Balance Error Scoring System Baseline Values Differ with Age but not Gender in High School Athletes

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Context
Assessment of postural stability is an important part of concussion evaluation and a comprehensive concussion management program (CMP). Baseline values for balance testing are an important piece of data when making return to participation (RTP) decisions, and may not always be available. Using age and gender-specific norms may be useful in cases where no baseline data exist. Age-stratified normative values for the Balance Error Scoring System (BESS) for high school athletes have not been previously reported.

Objective
To determine differences in age and to provide normative values for BESS baseline scores in healthy high school athletes.

Design
Retrospective cross-sectional study.

Setting
Controlled environment free of external stimuli in 28 participating high schools. Starting in 2010, baseline concussion testing was implemented by a statewide CMP led by a contingent of athletic trainers funded by the State of Hawaii Department of Health.

Participants
De-identified data from baseline BESS tests from school year 2010-2011 for 2,825 [age=15.5 ± 16y/o] females (F) n=979, males (M) n=1,846] high school athletes free of injury and not currently in a balance or postural stability training program.

Table 1. Participant Distribution

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-14 y/o</td>
<td>533</td>
<td>318</td>
<td>851</td>
</tr>
<tr>
<td>15-16 y/o</td>
<td>992</td>
<td>534</td>
<td>1526</td>
</tr>
<tr>
<td>17-18 y/o</td>
<td>321</td>
<td>127</td>
<td>448</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1846</td>
<td>979</td>
<td>2825</td>
</tr>
</tbody>
</table>

Interventions
Baseline BESS testing for all contact sport athletes was administered in a setting of 8 participants per group. Baseline BESS scores were video recorded and scored by two athletic trainers (intrarater reliability=.87) prior to the competitive season.

Main Outcome Measures
Total error score on the BESS was compared using univariate analysis of variance on gender (M, F) and three age groups (13-14y/o n=851, 15-16y/o n=1,526, and 17-18y/o n=448). Mean, standard deviation (SD), and 95% confidence intervals were reported.

Results
No significant (F1=.066, p=.798, power=.068) differences in baseline BESS scores were found between males (17.55±6.60, CI=17.26-17.93) and females (17.68±6.79, CI=17.02-18.01) (Figure 1). Significantly (F2=5.874, p=.003) higher baseline BESS scores were found for 13-14y/o (18.19±6.60, CI=17.73-18.72) compared to 15-16y/o (17.37±6.65, CI=17.04-17.74) and 17-18y/o (17.22±6.76, CI=16.34-17.71) (Figure 2). No significant (F2=1.361, p=.257) interaction between male and female BESS scores across age groups (Figure 3).

Conclusions
In our substantial sample of high school athletes, we found no gender differences and that younger athletes (13-14y/o) committed more errors than older athletes. These findings support the recommendation that baseline BESS scores be obtained every two years during high school matriculation14. Regardless of gender, for the majority of high school athletes in this sample, baseline BESS values were similar for older (15-18 y/o) high school athletes, indicating that the BESS was a robust balance test in this setting. In cases where no baseline exists, normative data may help health care providers interpret a normal baseline range of BESS scores for high school athletes or when determining if baseline scores seem reasonably valid.

References