FORWARD AND FALSE STEP TECHNIQUES USED FOR STANDING SPRINT START IN A SIDEWAYS DIRECTION: WHICH IS SUPERIOR?

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The purpose of this study was to determine which technique is superior to in a standing sprint start in a sideways direction: the false step or forward step technique. Nine males performed 5 m sprints in a rightward direction starting with these two techniques. They took a first step in their right side with their right foot in the forward step trials, whereas they took a first step in their left side with their left foot in the false step trials. No significant differences were found between the two trial conditions in the sprint times for 1 m, 2 m, 3 m and 4 m. These results indicate that the start techniques made no difference in the performance in the sideways direction, although the superiority of the false step technique for the forward sprint start was reported previously. This finding suggests that the superiority of the sprint start techniques is dependent on the sprint direction.

KEYWORDS: short-distance sprint, sprint time, agility.

INTRODUCTION: In field or court-based sports, athletes start a sprint on the basis of relevant visual cues such as the ball movement or opponent's unexpected moves. Thus, an ability to effectively start the sprint from the standing position is an important factor contributing to one's performance and the team's success in such sports. Forward step and false step are the two common techniques for the standing sprint start from a parallel stance. Athletes take a first step in the sprinting direction in the forward step technique, whereas the first step is taken in the direction opposite to the sprinting direction in the false step technique. The false step technique has generally been considered as an inferior technique, because it includes an unnecessary step in the direction opposite to the sprint. However, previous studies reported that the false step technique outperformed the forward step technique in the short-distance sprint from the standing position (e.g. Brown & Vescovi, 2004; Cronin, Green, Levin, Brughelli, & Frost, 2007; Cusick, Lund, & Ficklin, 2014; Frost, Cronin, & Levin, 2008). This superiority in the false step technique was caused by the generation of greater force and power at push-off (Kraan, van Veen, Snijders, & Storm, 2001). In addition, the performance of sprint start from the split stance is better than the start from the parallel stance with the false step. This is because starting from the split stance allows athletes to displace the center of pressure of the propulsive force (COP) to a position behind their center of mass (COM) before the initiation of forward movement (Frost et al., 2008). These previous studies suggest that the time to reposition the COP behind their COM is an important factor of effective sprint start from the parallel stance.
Athletes in field or court-based sports start the sprint in various directions. The superiority of the sprint start techniques possibly varies according to the sprint start direction, because the horizontal distance between the COM and COP at the parallel stance is dependent on the propulsive direction. When starting the sprint in a sideways direction with forward step technique, athletes can quickly move the COP by lift-off of their one foot. Thus, the superiority of the sprint start technique in the sideways sprint start may differ from that in the forward sprint start. However, previous studies comparing the short-distance sprint performance between these two techniques focused on only the sprint start in the forward direction. Therefore, it still remains unclear which technique is superior to effectively start the sprint in a sideways direction. Therefore, the purpose of this study was to determine which technique is superior to start a sprint in a sideways direction: the false step or forward step technique.

METHODS: Nine male Lacrosse players volunteered to participate in this study (Mean ± SD: age 20.7 ± 0.3 years, 1.74 ± 0.06 m, 66.8 ± 8.2 kg). The Human Ethics Committee of Ritsumeikan University approved all procedures of this study, and an informed written consent was obtained from each participant. Following an individualized warm-up, participants performed 5 m sprints in a rightward direction with the forward step and false step techniques. The participants stood with their feet shoulder-width apart, and the sprint was self-initiated in both trial conditions. In the forward step trial, the participants took a first step in their right side with their right foot (Figure 1a). In the false step trial, they took a first step in their left side with their left foot as an additional step before taking a step in their right side with their right foot (Figure 1b). The participants performed three trials for each sprint start condition, and the order of the trials was randomized. 3D-coordinates of 48 retroreflective markers attached on the anatomical landmarks in the whole body were recorded by an optical motion capture system constructed by 16 cameras (Raptor-E, Motion Analysis corp.). GRFs acting on each foot were recorded by the two force plates (TF-4060-B, Tec gihan corp.). The sampling rate of motion capture system and force plates were 200 Hz and 1000 Hz, respectively. The kinematic data were smoothed by the fourth order Butterworth low-pass filter. The cut-off frequency was set at 12 Hz based on the previous study focusing on the sprint start from the standing position (Murphy, Lockie, & Coutts, 2003). The movement initiation was defined as the instant when the vertical GRF acting on either foot exceeded the threshold value (calculated as the mean plus or minus three times the SD of the vertical GRF in the 500frames immediately before each frame). The 3D-coordinate of the COM was determined from the kinematic data based on the mathematical model (Hanavan, 1964), and the sprint distance was calculated as the COM displacement from the movement initiation. The sprint performance was evaluated by the sprint time over a sprint distance of 1, 2, 3 and 4 m. The COM-COP distance was defined as the horizontal distance between the COM and COP of the left foot, and was calculated at the movement initiation in both trial conditions and the false step touch-down in the false step condition. A paired t-test was utilized to examine the difference in each parameter between the two techniques. Significance level was set at 0.05.

