Most literature regarding sprint starts is written with reference to ‘Track’ sprint starting, there is only a limited body of knowledge referring specifically to beach sprint starts. This paper, aims to increase this limited body of knowledge on beach sprint starting by analyzing research papers on sprint starting and using a qualitative approach gathered from leading beach coaches and athletes.

Introduction

The start of a sprint race is that part of the race from the firing of the gun to the departure from the starting blocks, and includes a runner’s first few strides.

James C. Hay in “Biomechanics of Sports Techniques” (1994) describes: “At the starter’s command, the athlete moves forward and adopts a position with his hands behind the starting line and the knee of the back leg, resting on the ground. On the ‘set’, the athlete lifts the knee of the back leg off the ground thereby elevating the hips and shifting the centre of gravity forward. Finally, when the gun is fired, the athlete lifts his hands from the track, swings his arms vigorously (one forward and one backward) and with the forceful extension of both legs drives the body away from the blocks and into the running strides.”

Hay describes the motion of the athlete from the time he prepares for the start until he leaves the blocks in the first phase of the race. Although Hay was referring to the track start, it is relevant to the “Beach Sprint start”.

With beach starts, as no readymade blocks are permitted (SLSA Competition Handbook). However “competitors may create holes and/or hillocks, which act as starting blocks”. These rules also stipulate for the position of the hand “on or behind the line”.

In preparing for the start, athletes must consider a range of variables, from where to position blocks in relation to the starting line, where to position blocks in relation to the front and rear foot, what angles blocks should be built at. Athletes also need to consider how and by what method they will use to construct their blocks.

Athletes must also consider the position assumed prior to the gun being fired and the force that they will apply on leaving the blocks.

This paper considers these variables and their effects on the beach sprint start, with reference to the limited literature currently available.

Leading beach coaches and athletes will also be referred to using qualitative research methods to assist in bridging the gap that currently exist in the literature. This will assist in creating a greater body of knowledge on the beach sprint start.

**Starting Objectives:**

“The beach sprint starts” principal purpose of the beach sprint start is to facilitate rapid clearance from blocks constructed by the athlete and assist athletes to accelerate to maximum speed. There are a number of broad objectives of the sprint start; firstly, athletes must establish a balanced position in the starting blocks. They must also make sure suitable force is applied to the blocks. There must be correct positioning of the body to ensure their hips rise to the same height each time. Athletes must establish a foot position which enables them to come out of the blocks well balanced with adequate velocity to move into a full sprinting position. Finally, athletes must attempt to clear their starting blocks in the shortest possible time after firing of the starter’s gun.

**Types of Starts**

Three main types of starting positions for the sprint start are used. The principal difference between these starts is horizontal distance between front and back feet.
1. The Bunch Start: (also referred to as the bullet start). Feet are positioned close together with the toes of the back foot opposite the heel of the front foot. Sometimes the feet may be positioned even closer together. This involves a block spacing of less than 20 cm.

2. The Medium start: Feet are further apart. The knee of the back leg is placed opposite a point towards the toes of the front foot. Inter-block distance of this start has been described as approximately shin length apart. Arnold (’92) describes a position many athletes currently use which is slightly less than shin length apart, but not so close as to be called a Bunch or Bullet start. This position is referred to as a ‘Short Medium Start’.

3. The Elongated Start: The knee of the back leg is placed level or slightly behind the heel of the front foot. It is described as a position where inter-block distance is well in excess of shin length.

**Block Spacing**

Block spacing and its effect on the start has been the most common factor studied. Major research studies support the use of medium anterio-posterior spacing between the feet. (Menely and Rosemier 1986, Sigerseth and Grinaker 1962).

Earlier studies, (Dickson 1932) found the bunch start (foot space less than 10inches or 25cm) yielded faster starting times than medium or elongated starts. Like a number of other earlier studies this study, was conducted under belief the start was a distinct division of the race and disregarded the influence of the start on the complete race.

