INTRODUCTION
Concussions (mild Traumatic Brain Injury, mTBI) caused by direct mechanical forces to the brain or spinal cord, elicit a wide variety of cognitive and behavioral symptoms such as decreased balance control and motor coordination. Previous research evaluating balance showed that increases in center of pressure amplitude and velocity are indicative of short and long-term effects on postural stability following a concussion [1,2]. Therefore, balance control may be a key marker in identifying the progression of a concussion. Current, balance assessment tools used by clinicians to monitor the progression of a concussion are subjective in nature and lacking objective viewpoints to recognize when an athlete has returned to their balance state prior to the concussion. The objective of the present study is to determine if a simple balance task can be a reliable tool to quantify the changes in balance following a concussion.

METHODS
All participants included in the present study were members of the men’s varsity soccer. Baseline measurements were taken during training camp for all members on the team (control group; N=15, 18-22 years), and tested a second time if they experienced a concussion during the season (concussion group; N=5). All athletes in the concussion group were diagnosed with a concussion by an athletic therapists using the sport concussion assessment tool (SCAT2). All participants completed a health history questionnaire and provided informed consent prior to participation. Centre of Pressure (COP) measurements were taken using a Bertec™ force platform at 50Hz for 30s, during a simple balance task. Athletes were asked to stand quietly on with hands behind their back and feet together during two conditions: (1) eyes open and (2) eyes closed. The RMS of COP velocity was calculated for both the A/P and M/L directions.

RESULTS
The RMS COP velocity, in both the A/P and M/L directions, were analyzed using a 2 (control vs. concussed) x 2 (eyes open vs. eyes closed) repeated measures analysis of variance. In the anterior-posterior direction, a main effect between groups was found, indicating the concussion group (M=0.015m/s) displayed a significant increase in velocity compared to the control group (M=0.009m/s), F(1,19) = 428.557, p < 0.05. A main effect between conditions was also present, indicating the removal of vision (M = 0.0148m/s) significantly increased COP velocity compared to when eyes were open (M=0.01115m/s), F(1,19) = 67.297, p < 0.01.

DISCUSSION & CONCLUSIONS
The current study showed that COP velocity increased in both A/P and M/L directions following a sport related concussion. These findings from individuals 3-5 days post concussion are consistent with results reported by Geurts and colleagues [1] with individuals who had experienced their mTBI at least 6 months prior to testing. Therefore, changes in COP velocity may be a good indicator of postural stability following a concussion. The overall decrease in postural stability found during the first five days following a concussion was also consistent with previous studies monitoring the changes in sway index during the symptomatic phase following a concussion [2]. These significant findings confirm that a simple standing balance test is sensitive enough to quantify the changes in balance following an concussion, and suggests that multiple balance tests during the symptomatic as well, as the asymptomatic phases, may be warranted as an accurate objective marker to indicate the progression of an concussion.

REFERENCES