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Abstract

This exploratory pilot study was conducted to evaluate outcome differences between traditional individualized sensory integration treatment and integrated sensorimotor activities for preschool children with autism spectrum disorders. Pre- and post test measures of play were evaluated for two small groups of children who met criteria for exhibiting sensory processing issues. Results indicated positive differences in play behavior for both groups of children. Overall, further research is indicated to better understand the impact of various treatment approaches on participation in preschool occupations.

A Pilot Study Comparison of Sensory Integration Treatment and Integrated Preschool Activities for Children with Autism

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ABSTRACT

This exploratory pilot study was conducted to evaluate outcome differences between traditional individualized sensory integration treatment and integrated sensorimotor activities for preschool children with autism spectrum disorders. Pre- and post test measures of play were evaluated for two small groups of children who met criteria for exhibiting sensory processing issues. Results indicated positive differences in play behavior for both groups of children. Overall, further research is indicated to better understand the impact of various treatment approaches on participation in preschool occupations.

INTRODUCTION

Autism is a neurodevelopmental disorder that impacts typical childhood activities, such as socialization, and is often characterized by displays of repetitive and stereotyped patterns of behavior.¹ In addition to these core characteristics of autism, individuals with a spectrum disorder usually display different responses to sensory experiences when compared to typically developing peers. Unusual sensory responses, as well as preoccupations with sensory features of objects, have been reported for children with autism in several studies.²⁻⁴ Tomchek and Dunn reported that 95% of over 200 children with autism they studied demonstrated some degree of sensory processing dysfunction.¹ The decreased ability to effectively process sensory stimuli may lead to limited participation in preschool activities, such as peer interaction, pre-academic work, play, and feeding.^{5,6} There is a need to understand the differences in the various approaches to providing intervention for sensory processing challenges for children with autism within preschool environments, in order to support optimal participation in childhood occupations such as play.

Ayres Sensory Integration® therapy is often used to treat sensory processing disorders in children with autism. Sensory integration is a neurological process that entails organizing sensations from key receptors for use in everyday functional

activities.⁷ The sensory integration treatment approach was developed by Dr. A. Jean Ayres following a series of research studies that indicated specific sensory variations in children with learning disabilities.⁷ There has been a recent evolution in the way sensory aspects of functioning are conceptualized, however relationships to foundational aspects of Ayres Sensory Integration® are still present. Miller et al describe sensory processing as an umbrella term with sensory modulation disorder, sensory-based motor disorder, and sensory discrimination disorder falling under the main heading of sensory processing.⁸ Therefore, a sensory processing disorder can present in a variety of ways. Although there is no current consensus on a sensory processing taxonomy, this framework is beneficial for therapists in regards to categorizing and understanding particular sensory processing issues.

In the last few years, there is consistency in regards to what constitutes Ayres Sensory Integration® treatment. This is a common approach for children with sensory processing disorders. The core elements of the sensory integration intervention process, described as fidelity, are aspects that relate to authentic and traditional sensory integration.⁹ The core process elements of sensory integration fidelity include (a) provide sensory opportunities, (b) provide just-right challenges, (c) collaborate on activity choice, (d) guide self-organization, (e) support optimal arousal, (f) create play context, (g) maximize child's success, (h) ensure physical safety, (i) arrange room to engage child, and (j) foster therapeutic alliance. These core elements are key for identifying and structuring authentic sensory integration intervention.⁹ This program description provides an overview of preliminary program evaluation descriptive data that included play skill outcomes of integrated and pull-out sensory intervention, based on Ayres Sensory Integration® treatment, for seven preschool children with autism.

SENSORY INTERVENTION FOR CHILDREN WITH AUTISM

Studies related to the effect of Ayres Sensory Integration® strategies have included children with autism and other disabilities but are limited and not focused on examining a child's participation in preschool activities such as play.¹⁰⁻¹³ Case-Smith and Bryan studied the effects of occupational therapy intervention emphasizing Ayres Sensory Integration® with five preschool children diagnosed with autism.³ The results of this study suggest that four of the five children demonstrated decreased frequency of non-engaged behavior. Three of the five children demonstrated increased goal-directed play skills. The researchers found that the children made little gains with frequency of social interactions. These results are consistent with the literature supporting the usage of a sensory integration approach in treatment for young children with autism.³

