AOTA Critically Appraised Papers Series

Evidence Exchange

*A product of the American Occupational Therapy Association's Evidence-Based Literature Review Project

CRITICALLY APPRAISED PAPER (CAP)

Pfeiffer, B. A., Koenig, K., Kinnealey, M., Sheppard, M., & Henderson, L. (2011). Effectiveness of sensory integration interventions in children with autism spectrum disorders: A pilot study. A*merican Journal of Occupational Therapy, 65,* 76–85. https://doi.org/10.5014/ajot.2011.09205

CLINICAL BOTTOM LINE

Sensory integration (SI) treatment aims to create sensory opportunities to stimulate an adaptive motor response and is widely used as intervention for children with autism spectrum disorder (ASD). Traditional practice requires evidence-based research for treatment; however, current research is limited in terms of verifying the effectiveness of SI as well as choosing reliable and valid outcome measures.

This study was a randomized controlled trial that compared SI and fine-motor (FM) interventions, determined the appropriate outcome measures needed for treatment, and addressed the usefulness of SI interventions for children with ASD. Results indicate that the use of SI interventions resulted in fewer autistic behaviors, but no significant results were indicated on the other outcome measures administered. The SI intervention group demonstrated more progress toward goals in relation to sensory processing, motor skills, and social functioning on the Goal Attainment Scale (GAS); however, both groups were successful in showing improvements overall.

Occupational therapists can use this study to understand the efficacy of using the GAS and SI interventions for children with ASD. In addition, the evidence can inform therapists about the different SI interventions they can use to best treat children with ASD and lessen their autistic characteristics in a clinical setting. Therapists who work with children with ASD will also have more insight in determining outcome measures that are appropriate in their practice.

Funding from the Individuals With Disabilities Education Improvement Act of 2004 (IDEA) supported this research to investigate the effectiveness of SI interventions. IDEA requires the use of distinguishable measures, such as the GAS, to ascertain growth. As a result, this study indicates that the GAS is an effective outcome measure for creating individualized goals, measuring progress, and conducting research. Additional recommendations to enhance the strength of evidence include using the Autism Diagnostic Observation Scale to establish better standardized intervention groups and incorporating the interventions in the child's daily routines. The authors also suggested further research to establish the proper outcome tools that lead to success for each individual with ASD.

RESEARCH OBJECTIVE(S)

- To create a model for a randomized controlled trial research design
- To distinguish outcome measures suitable for children with ASD
- To address how effective SI interventions are for this population

DESIGN TYPE AND LEVEL OF EVIDENCE

Level I, randomized controlled trial

PARTICIPANT SELECTION

How were participants recruited and selected to participate?

Participants were recruited from a summer therapeutic activities program. Convenience sample was the method used for recruitment. The researchers randomly assigned participants to two treatment groups.

Inclusion criteria:

The study authors included only children diagnosed with ASD or pervasive developmental disorder not otherwise specified (PDD-NOS), defined by the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.). Children's diagnosis was confirmed by qualified diagnostician reports (ASD = 21, PDD-NOS = 16). The qualified participants were between the ages of 6 and 12 years. Children were also identified as having sensory-processing disorder, with a *T* score of 60 or higher on the Sensory Processing Measure.

Exclusion criteria:

Children diagnosed with Asperger syndrome or another pervasive developmental disorder

PARTICIPANT CHARACTERISTICS

N= 37

#/ % Male: 32/(86.5%) **#/ % Female:** 5/(13.5%)

Ethnicity: Not specified

Disease/disability diagnosis: ASD or PDD-NOS

INTERVENTION AND CONTROL GROUPS

Group 1: SI intervention

Brief description of the intervention	Children received an SI intervention that focused on 10 strategies to be used during therapy sessions. Strategies consisted of cooperating in choosing activities, setting up the participants' environment to provide sensory opportunities, ensuring safety, guiding participants to regulate their behavior, and modifying playful activities to successfully create a just-right challenge. This intervention aimed to help participants develop adaptive responses to meet the demands of the task in the environment. One session required that participants be videotaped by the on-site project coordinator for analysis purposes through the use of an SI treatment-fidelity measure.
How many participants in the group?	20
Where did the intervention take place?	SI interventions took place in a room separate from the FM intervention, in a location where the summer therapeutic activities program was held.
Who delivered?	The study authors did not identify who provided the intervention. Mention of "a clinician who was an expert in SI" (p. 3) was the only instance when the authors referred to clinicians in this article.
How often?	There were 18 intervention sessions that were 45 minutes each. However, 1 child only received 17 treatment sessions because they were absent on the last day of the program, and it was unclear which intervention group the participant was part of.
For how long?	All participants received individual treatment interventions three times a week over the course of 6 weeks.

