EFFECTIVENESS OF THREE SPRINT STARTS: A LONGITUDINAL CASE STUDY

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Sprint starts are increasingly important as race distance declines from 400 meters. In this study, three sprint start techniques, a crouch start, a crouch-to-upright start, and a standing start, were examined to determine their relative effectiveness. Effectiveness was defined as time to reach a series of timing gates. A single subject performed all trials in two sessions separated by four years. The mean times for each interval were calculated for each technique and each session. Each trial was videotaped, and representative trials were digitized in order to track the movement of the subject's center of mass. The results showed that the standing start was clearly faster than the other two techniques at every interval and that the center of mass exhibited full running stride characteristics at an earlier stage.

KEY WORDS: sprint starts, start techniques, track & field

INTRODUCTION: The start of a running event accounts for a greater proportion of the total time of the run as the event becomes shorter. Success, or lack of success, in a sprint race is often traced to the start. Interest in the effectiveness of the start has a history extending over a century. Although the standing start has an equally long lineage, it is generally agreed that the most effective start is from a crouched position. Numerous variables have been examined to better understand and improve the start (Bender, 1934; Henry, 1952; Menely & Rosemier, 1968; Mero, Luhtanen, & Komi, 1983; Schot & Knutzen, 1992). Quick response from the blocks has been associated with a "good" start. With the advent of instrumented starting blocks, reaction time is now even used in determining false starts.

Not everyone supports the idea that leaving the blocks quickly yields a good start. Henry (1952) demonstrated that the force-time characteristics of the runner's efforts on the blocks had a greater affect on the start than quickness in leaving the blocks. He concluded that reaction time had very little importance in sprinting ($r = 0.18$ between reaction time and 50 yard sprint time). Further, he noted that runners who produced high horizontal velocity consistently had better times at 10 and 50 yards and suggested that medium block spacing produced these better results with the crouched start.

The standing start has not been subjected to the same scrutiny as the crouched start. Nonetheless there has been punctuated interest over the decades (Clark, 1971; Desipres, 1973; Gibson, 1974; May, 1992). Coaches have noted some advantages of the standing start – easier to teach than the crouched start (Clark, 1971), quicker attainment of an upright position and full running stride, and faster over short distances (Gibson, 1974). These reported advantages have not resulted in widespread adoption of the standing start. Some writers found no time advantage over various short distances for the standing start (Desipres, 1973; Gibson, 1974; May 1992).

Most coaches view the standing start as inferior to the crouch. They employ it with novice runners, but only to gain time to develop the crouched start. There is even social pressure among track aficionados against the standing start. Most college coaches prohibit their athletes from using the standing start even though it is acceptable in the collegiate rules.

The purpose of this study is to examine the effectiveness of three different starting techniques. Effectiveness has been defined in various ways by different investigators. The most common was time to clear the blocks and time to cover selected distances. In this study effectiveness is determined not by how quickly the runner leaves the blocks, nor by how great of an impulse is applied to the blocks. Rather, it viewed as a function of how rapidly the runner is able to run through a series of timing gates and how quickly he is able to reach running stride.

METHODS: A single male runner was utilized in all trials on two data acquisition sessions separated by four years: 1996 and 2000. In the first session, the subject performed a series of starts using three techniques: a traditional crouch start, a crouch-to-upright start (the subject started in a traditional crouch start, then attempted to rise to an upright running position as quickly as possible), and a standing start utilizing starting blocks. In the second session the subject repeated the starts, but omitted the crouch-to-upright start.

After the start, the subject ran through 9 timing gates spaced 3 meters apart as a computer recorded the times. Means were calculated for each technique for each session and used as the basis for analysis. A video camera operating at 60 Hz recorded the starts for the first four meters for all trials. A representative trial for each technique on both sessions was digitized to examine the effect on running performance over the first four meters

In 1996 the subject was 16 years of age and had three years of competitive experience. He had developed experience with both the crouch start and the standing start and used both in competition although he appeared to be most proficient with the standing start.

In 2000 the subject was 20 years of age and had extended his experience to include two years of Division 1 collegiate competition. The only starting technique that was employed in collegiate competition was the crouch start. Further, the technique employed was sufficiently developed that the subject was utilized as the first runner in two relay events.

During session one (1996), the subject completed five trials of the crouch start, followed by three trials of the crouch-to-stand technique and then four trials of the standing start. In session two (2000), the subject completed five trials of the crouch start followed by four trials of the standing start. Each session was lengthy in an attempt to allow sufficient rest between trials.

RESULTS AND DISCUSSION: Mean values were calculated for each technique over both sessions. Mean time is plotted with respect to distance for both sessions in Figure 1. For session one, the starts were ordered such that the crouch-to-upright ranked third, the crouch start ranked second, and the standing start first. Once again for session two, the crouch start ranked second behind the standing start. Clearly, standing is the best start at all distances over both sessions.

Examination of the data revealed surprising results. Not only were the mean values for the standing start better, but all standing start trials were faster than the crouch-to-upright start and the crouch start over both sessions. These results are even more astonishing when the conditions of data collection are examined. In both sessions the standing start was the last technique to be employed. Thus, in session one the subject had completed eight starts each of which included a twenty-seven meter run before the first of four standing starts was attempted. Similarly, in session two the subject completed five crouch starts and runs before beginning four standing start trials. In addition, the second session took place late on a January afternoon with decreasing ambient temperature. These were not ideal conditions for running.

Analysis of the selected digitized video indicates that the subject obtains a full upright running position more quickly with a standing start than with either of the others. From the plots, it is obvious that the center of mass must be raised considerably and it is achieved less rapidly with the crouch start, suggesting inefficiency in the technique. Additionally, with the standing start, the subject's center of mass exhibited sine wave characteristics of a full running stride much earlier than with the crouch start.