A more recent study by Watling and Dietz evaluated the effectiveness of sensory integration intervention on behavior and engagement in tasks of four preschool boys with autism spectrum disorder.¹⁴ Objective results did not show any statistically significant change in undesired behaviors or task engagement. However, subjective (parent and personnel) observations suggested that Ayres Sensory Integration® intervention had a positive effect during treatment sessions and in the home environments. Positive changes in behavior demonstrated by the boys included increased compliance, vocalizations, eye contact, socialization, and making transitions during the day, as well as increased initiation of activity. Watling and Dietz suggested that additional research include more measurements of engagement to more accurately assess the effect of Ayres Sensory Integration® treatment.¹⁴

The studies by Case-Smith & Bryan and Watling & Dietz indicate the problems that are quite common with children on the autism spectrum who have sensory processing issues.^{3,14} Exploration of whether Ayres Sensory Integration® intervention for sensory processing difficulties among children with autism makes a difference for engagement in childhood occupations, such as play, may provide some indication for how practitioners may more effectively impact change. Recognition that sensory processing difficulties create issues with self-regulation and modulation, which in turn impact engagement in pre-school play, is significant for consideration of research questions, as well as choice of assessment tools.

In addition to evidence related to sensory related interventions, there is literature that indicates positive results for the partnership of parents, teachers, and therapists for promoting socialization and interaction among children with autism.¹⁷⁻¹⁹ Programs that promote an emphasis on social relationships and play within the classroom structure can have a positive impact on developmental outcomes.²⁰

PROGRAM OVERVIEW

The sensory focused program was developed within a preschool on a university campus in the Southeast United States. The preschool has provided services to children with autism spectrum disorders on the university campus since 1985. Currently, over 150 preschoolers (3 years old to pre-kindergarten), all diagnosed with autism spectrum disorders, attend the school on an annual basis. The preschool consists of 18 classrooms with at least a teacher and two aides in each classroom with an average of nine students. Two of the classrooms are integrated with typical children, but none of the seven children observed in the preliminary program evaluation processes were from these particular classrooms. The overall educational and therapeutic preschool

program is focused on building developmental skills in a wide variety of areas, including behavioral, social, and communication aspects, within a relationship-based environment.

Over the last 15 years, the occupational therapy staff has increased from one part-time therapist to four full-time occupational therapists (OTs), with experience ranging from 5 to 12 years. This increase in staff members who are all certified in Ayres Sensory Integration® Sensory Integration and Praxis Test (SIPT) has provided the opportunity for infusion of sensory activities into the daily routines of the preschool, with an awareness of how this could contribute to skill development. At the beginning of each school year, the occupational therapists provide a workshop to the teachers on sensory integration components, sensory processing, appropriate sensory activities for particular needs, and a description of the type of input that the activities provide. A particular emphasis is placed on the difference between vestibular, proprioceptive, and tactile input within various preschool related activities. Vestibular activities relate to movement sensations registered by receptors in the inner ear, proprioceptive input relates to the sensations received through joint and muscle receptors, and tactile input relates to a variety of sensations received through the skin.⁷

The teachers, in collaboration with the occupational therapists, develop and implement sensory related activities in the classroom setting on an ongoing basis for groups of children as general activities. Adaptations may be made for individual children as the teachers deem necessary. Children with specific sensory processing needs that interfere with educationally relevant skills are referred to occupational therapy. However, the classroom and outdoor play areas are set up to be sensory rich where all children can benefit from the variety of activities for engagement in play, social, and self-care occupations.

Sample Activities

The following are examples of sensory related activities that are provided within the routine school and classroom daily schedule. The occupational therapists are frequently consulted in the planning and development of these sensory experiences, and actually developed the initial gym oriented aspect of the curriculum. The gym activities are done in a large room and incorporate gross motor, coordination, and balance games for groups of children. The teachers and gym instructor will typically carry out the activities, but the occupational therapists participate in them in conjunction with their individual treatment goals for children as well.