Group 2: FM intervention

Brief description of the intervention	Children received an FM intervention that consisted of constructional, drawing and writing, and craft activities in a private room. The sessions fell under the fidelity criteria of appropriate supports and body positioning for the child while challenging their visual–motor and FM skills. In addition, interventions connected to the child's therapeutic needs to foster these skills. Children were given activities that would not completely overstimulate them by proprioceptive, tactile, and vestibular input and that interested them so they would maintain their attention on the task.
How many participants in the group?	17

Where did the intervention take place?	FM interventions took place in a room separate from the sensory-processing intervention, in a location where the summer therapeutic activities program were held.
Who delivered?	Occupational therapist student, under the direct supervision of an occupational therapist
How often?	There were 18 intervention sessions that were 45 minutes each. However, 1 child only received 17 treatment sessions because they were absent on the last day of the program, and it was unclear which intervention group the participant was part of.
For how long?	All participants received individual treatment interventions three times a week over the course of 6 weeks.

INTERVENTION BIASES

Contamination:

YES ☐ NO ☒	Parents could have talked to other parents about the progress or regression seen in their child's behavior, but it was highly unlikely to risk contamination bias.

Co-intervention:

YES ☒ NO ☐	Four identified participants received occupational therapy services, 1 participant received physical therapy services, and 7 participants received speech therapy services outside of the study and program setting.

Timing of intervention:

YES ☒ NO ☐	Maturation effects could have occurred over the 6-week period. In addition, behavioral factors of children with ASD and PPD-NOS could have affected the overall timing of intervention.

Site of intervention:

YES ☒ NO ☐	The summer therapeutic activities program site where the intervention was held contained appropriate equipment specifically designed for the SI interventions. Consequently, participants underwent different experiences of intervention in comparison with an alternative environment.

Use of different therapists to provide intervention:

YES ☒ NO ☐	An occupational therapy student provided the treatment for the FM intervention, which could have affected the way participants responded to therapy, in contrast to an experienced occupational therapist's knowledge of how to provide therapy. It was unclear who provided treatment in the SI intervention.

Baseline equality:

YES ☐ NO ☒	A statistician randomly assigned the participants to the SI and FM intervention groups with the use of the SPSS software program. This prevented bias between the groups at baseline.

MEASURES AND OUTCOMES *(Only on measures relevant to occupational therapy practice)*

Measure 1: Sensory Processing Measure

Name/type of measure used:	Home version of the Sensory Processing Measure		
What outcome is measured?	Praxis, social participation, and processing ability for children ages 5–12.		
Is the measure reliable (as reported in the article)?	YES ☒	NO ☐	Not Reported ☐
Is the measure valid (as reported in the article)?	YES ☒	NO ☐	Not Reported ☐
When is the measure used?	As a pretest before the intervention and as a posttest after the intervention		

Measure 2: Social Responsiveness Scale (SRS)

Name/type of measure used:	SRS		
What outcome is measured?	Social aspects of awareness, avoidance, information processing, communication ability, and characteristics of ASD		
Is the measure reliable as reported in the article?	YES ☒	NO ☐	Not Reported ☐

Is the measure valid as reported in the article?	YES ☒	NO ☐	Not Reported ☐
When is the measure used?	As a pretest before the intervention and as a posttest after the intervention		

Measure 3: Quick Neurological Screening Test (QNST-II)

Name/type of measure used:	QNST-II		
What outcome is measured?	Dexterity, praxis, spatial orientation, tracking, tactile perception, and motor skills for children from kindergarten to 12th grade		
Is the measure reliable as reported in the article?	YES ☒	NO ☐	Not Reported ☐
Is the measure valid as reported in the article?	YES ☒	NO ☐	Not Reported ☐
When is the measure used?	During the initial evaluation before intervention		

Measure 4: GAS

Name/type of measure used:	GAS		
What outcome is measured?	To determine relevant, functional, and meaningful goals in the areas of sensory processing, functional motor skills, and social–emotional functioning skills		
Is the measure reliable as reported in the article?	YES ☐	NO ☒	Not Reported ☐
Is the measure valid as reported in the article?	YES ☐	NO ☒	Not Reported ☐

When is the measure used?	The authors used this measure before the intervention to determine goal setting and reviewed it after the intervention to identify improvement toward the established goals. However, the GAS is not a standardized assessment, even though it has been reported to be an effective outcome measure.

