

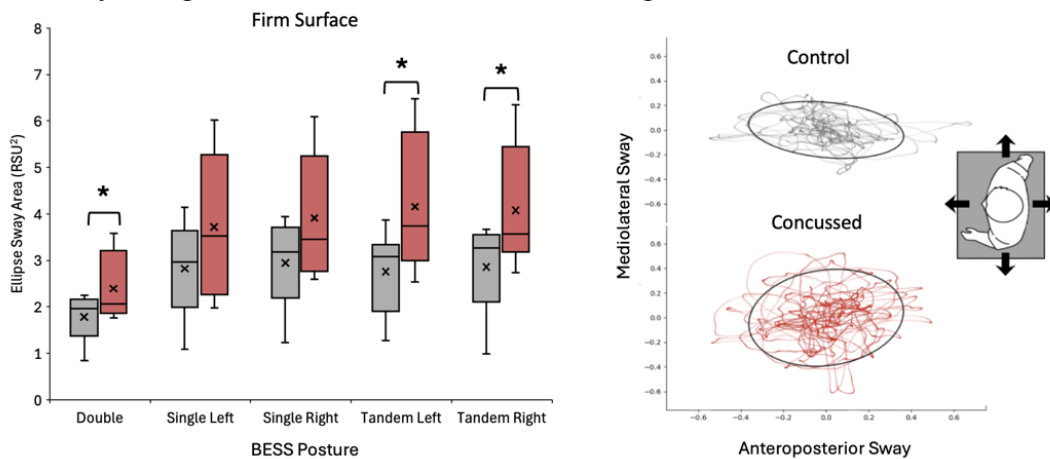
# CONCUSSION IMPAIRS BALANCE: INSIGHTS FROM STATIC POSTUROGRAPHY AND EMG

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**Introduction:** A concussion disrupts sensorimotor systems involved in postural control, resulting in symptoms such as vertigo and imbalance. Balance testing in concussion evaluation commonly uses the Balance Error Scoring System (BESS), in which static tasks are performed, and errors are counted to estimate impairment. However, such clinician-scored measures are limited by subjectivity and may not be sensitive to subtle impairments. We sought to more accurately quantify BESS performance using objective measures of static posturography and concurrent muscle activity to capture concussion-related balance impairments.



**Figure 1: Normalized ellipse sway area (95% CI) for control (grey) vs concussed (red) across BESS firm surface postures (\* $p < 0.05$ ). Example CoP trajectories of a control and a concussed participant (double-leg posture on a firm surface); black ellipse shows 95% sway area.**

**Methods:** Eight participants with self-reported concussions within the past 6 months and six control participants with no history of head injury or related afflictions were tested. Postural stability was measured using BESS balance tasks on both firm and foam surfaces, by measuring the centre of pressure with a force plate (Bertec FP4060-05 PT Bertec Corp, Columbus, OH, USA). Concurrent muscle activity of the tibialis anterior (TA) and medial gastrocnemius (MG) was recorded bilaterally (Delsys Trigno Avanti wireless surface EMG sensors, Delsys Inc., Natick, MA, USA).

**Results:** A repeated-measures ANOVA revealed a trend toward a group vs. posture interaction for ellipse sway area only on firm surface ( $F = 2.46$ ,  $p = 0.058$ ). Follow-up one-tailed independent-samples t-tests indicated significantly greater sway in the concussion group compared with controls during the double-leg and tandem stances on a firm surface (Figure 1). iEMG activity of the TA and MG appeared similar between groups. BESS error scores were not significantly different between groups.

**Discussion and Conclusions:** Measures of postural sway revealed differences in postural control not captured by traditional BESS scoring. The use of objective measures in balance assessments could improve sensitivity and support automated analysis.