Vestibular – Movement activities are promoted primarily through a structured gym class that was developed by the occupational therapists, as well as outdoor play opportunities. The gym class occurs once a week and promotes particular skills, such as balance and coordination. The classroom teachers are now responsible for carrying out this weekly special class in consultation with the therapists. The occupational therapists observe on the playground and classroom settings and offer suggestions to the teachers, as well as initiate conversations with the teachers when sensory needs are observed. In addition, the teachers frequently ask the occupational therapists for sensory strategy recommendations for various children in their classrooms when they are working with other children in the classroom or informally during school routines when the occupational therapists are available. Activities to promote skills include scooter relays, parachute play, and obstacle courses. In addition to the structured weekly gym class, the multiple playgrounds at the school site offer many opportunities for vestibular input. Push toys, rocking toys, slides, jungle gyms, and tricycles are available for use. Teachers, aides, occupational therapists, and physical therapists facilitate engagement with particular pieces of equipment depending on the various sensory processing needs. For instance, a child who exhibits gravitational insecurity may be encouraged to climb a small ladder. Viewing the playground equipment as potential tools for addressing sensory processing issues, such as gravitational insecurity, is key for a successful integrated sensory program.

Proprioceptive – Several teachers have identified the benefits of deep touch resulting in improved self-regulation with the children. In particular, a body sock is used for some children to aid in their ability to sleep during nap time. This lycra material covering almost the whole body provides deep touch and is comforting to many children. Other activities during play or gym time include the use of the bungee cord. A small trampoline is also used during patio play for children who benefit from joint input as a means of sensing where their body is in space and improving body awareness in general.

Tactile – Touch experiences are integrated throughout the daily routines within the classroom and on the playground. Examples include a “sensory road” with a variety of textures (e.g. sandpaper, bubble wrap, corrugated paper, feathers, wax paper, and aluminum foil), finding treasures in various media (e.g. sand, pasta, rice, putty, playdough), deep pressure lotion massage, and various activities using shaving cream. Teachers are aware of the variations in tactile responsivity, from defensiveness to craving touch, and grade activities accordingly, in consultation with the occupational therapists.

AYRES SENSORY INTEGRATION® TREATMENT

The occupational therapists and teachers consult in regards to whether integrated or pull-out approaches may be in the child's best interest following a thorough occupational therapy evaluation. Some children are perceived to need more direct sensory intervention due to the level of distractibility in the classroom, severity of their sensory processing issues, or the need to use specific equipment to elicit desired skills. This alternative consideration to integrated sensory classroom activities is the traditional pull out therapy where specific equipment is used in a child-centered way, to provide the appropriate input to elicit an adaptive response. This internally driven response is considered a productive outcome of a therapeutic challenge that is provided by the therapist within a conducive environment.²¹ For example, a child is able to initiate a complex movement pattern following the development of an obstacle course that adds a new aspect in each therapy session. Adaptive responses are actions or reactions of the child based on what is experienced in the environment.⁷ Typically, when individuals adjust to new challenges, such as engaging in a new craft, they are eliciting adaptive responses to be successful in the activity. Slight changes in an individual's actions and behaviors are adaptive responses that facilitate engagement in daily activities, such as play and self-care functional tasks.

The equipment in the occupational therapy treatment room consists of suspended swings, therapy balls, mats, tactile materials, and developmentally appropriate toys and activities. Treatment is provided on a variety of equipment during the session and activities are adapted as the child leads the session. Fidelity descriptions mentioned previously are useful for identifying authentic Ayres Sensory Integration® strategies. The fidelity descriptions are consistently used at the preschool as a means of verifying Ayres Sensory Integration® treatment.

An example of a pull-out sensory integration related treatment session includes offering choices of suspended equipment with incorporation of play activities (puzzles, toys, etc.) while on the equipment. Vestibular activities are graded based on adaptive responses from the child. For example, if a child is demonstrating fear of moving their feet off the ground, a suspended swing may be lowered just one inch off the ground for the first time. If the child demonstrates adaptation to this by expressing no fear and even initiating getting on, then the swing may be raised another inch. Other activities that incorporate vestibular and proprioceptive input include weight bearing activities on the mat, such as crawling through various equipment, incorporation of jumping on the trampoline while playing a game, and using the scooter board. The appropriate challenge is offered throughout the session by adjusting the height of equipment, incorporating more equipment, facilitating play choices, and grading the speed of various activities, among other things. In contrast to this, integrative approaches included providing movable or floor seating in the classroom to support a child's need for movement or encouragement to climb a jungle gym in the play area to foster adaptation to varying heights.

