A NEW APPROACH TO UNDERSTAND POSTURAL INSTABILITY IN YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDERS

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INTRODUCTION

Self-stimulatory behavior is one of the characteristics in children with autism spectrum disorders (ASD). Self-stimulation causes repetitive and stereotypic behavior such as unusual ritualistic hand and body movement. Previous research suggests that these unusual movements in children with ASD may stem from one of the motor control deficits. Furthermore, this abnormal motor control ability manifests in impaired postural stability in children with ASD [1].

Numerous studies support a deficit in the postural control ability of children with ASD during quiet stance. Unfortunately, most studies solely focused on standing posture and the comparison of postural control ability between children with ASD and typically developing (TD) children, not emphasizing the underlying mechanism through which such differences occur. Thus, to further understand the breadth of postural control abilities, we calculated and evaluated the ‘Approximate Entropy’ (ApEn) during quiet sitting [2]. Approximate Entropy is regarded one of the reliable and predictable parameters to assess postural control, or more importantly, is believed to provide insight into the structural nature of how the movement is controlled [3]. It is generally believed that a decrease in value of nonlinear measures such as ApEn are indicative of a less complex system.

For our present study, we hypothesized that children with ASD would have a difficulty with postural control in quiet sitting as a result of motor control deficits and these deficits would be highlighted by lower ApEn values in the COP time series data.

METHODS

For quite sitting performance, 16 children diagnosed with ASD (5.3±1.2 yrs, 114.8±11.5 cm, 23.7±6.5 kg) and 16 TD children (6.1±1.3 yrs, 114.5±7.4 cm, 20.3±3.0 kg) participated. All children and their legal guardians provided written informed consent as approved by the University of Florida institutional review board.

During quiet sitting trials, children were asked to sit quietly while watching a video segment with engaging images and sounds (Baby Einstein Mozart, The Baby Einstein Company, LLC).

Ground reaction forces and moments were recorded from a force plate embedded level with the laboratory floor (Type 4060–10, Bertec Corp., Columbus, OH) 360 Hz) while the children sat as still as possible on a child size stool with their feet firmly on the floor. Four, 120 s experimental trials were collected. The location of the center of pressure (COP) was calculated from the force plate data and each trial was divided into 20 s time intervals for the determination of ApEn data. ApEn values for the anteroposterior (ApEnx) and mediolateral (ApEny) components were calculated using customized Matlab software (Mathworks, Natick, MA). Independent T-test were used to compare performance between ASD and TD children with an aprior level of significance of p<0.05. All statistical tests were performed using SPSS 16.0 for Windows (Chicago, Illinois).

RESULTS

First of all, there was a significant difference in COP sway area between children with ASD and TD (p <0.05). Children with ASD showed 238% greater sway area values than children with TD. In addition,
children with ASD showed significantly smaller ApEn values in both the anteroposterior (AP) and mediolateral (ML) direction compared to TD children. The ApEn values were 28% smaller in AP direction and 31% smaller in the ML direction.

Our results showed that children with ASD had smaller ApEn in the both AP and ML direction compared to TD children. Smaller ApEn values indicate a reduced complexity of the COP time series data. This suggests that children with ASD possess more regularity in shifting their body weight while sitting quietly. The findings of the current study are aligned to previous findings reporting that clinical population with motor control deficits show relatively lower COP variability with a regular pattern when compared to age matched controls.

CONCLUSIONS

The ApEn results from present study suggest that postural control during quiet sitting is influenced by nonstrategic repetitive behavior and is believed to be indicative of more widespread motor control deficit associated with the disorder. To further elucidate disruptions in postural control system of individuals with ASD, dynamic and functional movements such as gait initiation and sit-to-walk should be examined in future.

REFERENCES


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