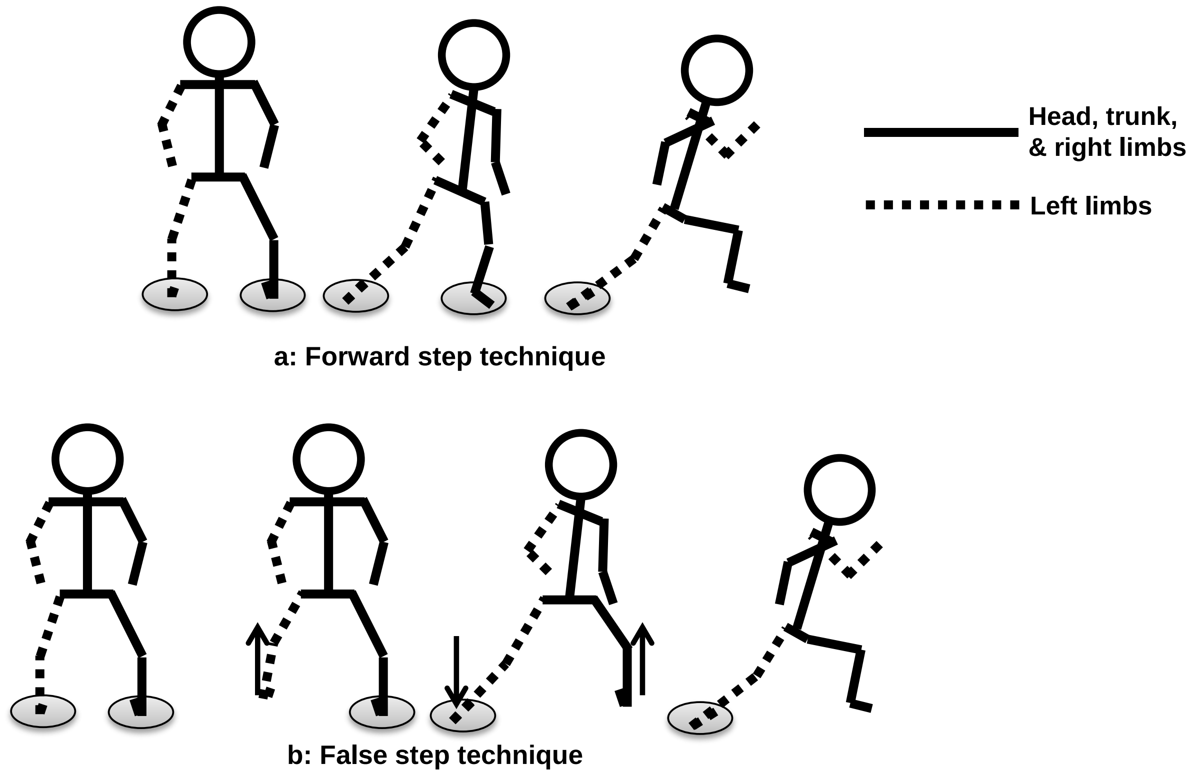

Figure 1: Back view of the participant performing the two sprint start techniques

RESULTS and DISCUSSION: The vertical COM position at the movement initiation was 0.91 ± 0.07 m in the forward step condition and 0.91 ± 0.07 m in the false step condition, and no significant difference was found between the two trial conditions. The starting posture at the movement initiation could be different between the two trial conditions, because the sprint was self-initiated. It was confirmed that there was no difference in the starting posture between the two trial conditions.