COMPARISON OF APPROACHES

With very positive teacher, parent, and administration feedback regarding the more integrative approach of providing ongoing sensory based activities in the classroom, the occupational therapists sought to understand if there is a difference between the integrative and pull out approaches. Since play is a primary occupation of preschool children and an area that is often facilitated for improved skills within this environment, it was chosen as an outcome measurement to provide a means of evaluating effectiveness in a preliminary manner. The goal remains to develop a more rigorous research approach to understanding these differences, but preliminary descriptive data was considered to be beneficial in providing some indication of whether an integrated or pull out approach is more effective for play performance outcomes.

PARTICIPANTS

Following university and county public school IRB approval and informed consent, seven children were included in the study for observations regarding play skills prior to and following integrated and pull-out sensory intervention. Initially, six male and two female participants from various nationalities made up the sample of eight children in the pilot project (See Table 1), who were randomly assigned to the two groups. The eight children were between the ages of three and five years and attended the preschool. Inclusion criteria met by the eight children included functioning at least at the 18-month-old level in order to follow very simple verbal directions and gestures, demonstrate a sensory issue (such as tactile or movement defensiveness or craving), and not currently receiving sensory integration related intervention (through occupational therapy, physical therapy or routine school-based therapy) from other sources, including therapy within the school environment. The study took place at the beginning of the school year and qualification for therapy services had not yet been determined for this group of children. All children had a diagnosis of autism. One of the eight children was not able to complete the study due to illness. The mean age for the three children in the pull out group was 4.5 years and the mean age for the integrated sensory classroom experience group was 4.4 years. Both groups were exposed to the sensory rich classroom environments each day. The specific sensory processing issues that were observed and reported prior the study included over-responsivity to touch and extreme sensory seeking.

Table 1. Participants

Participant	Age	Sex	Race	Typical Behaviors based on sensory evaluation (ESP)
S.A. (did not complete study)	4.1	Male	Bi-racial	S.A. seeks activities that involve pushing, pulling, lifting, and jumping. He dislikes or avoids activities such as, finger painting, pasting, sand, or any wet, messy sensory media.
S.V. (pull-out treatment)	4.6	Male	Hispanic	S.V. is sensitive to loud noises (cover ears) and under-reacts to loud noises. He grinds his teeth. He seeks pushing, pulling, and jumping activities. S.V. wants to touch different textures. Does not like to have nails cut, wears short clothing. He seems to have a high tolerance for pain.
J.F. (pull-out treatment)	4.0	Male	Hispanic	J.F. is sensitive to noise and easily distracted by visual stimuli. J.F. mouths inedible objects frequently. He seeks activities such as pushing, pulling, and jumping. He enjoys touching different textures. He dislikes engaging in personal hygiene activities.
J.Z. (pull-out treatment)	5.5	Male	Hispanic	J.Z. grasp objects tightly and exerts too much pressure to complete tasks and manipulate objects. He chews on toys, clothes, and objects frequently. J.Z. has high tolerance for pain. J.Z. is fearful of movement as in swings, slides, teeter-totter. However, he enjoys fast spinning rides.
E.H. (integrated treatment)	4.2	Female	Caucasian	E.M. enjoys fast spinning equipment. She constantly touches objects/people, but not as tolerant if someone touches her. E.M. gags at foods that are unappealing to her.
G.A. (integrated treatment)	4.1	Male	Bi-racial	G.A. seeks activities that involve pushing, pulling, and jumping. He also tends to play rough with peers. G.A. has difficulty with some personal hygiene tasks such as washing his face, combing his hair, having his nails cut.
G.B. (integrated treatment)	5.5	Female	Hispanic	G.B. is easily distracted by noise and visual stimuli. She overreacts to certain noises and injuries. G.B. tends to touch things frequently and has certain clothing preferences based on texture.
G.U. (integrated treatment)	3.9	Male	Bi-racial	G.U. is sensitive to sounds and will respond negatively to loud noises. He will gag at unappealing food and avoid foods. G.U. seeks pushing, pulling, and jumping activities. He seeks to touch different textures, but also avoid textures. G.U. prefers to touch than be touched. He spins more than other children and enjoys inverting himself. He is easily distracted by visual stimuli.

