INTRODUCTION
Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces [1]. Many clinical tests incorporate cognitive and symptomatic evaluations of concussion for injured individuals [2]. However, current clinical tests such as the SCAT2 are subjective in nature and lack sport-specificity [3]. Recently designed tests have expanded to include physical signs of a concussion such as balance impairments [4]. However, current tests do not incorporate objective measures of concussion which could clarify concussion progression. Balance analysis tasks, such as gait initiation, may provide an objective measure of balance control. Gait initiation is a self-generated perturbation that requires precise postural control [5]. The objective of the current study was to determine if the use of a functional task such as gait initiation would provide a more objective measure of acute balance control changes following a concussion.

METHODS
Participants (N=16) for the study were recruited from a men’s varsity soccer team between the ages of 18-25 with no known physical or neurological conditions. Individuals were tested both at baseline (i.e. pre-season) and 72 hours following a diagnosed concussion (N=4). During testing, participants stood on a force platform and were asked to take a single step forward of one of three different directions: 0° (straight ahead), 30° to the right or left of center (step wide or step narrow). This step was initiated following the illumination of one of three lights placed at eye level of the participant, in line with each stepping direction. Participants were required to step with their dominant foot in direction of the illuminated light for six trials at each location for a total of 18 randomized trials. Participants’ stepping kinematics and centre of mass (COM) were recorded using the Optotrak™ motion capture system. Participants were outfitted with 10 infrared light emitting diodes (IREDs) (i.e. 3 on the head, 3 on the torso and 2 on each lower leg). Participants’ medial/lateral (M/L) centre of pressure (COP) characteristics were recorded at 50Hz using a Bertec™ force plate. Initial analysis included the loading and unloading phases of gait initiation.

RESULTS
Only 2 of the concussed players had baseline data to be used as a comparison. Within-subject analysis using paired samples t-tests showed loading displacement was significantly less in step narrow (P<0.026) and step straight (P<0.003) in the concussed state. Unloading displacement was significantly less in step narrow (P<0.017) and step wide (P<0.022) heading in the concussed state. Samples means for loading and unloading displacement are shown below (Figure 1 & 2).

DISCUSSION
M/L loading displacement is decreased across all heading directions indicating reduced COP lateral movement. This trend was also observed during unloading following a heading change. Reduced COP displacement indicates an increased effort to control the COM and maintain stability throughout gait initiation. This strategy may allow athletes to better control their COM prior to a step and maintain stability well into their gait cycle. These findings suggest that following a concussion athletes exhibit a more conservative gait initiation strategy to prevent destabilization.

REFERENCES