Henry (1952) presented evidence that using a bunch start resulted in faster block clearance, but with less velocity than those achieved from a medium position. Other studies indicated that the medium start offers the greatest advantage to sprinters.

Studies or literature on the beach sprint start are limited. However in the small body of literature available there is a trend to a medium/bunch start or bunch start.

Most beach athletes interviewed had a preference of a bunched or medium-bunch start.
Darren Peters (2004) indicates, “in a crouch start, each athlete has a block spacing suited to their leg/body length and personal starting preferences”. He also indicated athletes should aim for a ‘medium’ or ‘bunched’ block spacing.

On the beach, Lou Bulian (1999) indicates a preference for block spacing “close to medium start and as close to the line as possible.”

Most beach sprinters have a smaller inter-block distance on the beach than they would on the track. Clayton Jones used a 30cm inter-block distance on the track (medium start) and 10cm inter-block distance (bunch start) on the beach. This was due to a belief that with the more unstable surface of the beach and less force being able to be pushed back into the blocks, a shorter inter-block distance was suited.

Athletes such as Ryan Hoffman, Clayton Kearney, Tristan Conn and Jake Lynch, all successful athletes both on beach and track, also have a shorter inter-block distance on the beach (approximately 20cm) than they had on the track (approximately 30cm). Their start positions would be classified as "medium-bunched". They all said they were slightly closer to the line in their Beach start. Callum Taylor has his track and beach starting positions at a similar distance between blocks.

**Distance from Starting Line**

In deciding the distance between the front foot and the starting line, (Barbaro 1983) mentions that weight distribution, hip position and effect of the front foot drive must be considered. If the front foot is too close to the starting line, much of the weight will rest on it and the knee angle will be less than 90 degrees. This will result in an inefficient front foot drive.

Bulian prefers a position as close as possible to the front line as long as the buttocks are in a position at least 6cm above shoulder height in the ‘set’ position.
Most of Beach athletes interviewed had a slightly shorter distance from the front foot to the starting line with their beach start compared to their track start. When questioned, most said the reason for this was they found it more comfortable or more efficient.

**Block Angles and Block Preparation**

SLSA coaching manual (4th Ed. 2007) states “*a good start begins with a good block setting. The blocks should be arranged so the maximum force can be exerted on the front foot in a 45 degree direction to the ground, driving the athlete up and out from the starting line*."

The obvious difference between beach sprint starts and track starts is; in Beach sprint starts there is a need to construct blocks in sands of varying consistency. This is compared with the exact and reproducible nature of track starting with starting blocks.

Speaking to various beach sprinters, there is a significant variation in block preparation depending on the individual. Quality of blocks also varied with the quality of the sand. Softer sand generally made it more difficult for athletes to prepare their blocks.

A number of variations in the way athletes prepare their blocks exist in the beach sprint start. Some athletes dig out their blocks from behind, some from in front (parallel to the lanes), and some across at right angles to the lane (sideways). All have the same objective of forming a firm base to apply force against to initiate the start.

Clayton Jones would "dig sideways with the front scooped out in a channel and also preparing an area in front of the blocks to minimizing tripping. There was also an emphasis on keeping block depth and lane level as close as possible"

The SLSA Coaching Manual states “*Start blocks should be dug out facing away from the track to ensure a solid base to push off*”.

However, it is not necessarily the method the athlete uses to dig out the blocks that is important, but more the attention to detail the athlete puts into construction of the starting blocks to ensure a solid or firm base to push off.
Most athletes interviewed built their blocks at an angle of approximately 45 degrees.

Interestingly the best starters were usually athletes who pay the most attention to their block preparation, making their blocks as neat and as firm as the condition of the sand would allow.

