INTRODUCTION

Postural stability is believed to be a prerequisite for the performance of mature patterns of fundamental motor skills. It has been reported that the development of postural stability is delayed among individuals with autism spectrum disorder (ASD); further, it may never reach mature levels [1]. Individuals with ASD also commonly exhibit poor motor skills when compared to typically developing peers [2]. Recent comparisons of postural stability in children and adults with ASD have indicated postural stability and motor skill difficulties may not be uniform across individuals with ASD [3]. At present it is not clear how postural stability and motor skill deficits may be related to ASD severity.

The purpose of this pilot study was to compare postural stability and motor skills among children with and without ASD. Additionally, relationships between postural stability, gross motor skills, and repetitive behaviors was examined in children with ASD.

METHODS

Twelve age-matched boys (6-12 years; 6 with ASD) provided assent to participate in the present study. Informed consent was also provided by a parent or guardian.

Postural sway and motor skills data were collected during a single testing visit. A parent or guardian completed the Repetitive Behavior Scale – Revised (RBS-R) for each child.

In order to assess postural stability participants completed three quiet standing trials. All trials were 20 seconds in duration. During the quiet standing trials participants were asked to stand quietly on the force plate, with their hands at their sides, their feet a comfortable width apart, while looking at a ‘smiley face’ on the wall at eye-level approximately 5 meters in front of them. Center of pressure (COP) data were sampled at 60 Hz with a Kistler force plate (Kistler, Amherst, NY, USA) or Neurcom Balance Manager Long Force plate (Neurocom, WA, USA).

In the same laboratory visit participants also completed the Test of Gross Motor Development, 3rd Edition (TGMD-3). The TGMD-3 is a criteria-based assessment consisting of 13 fundamental motor skills, including run, jump, and throw. For each skill a researcher provided a demonstration of the skill and the child then performed the skill twice. Performance of the motor skills was videoed and analyzed subsequently using the TGMD-3.

The following variables were computed for analysis: (1) Postural stability was assessed during the quiet standing trials by computing postural sway area which was defined as the smallest ellipse that included 95% of the COP data points; (2) motor skills were evaluated using the TGDM-3 total score; and (3) the RBS-R total scores were computed to assess severity of ASD. Paired, one-tailed t-tests were used to assess differences between children with and without ASD. Simple linear correlation was used to explore relationships between variables (i.e., sway area, TGMD-3 score, and RBS-R score) among children with ASD. To account for the
small sample size and multiple statistical comparisons, the alpha level was set at 0.025 for all statistical analyses.

RESULTS AND DISCUSSION

There were no differences in postural sway among children with and without ASD (t = -1.54, p = 0.092) (Table 1). This contrasts some previous work, however, it supports the idea that children with ASD may not exhibit uniform deficits in postural stability [1, 3]. Children with ASD did score significantly lower on the TGMD-3 (t = 3.32, p = 0.011) than their peers without ASD (Table 1). The deficits in motor skills observed in the present population are in agreement with previous findings [2]. Furthermore, these results highlight the need for appropriate means of identifying children with ASD who may be affected by motor skill deficits and developing effective interventions to target these deficits [2].

There was no relationship between postural sway area and motor skills in children with ASD (r = -0.588, p = 0.110) (Figure 1). When considered in light of the fact that this cohort did not exhibit deficits in postural stability compared to their peers it is possible that postural stability is not the limiting factor for motor skill development in this group of children with ASD. Similarly, severity of repetitive behaviors was not related to postural stability (r = -0.571, p = 0.118) or fundamental motor skills (r = 0.341, p = 0.23) in this group of children with ASD. Based on the present findings it does not appear that the RBS is a suitable tool for identifying children with ASD who may be affected by deficits in postural sway or motor skills.

CONCLUSIONS

Though, motor skill deficits were greater among children with ASD than among their peers without ASD this was not a predictor of postural stability. The present study is somewhat limited by the small number of participants. Differences between children with and without ASD and relationships between repetitive behaviors, motor skills, and postural stability among children with ASD may become more evident in a larger group of participants or under conditions of reduced sensory input (e.g., eyes closed or modified proprioceptive input).

REFERENCES


Table 1: Test of gross motor development (TGDM-3), postural sway area, and repetitive behavior scores (RBS-R) for children with and without ASD (Mean ± SD).

<table>
<thead>
<tr>
<th>Variable (units)</th>
<th>Children With ASD</th>
<th>Children Without ASD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sway Area (m²)</td>
<td>0.00942 ± 0.005</td>
<td>0.01161 ± 0.012</td>
</tr>
<tr>
<td>TGMD-3 Total Score</td>
<td>44.0 ± 23.6*</td>
<td>72.3 ± 21.5</td>
</tr>
<tr>
<td>RBS-R Total Score</td>
<td>22.6 ± 13.0</td>
<td>4.6 ± 5.5</td>
</tr>
</tbody>
</table>

* p < 0.025 vs. children without ASD