Some may question the validity of these data by arguing that more and better training in the crouch start would have yielded different results. One could not dispute that improvements in crouch start technique may produce better results. Of course, it could also be argued that improvement of standing start technique may produce performance improvements. Further, it must be emphasized that the subject completed two years of advanced level competition in which only crouch starts were employed. There had been few opportunities to practice or use the standing start, yet the standing start prevailed.

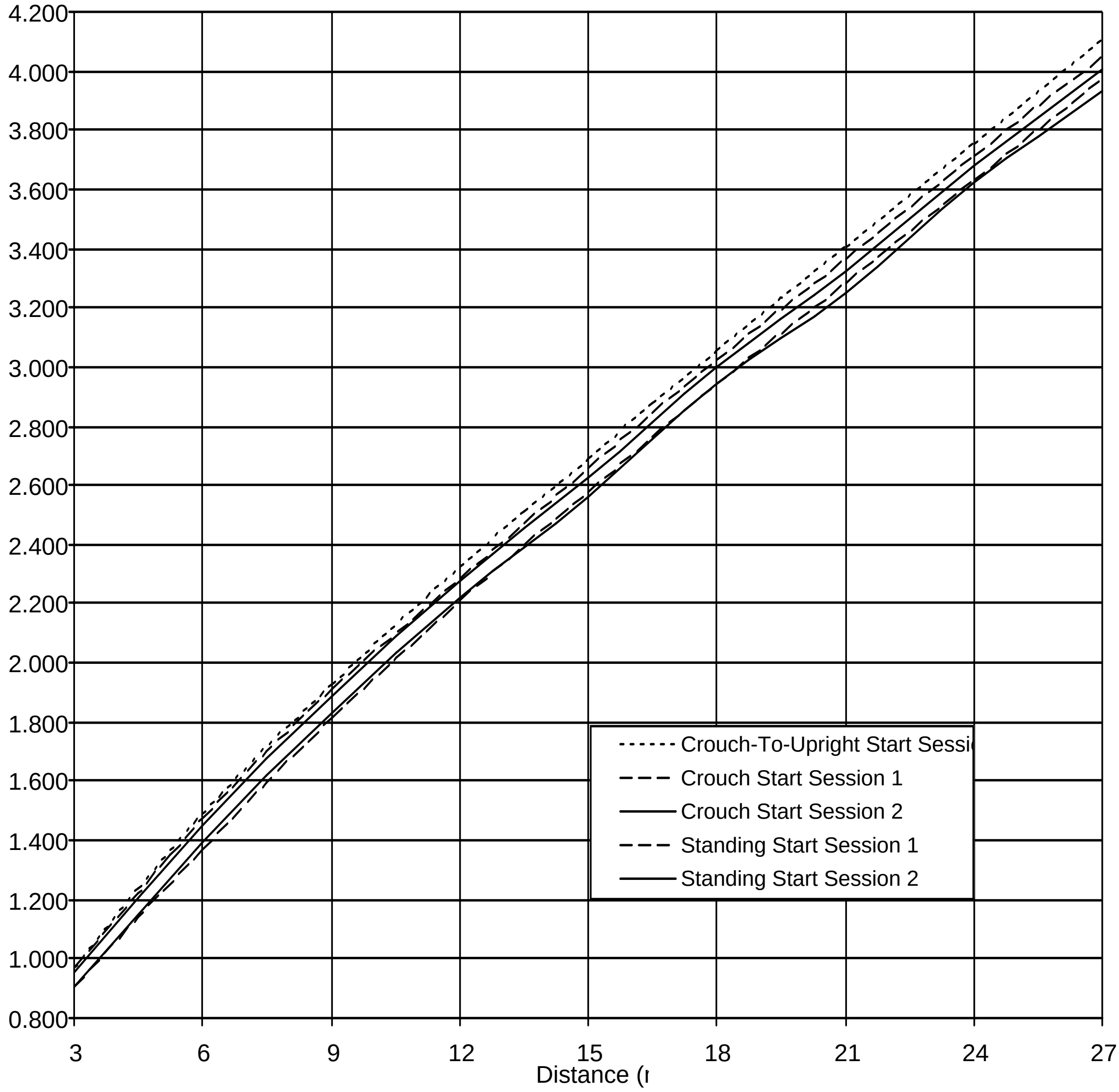

Figure 1 - Mean time versus distance for three start techniques.

CONCLUSIONS: In the present study, the mean times for the standing start trials were consistently faster than those of the other two starts. Furthermore, all standing start trials were superior at every timing point.

There have been tentative suggestions that standing starts are worth considering. Despires (1973) reported that the technique was used in the Republic of South Africa in late 1960 and early 1970. Hay (1973) pointed to a mild revival of interest in the standing start and reported that South African sprinter Paul Nash used the standing start to run 100 meters in 10.1 seconds. With this subject, the standing start is clearly more effective than the crouch start over all distances to 27 meters. Starting variables such as horizontal impulse and leg strength that were found to be essential in crouch starting (Henry, 1952; Mero et al., 1983; Payne & Blader, 1971) would not appear to be as important in the standing start. Attainment of a full running stride as quickly as possible seems to overshadow other variables.

Implications: Coaches tend to teach as they were taught and athletes tend to resist radical changes in technique. The crouch start is entrenched in the minds of both. For some unknown reason, standing starts are not even permitted in international competition. In the quest for improved performance perhaps it is time for everyone, athletes, coaches and officials to expand their thinking about standing starts.

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