Measure 5: Vineland Adaptive Behavior Scales

Name/type of measure used:	Vineland Adaptive Behavior Scales (2nd ed.)		
What outcome is measured?	Communication, daily living, social, and motor skills as well as maladaptive behavior		
Is the measure reliable as reported in the article?	YES ☒	NO ☐	Not Reported ☐
Is the measure valid as reported in the article?	YES ☒	NO ☐	Not Reported ☐
When is the measure used?	During the initial evaluation before intervention		

Measure 6: Adaptability Scale

Name/type of measure used:	Adaptability Scale of the Carey Temperament Scales		
What outcome is measured?	This scale consists of five questionnaires that measure nine categories of temperament: activity level, intensity, mood, adaptability, regularity, threshold for sensory input, distractibility, persistence, and initiating approach–withdrawal.		
Is the measure reliable as reported in the article?	YES ☐	NO ☐	Not Reported ☒
Is the measure valid as reported in the article?	YES ☐	NO ☐	Not Reported ☒
When is the measure used?	As a pretest before the intervention and as a posttest after the intervention		

MEASUREMENT BIASES

Were the evaluators blind to treatment status?

YES ☒ NO ☐	The researchers were blinded to the assignment of the intervention groups.

Was there recall or memory bias?

YES ☒ NO ☐	The three questionnaires completed by the parent or caregiver of the participant were self-report scales and tools, along with an interview with the researchers. Recall or memory biases could have occurred if parents tailored their ratings of their child to obtain a certain result.

RESULTS

At the culmination of 6 weeks, both groups, overall, showed significant progress toward attaining goals of sensory processing, motor skills, and social functioning categories from the GAS, as reported by parents ($p < .05$, effect size = .125) and teachers ($p < .01$, effect size = .360). More improvement was indicated by the SI group, however.

Participants in the SI group also displayed fewer behavioral signs of ASD than the FM group, as determined by an SRS subscale ($p < .05$, effect size = .131). This meant that the interventions used in SI treatment sessions could have affected the decrease of symptoms.

Neither group showed significant comparisons when the authors analyzed the results for sensory-processing standardized scores, additional subtests of the SRS, and the QNST-II. Only 70% of the SI participants and 17% of the FM participants finished all or only a portion of the administered QNST-II pretest and posttest. SI participants who completed the QNST-II showed an overall significant improvement in contrast with the FM participants.

Was this study adequately powered (large enough to show a difference)?

YES ☒ NO ☐	Although the sample size (N=32) was slightly small for the use of a comparison group, it adequately powered the study, given the significant improvements and results in certain outcome measures.

Were the analysis methods appropriate?

YES ☒ NO ☐	The authors used chi-square analysis to establish any differences at baseline and in demographics between the two groups. They used analysis of covariance to identify differences in participants' levels of behavior from their Vineland Adaptive Behavior Scales scores.

Were statistics appropriately reported (in written or table format)?

YES ☒ NO ☐	The statistics of the outcome measures used were clearly described in written format. In addition, the researchers provided a table that showed the demographic and baseline variables for both treatment groups.

Was participant dropout less than 20% in total sample and balanced between groups?

YES ☒ NO ☐	Before the established sample size, 4 children dropped out from the study. Two participants were removed from the program by their parents' decision, and 2 were asked to leave because of aggressive behaviors demonstrated before the intervention.

What are the overall study limitations?

Many of the parents completed the measures by observing the child at home instead of in the clinical setting where the interventions were given, which might have affected the results of the outcome measures when analyzed. The treatment interventions could have yielded more significant results if participants were given a longer period of time with more than three sessions per week.

According to the authors, inclusion of more participants to increase the larger sample size could have provided more supporting evidence for the use of interventions focused on SI, as well. The study also limited participants' ability to use the implemented SI interventions at home to perform their daily routine, because of types of equipment used during the sessions.

Additionally, the authors indicated that the Autism Diagnostic Observation Scale would have been a beneficial tool to determine homogeneity in groups. In addition to the GAS, more measurement tools catering to each individual could have brought more variability and insight into ASD.

CONCLUSION

The authors studied the efficacy of SI interventions for children with ASD while considering applicable outcomes to be used. Results indicate that individualized SI-focused intervention was effective in comparison with FM intervention when the GAS was used to measure outcomes. However, no significant results were identified with use of other measures.

The initial findings demonstrate positive results of the effectiveness of SI interventions, but additional research would be beneficial to increase understanding of the use of the GAS. Additionally, it may be possible to generalize these SI interventions in home and community settings. There is preliminary evidence that the measures and outcomes of this population may be generalized to other individuals with developmental disabilities or intellectual disabilities.

This work is based on the evidence-based literature review completed by Justine Cabrera and Mark Kovic, OTD, OTR/L, FAOTA, Midwestern University.

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