INTRODUCTION
The beginning of any sprint consists of the sprint start and acceleration. These two phases are critical in order for the athlete to efficiently transition into maximum velocity sprinting, and have been shown to account for 64% of the total result in the 100m (1). Improving efficiency of the start requires positively affecting performance related variables such as stride length, stride rate, ground contact time, and air time (2). Coaches may target specific aspects of an athlete’s kinematics to do this. For example, a lower heel recovery during the initial acceleration is suggested to improve performance (3)

Determining how to help an athlete make the desired changes is a critical issue for coaching sprint starts. Typically, coaches use a combination of video and/or verbal cues. However, there are other senses such as hearing or proprioception through which athletes can receive feedback. To date, coaching strategies tapping into these other senses have received minimal study in the literature. Therefore, the purpose of this study was to evaluate the effects of a proprioceptive intervention specifically designed to improve initial acceleration from the starting blocks.

METHODS
Nine NCAA Division 1 sprinters (4 males with PR of 10.62 ± 0.25 seconds, 5 females with PR of 10.88 ± 0.17 seconds) completed two baseline sprint starts followed by two starts after a proprioceptive intervention. The intervention used an elastic band to apply resistance to the athletes’ leg as they exited the blocks and throughout the first few steps. The band was applied in a way which forced the athletes to adopt a lower foot position during the swing phase of each step. Athletes practiced three trials with the intervention before restesting. Whole body kinematics from the start through the first two steps were recorded at 250 Hz using a 12-camera motion capture system.

Marker trajectories were filtered using a zero-lag low pass Butterworth filter with a cutoff frequency of 8 Hz. The following dependent variables were then calculated: time from initial movement to block clearance (TTBC), ground contact (GCT) and swing times (ST) for each step, maximum height of foot center of mass (FootH) during swing phase of each step, stride lengths (SL) for each step, and horizontal velocity (Vh) at the moment of ankle cross on the second step.

RESULTS AND DISCUSSION
The intervention had effects on several of the kinematic parameters. TTBC and GCT on the first and second steps increased post-intervention (p = .02, p = .03, p = .04) while FootH during swing phase on both steps decreased (p = .03, p = .04; Table 1). SL was longer on the second step (p = .002), but not the first (Table 1). There were no differences in ST on either step or Vh at ankle cross (Table 1).

The intervention resulted in longer GCTs for both first and second steps. If force remains constant, a longer GCT during the acceleration phase of the sprint allows the athlete to apply force over a longer time. This larger impulse should allow the athlete to produce a greater change in velocity, and thus, a more effective acceleration. However, when this manifests in the acceleration phase is not clear. In the current study velocity was not different at ankle cross between steps one and two. We did not, however, measure velocity later in the sprint. It is possible the impulse generated in the first few steps may result in a higher velocity later in the acceleration or may put the athlete in a better position to more efficiently transition into maximum velocity.

In summary, the results of this study indicate that incorporating proprioceptive feedback as a coaching strategy can influence an athlete’s kinematics, and by extension improve performance. Most effective methods for incorporating these types of interventions, or the most likely applications of them remain to be determined.

REFERENCES

Table 1: Performance measures analyzed pre and post intervention (mean ± standard deviation). * indicates post intervention is significant different than pre-intervention at p < .05. See methods for abbreviations.

<table>
<thead>
<tr>
<th></th>
<th>TTBC (s)</th>
<th>First step GCT (s)</th>
<th>Second step GCT (s)</th>
<th>First step ST (s)</th>
<th>Second step ST (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.364 ± 0.02</td>
<td>0.199 ± 0.02</td>
<td>0.166 ± 0.02</td>
<td>0.300 ± 0.03</td>
<td>0.369 ± 0.03</td>
</tr>
<tr>
<td>Intervention</td>
<td>0.378 ± 0.02*</td>
<td>0.224 ± 0.04*</td>
<td>0.189 ± 0.03*</td>
<td>0.300 ± 0.03</td>
<td>0.367 ± 0.03</td>
</tr>
<tr>
<td>First step max FootH (m)</td>
<td>0.417 ±0.05</td>
<td>0.479 ± 0.09</td>
<td>1.23 ± 0.15</td>
<td>2.10 ± 0.3</td>
<td>3.56 ± 0.3</td>
</tr>
<tr>
<td>Second step max FootH (m)</td>
<td>0.343 ± 0.03*</td>
<td>0.405 ± 0.08*</td>
<td>1.21 ± 0.16</td>
<td>2.15 ± 0.3*</td>
<td>3.53 ± 0.2</td>
</tr>
</tbody>
</table>

FootH, SL, and Vh are measured in m; Time is recorded in seconds; Horizontal Velocity is recorded in m/s.