POST-CONCUSSION DIZZINESS SEVERITY PREDICTS DAILY STEP COUNT DURING RECOVERY AMONG ADOLESCENT ATHLETES

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Background: Physical activity after concussion is an important aspect of appropriate management and may help to improve recovery time. However, symptom burden or functional deficits may be self-limiting and reduce activity level in the first weeks following a concussion.

Purpose/Hypothesis: To examine dizziness and postural stability as potential predictors of physical activity level after concussion. We hypothesized that increased dizziness severity and more postural instability would predict lower step count acutely post-concussion.

Methods: We initially evaluated athletes ages 12-18 years within 14 days of concussion using questionnaires and clinical tests to assess overall symptom burden, dizziness, and postural stability. Athletes were provided with an activity monitor that tracked daily step count for the subsequent two weeks after their initial care visit. Our primary outcome variable was daily step count (mean steps/day) during this two-week period. Potential predictor variables included participant characteristics (sex, age, time since injury, and history of: concussion, musculoskeletal injury, migraine, ADD, anxiety, depression), Post-Concussion Symptom Inventory (PCSI) total symptom burden, specific PCSI ratings of dizziness and balance impairment, and postural stability assessments [single and dual-task tandem gait (TG) and modified balance error scoring system (mBESS)]. To examine clinical predictors of activity we calculated Pearson correlation coefficients between mean steps/day and each potential predictor, and then included significantly correlated variables in a multiple linear regression model.

Results: Athletes who participated in the study (n=35, mean 15.2±1.7 years of age, 49% female, mean steps/day=9195±3779) were initially evaluated a mean of 7.3±3.0 days post-concussion. PCSI dizziness rating (Pearson R=-0.49, p=0.003; Figure 1) and sex (mean difference=2449 steps/day, p=0.05) were associated with daily step count upon univariable evaluation and included in the multiple linear regression model. No other participant characteristics, symptom ratings, or objective balance or postural stability measures were significantly associated with steps/day (Table 1). In the multivariable
model, PCSI dizziness rating ($\beta=-1035; 95\% \text{CI:} -191, -1880; p=0.018$), but not sex, predicted average steps/day in the two weeks after initial clinical care visits.

Conclusion: Self-reported dizziness severity assessed within 14 days of concussion predicted daily step count in the subsequent two weeks, while other measures of overall symptom severity and postural stability did not. Given the importance of physical activity for concussion recovery, identifying individuals with acute post-concussion dizziness may facilitate timely treatment of dizziness, potentially reducing a barrier to physical activity to improve recovery trajectories.

Tables/Figures:
Figure 1: Scatterplot and line of best fit of the relationship between PCSI dizziness rating and average step count per day.
Table 1: Symptom ratings, postural stability measures, and balance assessments and associations with average steps/day.

| Variable                                      | Mean (SD) | Correlation with steps/day (Pearson R) | P-value |
|-----------------------------------------------|-----------|----------------------------------------|---------|
| PCSI dizziness rating                         | 2.7 (1.6) | -0.49                                  | 0.003*  |
| PCSI balance impairment rating                | 2.8 (1.5) | -0.08                                  | 0.65    |
| Total PCSI rating (minus dizziness and balance)| 50.7(24.8)| -0.28                                  | 0.11    |
| Single-task tandem gait time (s)              | 25.7 (10.6)| 0.08                                  | 0.67    |
| Dual-task tandem gait time (s)                | 35.2 (14.0)| -0.004                                | 0.98    |
| mBESS: single limb stance errors              | 4.2 (1.9) | 0.26                                   | 0.13    |
| mBESS: tandem stance errors                   | 3.8 (2.8) | 0.10                                   | 0.58    |
| mBESS: total errors                           | 8.9 (5.1) | 0.10                                   | 0.56    |