The Effects of Concussion on BESS Scores Among Adolescent Male and Female Athletes
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Introduction

Sport-Related Concussion (SRC)
- Defined as an alteration in mental status as a result of a traumatic event resulting in direct or indirect forces to the head that cause a rapid acceleration or deceleration of the brain within the skull.1
- Symptoms of SRC include headache, dizziness, nausea, double/blurred vision, tinnitus, loss of consciousness, balance deficit, anterograde/retrograde amnesia, and confusion.1
- Balance is initially controlled by the visual system in the early stages of life but evolves into a more proprioceptive and vestibular control as the brain develops; therefore, younger athletes tend to have poorer balance than older athletes.2,3
- High school male athletes performed worse than high school female athletes on balance tests.4

Purpose Statement

The purpose of this study is to investigate the differences in BESS scores of adolescent athletes who have sustained one or more sport related concussions based on age and sex.

Hypotheses

It is hypothesized that 13-15 year old athletes will not perform as well on the BESS test as 16-18 year old athletes. It is also hypothesized that female athletes are expected to earn better scores than male athletes on the BESS test.

Methods

Study Design
- Retrospective cohort design
- Independent variables: age and sex of athletes with concussion
- Dependent variable: athletes’ scores on mBESS

Participants
- Inclusion criteria: 13-18 year old athletes, have suffered a SRC, and were evaluated at a local clinic
- Classified as Exempt Review at Daemen College approved by the Institutional Review Board; Secondary Use of Data at Brock University approved by Research Ethics Board

Balance Assessment
- Non dominant side is tested with hands on hips and eyes closed for maximum of 20 seconds per position
- Score: based on number of errors such as postural deviations (swaying, falling, being unable to maintain balance), opening eyes, hands lifting off of the hips, moving the hip into more than 30 degrees of flexion or abduction, lifting the forefoot or the heel, and remaining out of the testing position for more than five seconds; each error increases score by one point and the test is stopped if the patient earns 10 points; higher score indicates poorer performance

Procedures
- Participants were evaluated at a local concussion clinic after receiving SRC
- Each participant was evaluated by AT, PT, and PA
- Evaluation: SCAT-5, ImPACT, cranial nerve assessment, cervical screen, vestibular-ocular assessment, mBESS
- PA determined clearance for RTP progression; if cleared, the patient completed the Buffalo Concussion Treadmill Test (BCTT)
- Data was de-identified and placed in a password-protected document
- Data included demographic information, date of injury, date and scores of mBESS, date of BCTT, symptoms

Statistical Analysis
- IBM SPSS Statistics for Windows (version 25; IBM Corp, Armonk, NY)
- ANOVA was used to identify the interaction between age and sex with BESS performance following SRC
- P ≤ 0.05

Results

Table 1. mBESS scores among adolescent male and female athletes

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13-15</td>
<td>5.425</td>
<td>4.116</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>16-18</td>
<td>6.026</td>
<td>5.464</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>5.639</td>
<td>4.619</td>
<td>68</td>
</tr>
<tr>
<td>Female</td>
<td>13-15</td>
<td>7.676</td>
<td>5.497</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>16-18</td>
<td>6.296</td>
<td>5.181</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7.094</td>
<td>5.181</td>
<td>64</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6.206</td>
<td>4.739</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>13-15</td>
<td>6.138</td>
<td>5.123</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>6.180</td>
<td>4.872</td>
<td>172</td>
</tr>
</tbody>
</table>

Table 2. Tests of between-subjects effects

<table>
<thead>
<tr>
<th>Source</th>
<th>F</th>
<th>P-value*</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>2.584</td>
<td>.110</td>
<td>0.359</td>
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<tr>
<td>Age group</td>
<td>0.249</td>
<td>.618</td>
<td>0.078</td>
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<tr>
<td>Sex*Age group</td>
<td>1.594</td>
<td>0.208</td>
<td>0.241</td>
</tr>
</tbody>
</table>

* significance is determined if P ≤ 0.05

Conclusions/Discussion

- The results of the study reject both hypotheses.
- Power is low indicating that the effect of age and sex on BESS scores following SRC is low.
- Data is not evenly distributed; more male subjects than female subjects
- More research is needed to determine clinical significance.

References