**Knee Angles**

An important factor in determining power and momentum developed in the sprint start is the angle of the front knee in the set position. Most literature accepts that a front knee angle close to 90 degrees is the ideal for the set position. An angle of 90 degree allows the knee extensors to work most efficiently for maximum power and momentum to be developed. An angle in excess of 90 degrees may allow faster leg speed out of the blocks but will result in a reduction in the power and momentum created; hence a slower overall start. Borzov (1980) in his investigations into optimal starting positions varies a little suggesting a front leg angle of 100 degrees. Tellez and Doolittle (1984) suggest an optimal angle of above 135 degrees for the rear leg because it allows for the lever to move more quickly and allows greater impulse from a static position.

**Hips**

Height of the hips and amount of forward lean in the set position is of paramount importance. This is interrelated with leg angles. If the hip height is too low the leg angles are too close and the centre of mass is not in an ideal position to displace in the direction of the run. If the hips are too high the knee angles are too open, affecting the optimal force against the blocks. Barbaro suggest the hips should be 6-12cm higher than the shoulders. Lou Bulian mentions that when in the set position the runner’s buttocks should be at least 6cm above shoulder height.

Forward lean should be such that it is not too far forward it will diminish front foot drive. If the hips are just above or behind the front foot there will be more vertical component instead of horizontal component in the drive out. The hips should be therefore just forward of the front foot in the set position.
Arms

Arms should be shoulder width or slightly wider. If the arms are too narrow, the set position becomes unstable. If the arms are too wide, the head and shoulders drop too far below hip height.

Reaction Time

Reaction time has been described as the elapsed time between the firing of the starting gun and first reaction of the athlete. Reaction time can be divided into:

1. Pre-motor time: the time from the gun until the onset of electrical activity in skeletal muscle.
2. Motor time: delay between the onset of electrical activity and the force production by the muscle.

Reaction time while an important of the sprint start plays only a small part of the overall race performance.

Block Clearance

As the athlete drives from the blocks, the rear leg is pulled through fast, the front leg fully extends, and the arms drive vigorously in a short arm action, while the head remains in a neutral line with the trunk.

The SLSA Coaching Manual states that “after the gun, the body should move out and up following a 45 degree path. Care should be taken by the coach to ensure the body line through the sprint to the head remains at the 45 degree angle and narrowly moves up to the running angle.”

Tellez and Doolittle suggest that as a result of drive from the blocks, the force that has been applied through the front block travels in one direct line through the body. An angle of 45 degrees being suggested as the optimum angle for the most effective drive from the blocks. It would appear that an angle of greater than 45 degrees would lend itself to too much vertical component and therefore sacrificing some early acceleration.
An angle less than 40 degrees may cause a stumbling effect necessitating short strides to correct the imbalance. Payne and Blade (1971) found that in general, both rear and front feet started to exert forces on the blocks at the same time. Athletes with the best starts usually had a strong rear leg action. However, it was the front foot with its longer contact time which provided the greater part of the acceleration of the body.

Peters (2004) describes a “glide out of the blocks rather than a push or jump when referring to beach block clearance, focusing on a smooth, low (head down) acceleration”.

Clayton Kearney describes an "emphasis on leg speed rather than force" when comparing beach block clearance to that of the track. Clayton feel this emphasis on leg speed assists in getting "on top of the sand" for a smooth acceleration phase.

Callum Taylor refers to a 'more vigorous arm action' when driving out of the blocks than would be used with a track start. Clayton Jones has "an emphasis on a clean start with minimal head movement and gradual acceleration and movement into full upright position by 30 meters".

**Conclusion**

A range of variables can affect the sprint start. These variables include the athletes knee angle, hip angle, angle of blocks, intra block distance, distance from the starting line, arm position and block preparation.

The beach start is further complicated by variations in the types of sand on individual beaches and in individual lanes. As well as an athletes ability to prepare their starting blocks. However, if the athlete applies basic principles discussed and prepares their blocks consistently and to the best of their ability under the conditions on the day, a good consistent start is achievable.

As Barbero states “*A coach can do no worse than start with the best mechanical position and then modify, if necessary to suit the characteristics of the individual athlete.*"

As a coach, it may be wise to consider studies and views referenced in this paper and apply this information in assisting your athletes.
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