No significant differences were found between the two sprint start conditions in the sprint times for 1, 2, 3 and 4 m (Figure 2). These results indicate that the sprint start techniques made no difference in the performance of the short-distance sprint. This finding conflicts with the superiority of the false step for the sprint start in a forward direction found in the previous studies (e.g. Brown & Vescovi, 2004; Cronin et al., 2007; Cusick et al., 2014; Frost et al., 2008), which implies that the superiority of these two techniques is dependent on the sprint direction.

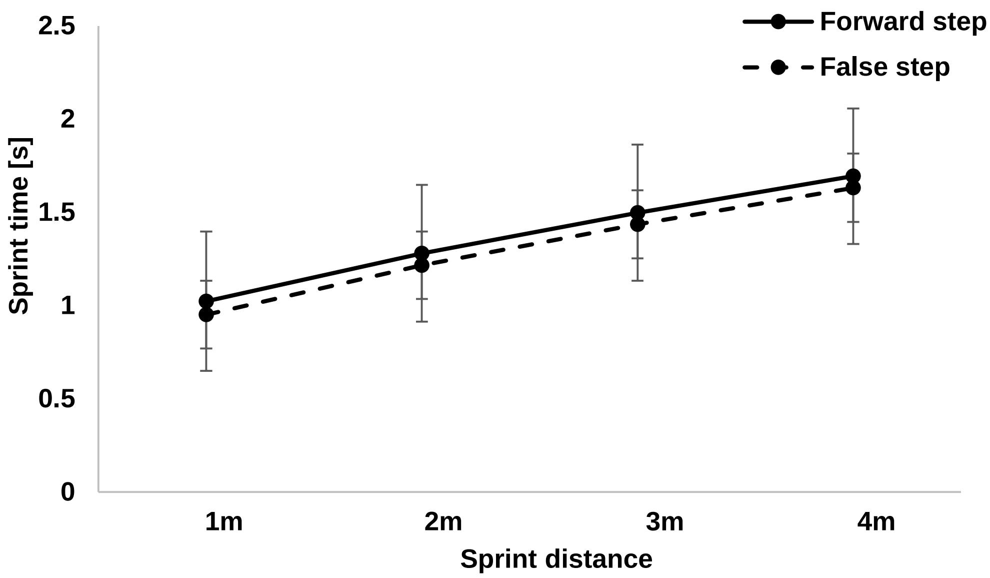

Figure 2: Sprint time for each sprint start technique

One of the possible reasons for the direction-dependence of the superiority of the sprint start techniques is the difference in the COM-COP distance at the parallel stance between the sprint start in a forward direction and sideways direction. The COM-COP distance in the sprint start in a sideways direction is about the half of shoulder width. Thus, when starting the sprint in the rightward direction in this study, the participants can be quickly move the COP by lift-off of their right foot. The COM-COP distance at the movement initiation was 0.30 ± 0.05 m in the forward step condition, and 0.30 ± 0.06 m in the false step condition. The COM-COP distance at the false step touch-down was 0.42 ± 0.09 m, which is about 140% of that distance at the movement initiation. These results indicate that the advantage of the 40% gain of the COM-COP distance was compensated by the disadvantage of the additional time to take the false step.

Although no difference was found in the sprint performance, the false step technique have another advantage in utilizing of the stretch shortening cycle of the muscle-tendon complex (e.g. Brown & Vescovi, 2004; Cronin et al., 2007; Cusick et al., 2014; Frost et al., 2008). This provides athletes with the effective force production and the advantage in the lower limb fatigue. Therefore, the false step technique may be the most effective in field or court-based sports.

CONCLUSION: No significant difference was found between the forward step and false step techniques in the performance of the short-distance sprint in a sideways direction. This finding suggests that the superiority of the sprint start techniques is dependent on the sprint direction.

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