EVALUATION INSTRUMENTS

The Evaluation of Sensory Processing was completed by parents.²² The Evaluation of Sensory Processing is a non-standardized tool that includes a checklist of 76 questions related to the child's sensory systems. This tool was chosen because of the researchers' familiarity with the tool authors and their desire to provide additional information on its use. A score of 277 or below indicates a sensory processing deficit. The results were used for inclusion criteria as an objective way of determining the presence and type of sensory issues. The children who were randomly selected for each of the classroom observation and pull out treatment groups all scored at 277 or below. Descriptions in Table 1 indicate sensory challenges that would warrant inclusion in the pilot study based on the sensory processing assessment.

The Revised Knox Play Scale was administered by the same occupational therapist, pre and post intervention.²³ This tool provides an overall play age, considering space management (gross motor), material management (fine motor), and pretense-symbolic and participation (social) areas of play, following observations in indoor and outdoor environments. Jankovich et al. evaluated inter-rater agreement and construct validity of the Revised Knox Preschool Play Scale.²⁴ They found inter-rater agreement to be almost 90% and construct validity of the scale by play age and chronological age matches to be between 92% and 100%. Two other occupational therapists provided all treatments and were not involved with the testing in order to maximize objectivity.

INTERVENTION

Following the administration of the Evaluation of Sensory Processing and the Knox Preschool Play Scale, four children were randomly assigned to the pull-out sensory integration therapy regime and three children remained in the classroom for routine

sensory activities that were offered to all classroom children in their respective classes. None of the children were in the same classrooms. During a twelve-week span of time, sensory activities in the classroom were suggested via consultation and collaboration with the teachers by the occupational therapists as routine experiences in the preschool setting throughout each morning. These activities included opportunities for vestibular, tactile, and proprioceptive input throughout the day. The activities were integrated into the classroom curriculum schedule which included table tasks, circle, story, art, sensory, play, computer, teacher time, independent work, nap, mealtime, gym, and playground time. The amount of time in sensorimotor-related activities was intended to match the time of the one hour pull out sessions, since there were set curricula in place for each classroom.

The four children who received pull out therapy were provided individualized intervention in a therapy room that met their specific needs for tactile defensiveness, under or over-responsivity to vestibular input, and other specific sensory processing issues as identified by the Evaluation of Sensory Processing results. Descriptions of specific types of activities were mentioned in the Sensory Integration description above. Therapy occurred twice weekly for 30-minute sessions each time. Although this is less than typical for traditional sensory integrative approaches, it fell within the parameters of treatment time designated by this school system. When they returned to the classroom, they did get exposure to other routine sensorimotor activities that occurred in center times during the day, although it was encouraged that the more structured and intentional sensory related activities occurred in their absence.

DESCRIPTIVE OUTCOMES

When the treatment and the comparison groups were compared prior to intervention, it was noted that there were some differences in certain variables between the two groups (Table 2), indicating a higher mean in play skills for the group that was assigned to the integrated experiences.

The treatment and integrated sensory group means were compared again at the completion of the intervention (Table 2). Results indicated an improvement for both treatment and control groups in their overall play skills within this short 12 week period. Sensory testing was only used to determine inclusion criteria at the beginning of the study and was not used for re-testing, since the emphasis was on a determination of functional skill outcomes.

Table 2. Descriptive Statistics and Comparison of Treatment and Control Group at Pre and Post (n=7)

Constructs	Treatment Mean Score	Control Mean Score
Knox Preschool Play Scale - Pre	28.50	32.62
Knox Preschool Play Scale - Post	39.37	47.40

PRELIMINARY IMPLICATIONS

Traditional Ayres Sensory Integration® therapy is often used for children with autism, and the application of sensory integrative principles can be used in classroom settings. The program at this particular preschool has created a focus on carefully planning integrated sensory activities to provide a rich sensory environment that meets the needs of a variety of children with sensory processing issues. Educating teachers regarding sensory processing and collaboration with therapists on an ongoing basis can have a positive impact on children's skills. Understanding the effect that these integrated activities have on children and understanding if this is different than traditional pull out therapy is critical for establishing effective treatment planning and implementation. The results of this preliminary evaluation indicated improvements in play skills for all children involved in the pilot study.

