INTRODUCTION

The prevalence of autism spectrum disorder (ASD) is growing in the United States, resulting in an increased need to expose children with ASD to effective therapeutic interventions [1,2]. Sensory integration (SI) therapy has been successful in improving social behaviors and sustained attention while reducing repetitive mannerisms and hypersensitivity [2]. It is difficult to accurately measure the effectiveness of SI therapy, however, due to the subjective nature of its results [2,3]. A literature search of the terms “SI therapy” “autism” and “evaluation” in Pubmed and Medline databases over the last 30 years yields no studies that quantitatively assess therapy data. One solution to this research gap is to quantitatively assess changes in sensory processing after therapy by measuring changes in physiological systems that require sensory interaction, such as postural control. Researchers have demonstrated that children with autism have atypical balance [4]. Therefore, as an improvement in sensory integration could result in a shift in postural stability, quantitative research could be conducted to determine the effectiveness of a SI program. As work in this field has been so limited to date, a preliminary, exploratory study was undertaken prior to initiating a full scale study. This research sought to determine whether SI therapies produce measurable, physiological trends, as well as identify any challenges that may arise in working with this special population. It was the objective of this pilot study to evaluate postural changes in children after a vestibular swing therapy. A further objective was to determine data trends, experimental feasibility, and data collection procedures for a larger, future study. It was hypothesized that subjects would demonstrate increased postural stability after undergoing a SI swing therapy protocol.

METHODS

Five children were tested for this study (8.6 ± 1.52 years old, 33.7 ± 9.7 kgs, 134.4 ± 12.5 cm). Three subjects were typically developing (TD) and two had been diagnosed with ASD. Subjects were required to be verbal, to have no medical conditions that would affect postural stability, and to have undergone no medication changes six weeks prior to testing. IRB consent was obtained from the University of Dayton prior to testing and the parents of all subjects gave written, informed consent. The test protocol to evaluate therapeutic effect was structured as a pre-test/post test. Subjects underwent static posturography testing on a Bertec Force Plate (BP 5050). Postural sway data was collected under four different sensory conditions: on a flat plate with eyes open/eyes closed, and on a foam pad with eyes open/eyes closed. For both the pre-test and the post-test two trials of every condition were taken, resulting in a total of 16 total trials for the entire session. Data was collected for a period of 20 seconds. As the subjects were younger children and two had ASD, additional measures were taken to increase the likelihood of a successful trial completion. These measures included a researcher quietly counting to 20 during each trial and using a photo of an animal as a visual fixation point. The photos were switched out for variety but the same image was used for each respective test condition – e.g. image A was always used for the eyes open/flat plate condition for each trial and for each subject.

The pre-test was conducted before the subject underwent a 10 minute SI therapy session on a vestibular swing. Following the therapy, the post-test was administered. The anterior-posterior (A/P) and medial-lateral (M/L) center of pressure (COP) data were used to calculate A/P sway range (APSR), medial-lateral sway range (MLSR), and mean velocity (MV). Due to small subject size, statistics
could not be performed but trends and percent changes were examined.

RESULTS AND DISCUSSION

One of the purposes of this study was to test the feasibility of having children, including those with ASD, successfully complete the protocol. From this perspective, it appears that the strategies employed were helpful but problems with compliance still existed. Subjects with ASD had to repeat approximately 25% of the trials because they did not follow the testing instructions. Future studies might benefit from alternative means of data collection, such as shorter trials or seated posture.

As the vestibular swing seeks to stimulate vestibular function, there was particular interest in examining the effect of the swing on postural sway during the eyes closed, foam pad condition, as this condition is known to require vestibular reliance to maintain upright stance. After undergoing the swing therapy, 4 of the 5 subjects demonstrated an average A/P sway decrease of 3.95±2.4mm, as seen in Figure 1.

![Eyes Closed/Foam Pad](image)

**Figure 1**: Average A/P sway range while standing on foam pad with eyes closed. Subjects 4 and 5 were diagnosed with ASD.

Though minimal clinically important differences (MCID) have yet to be determined for postural sway, the data suggests that most subjects experienced improvements in balance, under this testing condition. Although these improvements are small in magnitude, they were noticeable after just ten minutes of a single therapy session. Future work should examine the effect of exposure to this therapy longitudinally.

Mean Velocity revealed perhaps the most interesting trends as subjects with ASD exhibited decreased MV (generally indicative of improved postural control), whereas the TD children exhibited increased mean velocity (generally indicative of poorer control). Future work should target this particular outcome to determine whether these findings exist in a larger data set, and seek to explain why these differences would exist. It is possible that the vestibular swing routine is only beneficial to those with sensory processing issues (i.e. children with ASD). On the other hand, despite the increases in MV, A/P and M/L sway ranges did not indicate poorer performance.

Although this study is limited by a small sample size, it is the first of its kind to indicate that SI therapy does produce measurable, albeit small, changes in postural control. If more information about SI therapy’s physiological effect is procured, then it may be possible to start optimizing therapy sessions by identifying best evidence based practices. Furthermore, if the therapy is found to be beneficial, families may have grounds to seek reimbursement, increasing the number of children with ASD who could be exposed to this therapy.

CONCLUSIONS

It was found that SI therapy leads to small changes in postural stability in children with ASD. The clinical and practical significance of these findings is yet to be determined.

REFERENCES


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