A COMPARISON OF TWO DIFFERENT SPRINT START TECHNIQUES IN COLLEGIATE LINEBACKERS

Robin Lund, Jason Cusick and Travis Ficklin
Biomechanics Laboratory, University of Northern Iowa, Cedar Falls, IA, USA
e-mail: robin.lund@uni.edu

INTRODUCTION

Anecdotally, many linebacker coaches attempt to coach their players to eliminate the false step (rhythm step) during play. This motion has been deemed by many coaches as a wasted movement since the initial motion is backward [1]. The forward step is taught by numerous coaches to eliminate counterproductive movement, however it may be beneficial to step back before accelerating. By stepping back, the athlete utilizes the stretch-shortening cycle (SSC) which can lead to an increase in muscular force during push-off [2]. Stepping backward also allows the athlete to have a larger horizontal component of their ground reaction force (GRF). These benefits have been explored in previous work related to multiple activities [2,3,4], but not for the football linebacker position, where players are often coached to eliminate this rhythm step. The purpose of this study is to compare the rhythm step (RS) and the forward step (FS) on sprint start ability in collegiate linebackers.

METHODS

Fifteen collegiate football players who play the linebacker position executed three maximum effort sprints through 5 meters of both the RS and FS techniques in a randomized counterbalanced order following an auditory cue. Prior to this, three 5 meter sprint starts were also performed from track blocks (BS) to determine a best performance for comparison. For the RS and FS techniques, each subject started in the ready position they would use in game conditions.

Subjects were allowed to use their preferred leg to initiate each trial. High-Definition video of each trial was captured using a camera shooting at 60 Hz (JVC GC-PX1, Tokyo, JP). The camera was positioned such that its optical axis was perpendicular to a vertical plane bisecting the length of the running lane.

The forward-most point of the trunk was manually digitized for all frames of the run, starting at the subject’s first movement after a visual signal that was made by the starter, simultaneously with the audio cue to start. This trunk position was converted to meters relative to the start line using calibration points visible in the video, and the time series location data were smoothed using a 4th-order zero-lag butterworth filter at 12 Hz. The times at which the forward-most point of the trunk crossed both the 2.5-m ($t_{2.5}$) and 5-m marks ($t_5$) were calculated by interpolation from time series horizontal position data.

This trunk point was chosen to be consistent with track and field timing rules and also represented meaningful forward progress by a linebacker trying to reach a location to execute a tackle. The time split between 2.5 m and 5 m was also recorded ($t_{\text{split}}$). The best trial for each technique was recorded in seconds (s).

Descriptive statistics (mean ± SD) were performed on all performance variables. A repeated measures MANOVA was used to compare the two techniques (RS, FS) as well as the block starts (BS) on $t_{2.5}$, $t_5$ and $t_{\text{split}}$. When appropriate, separate repeated measures ANOVA tests as well as paired samples t-tests were used as post hoc analyses. A Bonferroni correction was used to control for family wise error. Alpha was set at 0.05 for all tests.

RESULTS

Descriptive statistics can be found in Table 1. The repeated measures MANOVA indicated that there was a significant technique effect ($F(3,13)=32$, $P<0.01$).
Mauchley’s test of sphericity was rejected for each of the three separate repeated measures ANOVA tests therefore a Greenhouse-Geisser penalty was assessed for these tests. A significant technique effect was observed for \( t_{2.5} \) (\( F(1.4,21)=75.5, p=0.001 \)) and \( t_{5} \) (\( F(1.4,21.5)=67.4, p=0.001 \)) but not for \( t_{\text{split}} \) (\( F(1.2, 18.6)=1.9, p=0.18 \)). Paired samples t-tests indicated that BS was significantly faster than RS (p=0.001) and RS was faster than FS (p=0.001) for \( t_{2.5} \). The same trend was observed for \( t_{5} \). There were no differences between any of the techniques in \( t_{\text{split}} \) from 2.5 to 5 meters.

**DISCUSSION**

Horizontal forces are extremely important for acceleration/sprint starts. It is unsurprising that the BS resulted in the greatest horizontal forces because they maximize the forward horizontal component of GRF by allowing for normal forces with the blocks greater than those possible by friction with level ground.

Linebacker coaches may assume that the backward motion inherent to the RS is counterproductive. However, all subjects preformed better with the RS than the FS. First, using the RS allows the player to lower the center of mass (CM) and have more forward lean. This allows for more horizontal force, similar to using BS. Additionally, using the RS allows the player to utilize the SSC for generating initial force. Any benefit of SSC in the FS is likely to be less, if it exists at all, due to limited or eliminated range of stretching motion of the muscles.

The benefits of this technique are limited to the first few steps of the linebacker’s motion (2.5 m) and are preserved through at least the 5-meter mark. All subjects were faster through 2.5 m in the RS condition, and through 5 m, but this benefit was realized in the first 2.5 m. After that, it seems that the player is moving similarly in any of the conditions.

Previous work [1,3,4] has shown also shown that the RS is superior for starting speed compared to FS. It is a naturally occurring motion that is often “coached out” of the athlete. The results of the present study suggest that in the case of the linebacker position it should not be. The players in the current study had previously been coached to perform only the FS, but were able to realize immediate benefit by abandoning it. Football coaches should be encouraged to revisit their methods for coaching this particular position.

**REFERENCES**