Overall, results indicated that integrated activities during routine classroom time were able to provide opportunities for improved performance skills for participation in preschool activities, particularly play. The children in the pull-out intervention group demonstrated increases in mean scores of play skills, but the control group also improved in this area of function. In the single subject design study by Watling and Dietz that evaluated the effectiveness of sensory integration on task engagement, the authors also indicated mixed results with no clear pattern of significance for engagement.¹⁴

The fact that the differences in play behaviors were notable for both groups indicates there is a need for research in this area. Observations of play changes in the pull-out group, by the occupational therapist who scored the Knox Preschool Play Scale at the beginning and ending of the pilot study, included less random and more purposeful environmental exploration in the space management category. In addition, the material management and participation Knox Preschool Scale areas included engagement with other peers for brief periods during outdoor sensory play when this was not apparent at the beginning for the pull-out group. Sensory based activities could have a notable impact on a child's ability to participate more effectively in play, which could have implications for children outside of the spectrum disorder diagnostic categories, as well as for children with

autism. Additional measures for this particular childhood occupation would strengthen the ability of researchers to ascertain the effect of traditional Ayres Sensory Integration® treatment, as well as other intervention strategies.

Overall, increased numbers of children are needed to more accurately evaluate differences between the groups. In addition, longer periods of treatment may be indicated to clearly detect if ongoing sensory integration treatment as pull-out therapy is effective in improving areas of occupation, as well as performance skills for preschool participation. However, a developmental advance as much as one year in play age was noted for some children, indicating that this progression was very unlikely to occur in 12 weeks without any intervention.

Observations of the control group revealed the ability of teachers to effectively integrate sensory activities that meet a variety of sensory processing needs of children who have autism. This is in alignment with literature that supports interdisciplinary collaboration for improvements in developmental skills of children with autism.²⁰ Tactile play, graded art activities, and movement groups are examples of typical teacher-driven activities that are integrated into the preschool routines. Since four occupational therapists work in this environment and contribute to teacher planning and implementation in general, it appears that integrated sensory activities may be meeting children's sensory processing needs in significant ways, and therefore improvements for both groups may be related to the benefits of these ongoing sensory opportunities. Occupational therapists within the school environment provide in-servicing to teachers at the beginning of the school year and include sensory information. They also provide classroom consultation on a routine basis for children who are demonstrating sensory processing issues. For example, they will suggest appropriate noise levels, tactile opportunities, and various play adaptations. Specific suggestions were not provided for any of the children in either group during the study, but the overall culture of this type of collaboration exists. In addition, the pull out treatment group still participated in many of the routine integrated classroom activities, so it is difficult to assess which aspect had the most influence and this is recognized as a study limitation. This does, however, indicate the potential of teacher-driven, sensory-rich classroom and outdoor activities that can enhance overall play skills and functioning. Research studies of integrated sensory activities within the preschool environment are warranted.

This small sample size also limited the ability to generalize these results, and outcomes should be considered with caution. The intent was to provide preliminary information about an integrated sensory program with comparisons to traditional pull-out therapy, which will guide future research projects with larger samples. A limitation of this pilot phase is that there are standardized assessments for evaluating sensory processing deficits that could have been used for a more reliable assessment for inclusion criteria, as well as using for post-testing. This will be a strong consideration for future research.

The wide variety of classroom sensory activities that were provided in each of the classrooms made it quite difficult to truly assess what aspects of the classroom environment enhanced the participation of the children in the control group. In addition, the children in the pull-out group continued to participate in all of their routine classroom activities except for the two sensory integration sessions per week, and it was difficult to truly assess the impact of the separate aspects of their day.

SUMMARY

This program description provided an overview of preliminary program evaluation descriptive data which included play skill outcomes of integrated and pull-out sensory intervention for seven preschool children with autism. It is notable that a sensory-rich environment with structured sensory activities included does have the potential for improving overall play skills among children with autism. Further research is warranted to more clearly distinguish the impact of the varying approaches, controlling for confounding variables, as well as to understand the role of the teacher and occupational therapists in the provision of a sensory rich school environment.

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KEY TERMS

Sensory Integration, Autism, Spectrum Disorders, Sensory Processing