Background
The Symptom Evaluation Scale (SES) of the Sports Concussion Assessment Tool (SCAT5) is a key sideline evaluation used for baseline assessment of concussion symptoms and tracking concussion symptomology in athletes (McCroy et al., 2017). A new iteration of the SCAT5 includes changes to how baseline data is collected by asking participants to respond in regards to how they feel typically versus previous iterations which ask participants to respond in regards to how they feel right now. Given the frequent practice of repeated testing (i.e., baseline and serial post-concussion assessments) in the context of sports related concussion (SRC), establishing the reliability and stability of the measure is important (Merritt, Bradson, Meyer, and Arnett, 2017).

The current study is concerned with examining baseline responses across two timepoints in a single testing session. The immediate temporal proximity of the testing allows for the examination of test-retest effects under the position that there are no clinical or external reasons for a change in response – to date, no previous research has examined test-retest reliability in this way on any form of the SES. Additionally, there have been mixed findings in regards to the effects of gender and concussion history on baseline responses to the SES (Downey et al., 2018). Previous research has been conducted in both high school and collegiate samples. This study aims to add to the literature in regards to the effects of gender and concussion history on baseline responses in a solely young adult sample. Findings from this study may aid physiotherapists and clinicians in making more informed return-to-play decisions.

Research Questions
Q1. What are the test-retest effects on baseline responses to the SES of the SCAT5 (symptom severity score, by symptom cluster and by item) when tested in immediate succession? Do responses change significantly over a small amount of time?
Q2. Are individual characteristics (gender and concussion history) an influencing factor on baseline scores (symptom severity score, by symptom cluster and by item)?

Methods
Participants
The sample consisted of 97 participants, with 72 females and 25 males. 19 participants reported having a previous history of concussion, which is approximately 19.6% of the sample. 78 participants (80.4%) did not report any history of concussion. 73.2% of the sample identified English as their first language and participants primarily identified as Caucasian (38.1%) and Asian (35.1%).

Procedure
First, participants completed a short demographic questionnaire. Participants then completed the SES of the SCAT5 questionnaire twice in immediate succession within a single testing session in regards to how they typically feel.

Measure
The SES is a 22-item measure on a 7-point Likert scale, from “0 to 6”, with “0” representing no symptoms, “1-2” representing mild symptoms, “3-4” representing moderate symptoms and “5-6” representing severe symptoms. A higher symptom severity score on this measure indicates higher symptom severity following a concussion (McCroy et al., 2017). See Table for items.

Symptom Cluster Scores
A symptom severity score (SSS) for each time point was created by summing across the twenty-two SES items. The possible range of scores is from 0-132.

Analysis and Results
Analyses and results are summarized in Tables and Figures and the Bland-Altman Repeatability Chart.

Test-retest Effects
Symptom Severity Score
Results from an ANOVA model at the SES symptom severity score level indicated a main effect of time (F(1, 93) = 16.13, p < .001). There was a difference in scores between Time 1 (M = 20.82, SD = 17.23) and Time 2 (M = 18.78, SD = 16.2), wherein participants lowered their SES symptom severity score by an average decrease of 2.04 (SD = 3.40), d = .6 points. Symptom Cluster Scores
The cognitive symptom cluster scores exhibited a mean difference of 0.40 (SD = 1.48), d = .33 from Time 1 (M = 5.11, SD = 4.48) to Time 2 (M = 4.63, SD = 4.28), F(1, 93) = 8.05, p = .005. Item Level Scores
“Difficulty remembering” scores exhibited change from Time 1 (M = 1.15, SD = 1.35) to Time 2 (M = 1.07, SD = 1.27), d = .14, F(1, 93) = 8.63, p = .004.

Gender
Symptom Severity Score
There was a main effect of gender on baseline scores, F (1, 93) = 8.29, p = .005, wherein females (M = 21.33, SD = 17.34) scored on average 8.84 points higher than males (M = 12.50, SD = 9.52). Symptom Cluster Scores
At the symptom cluster level, females (M = 7.50, SD = 13.04) scored higher than males (M = 3.38, SD = 3.38) on the physical symptom cluster composite, F(1, 93) = 7.63, p = .007, and the affective symptom cluster composite, F(1, 93) = 7.81, p = .006 (Females: M = 5.46, SD = 4.53; Males: M = 3.18, SD = 3.22).

Conclusion History
Symptom Severity Score
There was a main effect of concussion history at the symptom severity score level, F(1, 93) = 5.12, p = .025, wherein those with a history of concussion scoring higher (M = 29.24, SD = 23.00) than those without concussion (M = 16.57, SD = 13.04).

Tables and Figures

Conclusions
Making accurate return-to-play decisions is a critical component in the management of concussion, in which the ultimate goal is to prevent athletes from sustaining further injury that could cause lifelong cognitive impairments. In the current study, participants exhibited a lowering in symptomatology (mean change 2.04, SD of change = 3.40) across repeated assessments in the absence of a clinical or external reason. Current practice in regards to baseline assessment recommend athletes return to an “asymptomatic” level, which is specific to that individual’s baseline performance, before the are allowed to play that sport again (Custer et al., 2016; McCroy et al., 2017). This has implications for return-to-play decisions in that athletes could perhaps return to play earlier than intended. A tentative recommendation is to take two baseline assessments and take the lower of the two in order to err on the side of caution and prevent athletes from exposing themselves to further injury. Based on test-retest analyses, the symptom clusters were more stable than the symptom severity score. This study tentatively provides evidence for the use of symptom cluster scores in monitoring a concussed athlete back to baseline. Gender and concussion history were examined in the context of baseline assessments, which adds to the existing literature on modifying effects in a collegiate sample. Specifically, females scored higher than males at the symptom severity score, physical and affective symptom cluster level as well on items “Headache”, “Feeling slowed down”, “Fatigue or low energy”, and “Dizziness.” Participants with concussion history also scored higher than those without a history of concussion at the symptom severity score level. This information is particularly important if a clinician chooses to use normative values over individual baseline scores, in that clinicians need to be aware of possible effects of gender and concussion history in participants at baseline in normative values in order to interpret an individual’s symptom reporting post-concussively. The results of this study could possibly aid clinicians and physiotherapists in making more informed return-to-play decisions.

Note.
The research team acknowledges SFU is situated on