their body down the track, pitch, field, or court as fast as possible.

If we consider this task simply, the athlete who can most-appropriately project their body forward in the shortest time-frame, and maintain top-speed the longest, will be the most successful. This type of motion has specific kinematic characteristics differentiating its gait from walking, jogging or sub-maximal running. Understanding what the gait cycle looks like is therefore a key tool in being able to error-detect and correct.



The gait cycle is the basic unit of measurement in gait analysis, and begins when one foot comes in contact with the ground, and ends when the same foot contacts the ground again.

Key landmarks in the gait cycle include:

- **Touch-down:** the point where the foot contacts the ground.
- **Stance-phase:** the weight-bearing phase of gait cycle. During the stance phase, the foot is on the ground acting as a shock absorber, mobile adapter, rigid lever, and pedestal, as the body passes over the support leg. Stance ends when the foot is no longer in contact with the ground.
- **Toe-off:** the beginning of the swing phase of the gait cycle where the foot leaves the ground.
- **Swing-phase:** the phase where the foot is no longer in contact with the ground and the free leg is recovering forward in preparation for ground touch-down.
- **Flight-phase:** seen in running only, this represents the period where neither foot is in contact with the ground. This includes the swing phase above.

Humans transition from a walking gait to a running gait at a certain speed threshold generally between 2.0 - 2.7m/s (Schache et al. 2014). The demarcation between walking and running occurs when periods of double-support during the stance-phase of the gait cycle (both feet simultaneously in contact with the ground) give way to two periods of double-float at the beginning and the end of the swing-phase of gait (neither foot touching the ground). In running, there are no periods when both feet are in contact with the ground. As the athlete's speed increases, less time is spent in stance. Jogging is normally seen at speeds of approximately 3.2-4.2 m/s; running at around 3.5 to 6.0 m/s; and sprinting, anywhere upwards from there, depending on the individual.

2.2 Sprinting Gait

When approaching maximal speed, we see subtle differences in gait to that noted in submaximal running. As running speed increases, time spent in swing increases, stance-time decreases, double-float (flighttime) increases, and cycle-time shortens. Generally as speed increases, initial contact changes from being relatively rearfoot to relatively forefoot. This is important to understand, as it relates to footwear, cognitive control of ground-strike, and questions in regards to dorsiflexion and plantarflexion.

3. The ALTIS Kinogram

The first to examine sprint kinematics, and display it in pictorial form, was Eadweard J. Muybridge in the 1880s, using cinematographical and dynamographical techniques to explore vertical reactions during various gaits (Vazel, 2014)

‘Cinematography’ was soon replaced by ‘chronophotography’. A ‘kinogram’ is a set of still pictures derived from a video source. First found in 1880s French physiology textbooks, it was also used to describe movement in early 1930s USSR biomechanics publications. It is often used as a synonym for chronophotography, but is differentiated through the optional choice of frame usage; with chronophotography, the time-interval between still-frames remains constant; while with kinograms, we can select the frames as we feel are most-appropriate (Vazel, 2018).

The following five frames are used by the ALTIS coaches, and form the ALTIS Kinogram Method





Questions:

1. What is the overarching aim of sprinting?
2. What are the 5 key landmarks noted in the gait cycle?
3. In running, how many periods are there when both feet are in contact with the ground?



Email your discussion questions to the following instructors:

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