

POST-CONCUSSIVE CHANGES IN BALANCE AND POSTURAL STABILITY MEASURED WITH CANESENSE™ AND THE BALANCE ERROR SCORING SYSTEM (BESS) IN DIVISION I COLLEGIATE FOOTBALL PLAYERS: A CASE SERIES

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ABSTRACT

Introduction: Impairments in postural stability have been identified following sports-related concussion. CaneSense™ is a recently developed mobile lower limb motion capture system and mobile application for movement assessment which provides an objective measure of postural stability. One of the components within CaneSense™ is the Post-Concussive Excursion Index (PCEI), a measure of postural stability expressed as a percentage of symmetry between lower limbs.

Purpose: The purpose of this case series is to examine pre- and post-concussion differences using two separate measures, CaneSense™, and a known test, the Balance Error Scoring System (BESS), in Division I collegiate football players.

Methods: A convenience sample of eight football players diagnosed with a concussion, were the subjects in this case series. All subjects underwent baseline testing prior to the start of pre-season camp consisting of the single limb stance (SLS) test with CaneSense™ and the BESS test. Twenty-four to 72 hours following their concussion, SLS with CaneSense™ test and the BESS test, were administered. Segmental excursions for the thigh and shank segments for each lower limb were combined into the Post-Concussion Excursion Profile (PCEP), which represents each segment's maximum excursion in the medial-lateral and anterior-posterior direction. The PCEI is a single metric generated to quantify differences within subjects by comparing the PCEP value between lower limbs during SLS where 100% suggests absolute symmetry.

Results: The PCEI value decreased significantly post-concussion ($41.43 \pm 15.53\%$ vs. $87.41 \pm 6.05\%$, $p < 0.001$) demonstrating a 52.6% decrease in inter-limb symmetry when compared to baseline values. There was an unanticipated 36.36% improvement in composite BESS performance post-concussion (10.5 ± 4.87 errors vs. 16.5 ± 8.49 errors, $p = 0.10$).

Conclusions: Differences in inter-limb postural stability were found in subjects post-concussion. By assessing postural stability in both lower limbs individually, using the PCEI, impairments were detected that otherwise would have likely gone undiagnosed using the BESS test alone.

Levels of Evidence: Therapy, Level 4

Key Words: Balance Error Scoring System, CaneSense™, Concussion, Performance-based measure, Postural Stability

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