The Effects of Occupational Therapy With Sensory Integration Emphasis on Preschool-Age Children With Autism

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Key Words: child development disorders, pervasive • interpersonal relations • play therapy

Objective. *Using single-subject research design, the effects of an occupational therapy intervention emphasizing sensory integration with five preschool children with autism were examined.*

Method. *In the AB design, nonengagement, mastery play, and interaction were measured, using videotape clips of each child's free play in the preschool. Following a 3-week baseline, an occupational therapist provided one-on-one sessions and consultation to teachers for 10 weeks.*

Results. *When baseline and intervention phases were compared, four children demonstrated decreased frequency of nonengaged behavior, and three demonstrated increased frequency of mastery (goal-directed) play. Improvements in frequency of interaction were minimal.*

Conclusion. *The results support descriptions in the literature regarding the behavioral changes that children with autism can make when participating in intervention using a sensory integration approach.*

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Young children with autism or pervasive developmental disorders have global problems in relating to others. These pervasive difficulties affect their ability to communicate with adults and peers and to engage in the complex play of preschool children who are developing typically. Most of these children remain relatively unrelated to others and interact in rigid, mechanical, and idiosyncratic ways (Greenspan, 1992; Greenspan & Wieder, 1997a). Many authors have speculated about the basis for their communication problems. Huebner (1992) explained that children with autism have difficulty recognizing emotional gestures and expressions. They fail to perceive the dynamics of emotional expression. Other researchers have hypothesized that persons with autism lack the ability to understand another person's point of view. They suggest that the relatedness problem observed in children with autism is primarily a cognitive disorder (Baron-Cohen, 1991). Osterling and Dawson (1994) described the basis of communication dysfunction as failure to orient to social stimuli, impoverished social gaze, and impairment in shared attention and motor imitation.

Greenspan and Wieder (1997a, 1997b) believe that biologically based regulatory difficulties contribute to the relationship and communication difficulties. For example, the child may be overreactive to sound or may crave proprioceptive and vestibular input (Grandin & Scariano, 1986). Vestibular responses are often delayed or abnormal. Children with autism demonstrate difficulty coordinating visual and vestibular responses (Dawson & Lewy, 1989).

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Vestibular system dysfunction may relate to problems in orienting and attending to relevant visual stimuli. Ornitz (1974) hypothesized that disturbances in sensory modulation are the primary symptoms of autism and that disturbances in social relating, communication, and language are consequences of difficulty in modulation of sensory input.

To help regulate their sensory systems, often these children engage in perseveration or stereotyped movements (Baranek, Foster, & Berkson, 1997). They line up cars or plastic animals, spin wheels, move a toy repeatedly back and forth on the table, or run back and forth in the room oblivious to objects underfoot. Most children with autism exhibit self-stimulation behaviors, including rocking, spinning, or flapping their hands. The child's sensory processing problems are believed to be a causative factor for self-absorbed behaviors (Greenspan & Wieder, 1997b).

In summary, children with autism avoid attending to others and rarely use reciprocal communication. The abilities to engage in a play activity and to interact with reciprocity are basic to the development of social relationships. These skills are fundamental to communication and learning and are the focus of the present study.

Occupational Therapy With Children With Autism

Occupational therapists are often concerned about children's sensory processing and modulation. Williamson and Anzalone (1997) described a sensory integrative approach when working with children with pervasive developmental disorders. They define three elements to the sensory integration approach:

1. Helping parents understand their child's behavior and foster nurturing relationships
2. Helping parents and teachers modify the environment so that it matches the child's sensory needs
3. Helping children organize responses to sensory input.

Activities consistent with a sensory integration approach provide graded tactile, proprioceptive, and vestibular input to the child to influence arousal and attention. Activities may be designed to decrease arousal (raise neural thresholds) or increase arousal (lower neural thresholds). Sensory integration techniques have been well defined in the literature (Ayres, 1972, 1979; Koomar & Bundy, 1991; Parham & Mailloux, 1996). They have been applied specifically to children with autism, particularly services to remediate behaviors indicative of sensory defensiveness and intolerances (Ayres & Tickle, 1980; Baranek, 1998; Williamson & Anzalone, 1997).

Sensory integration is fundamental to the child's ability to engage in play and sustain interaction (Wieder, 1996; Williamson & Anzalone, 1997). A child can purposefully interact with the environment only when appropriate levels of arousal, orientation, and attention are attained. When a child can modulate incoming sensory information and achieve homeostasis, then he or she is able to focus on relevant stimuli, assimilate incoming sensory information, and respond in developmentally appropriate ways. Sensory integration is also fundamental to the motor planning skills inherent in the play activities typical of preschoolers. At this age, children play by constructing and manipulating objects and materials, which requires not only attention and optimal arousal, but also motor planning and bilateral sequencing/integration. In summary, impaired sensory processing in children with autism seems to be associated with dysfunction in attending, arousal, interactions with others, and goal-directed play (Greenspan & Wieder, 1997a; Koomar & Bundy, 1991; Wieder, 1996). These associations support the use of a sensory integrative approach in occupational therapy. Psychiatrists who frequently manage the care of children with autism and may provide therapeutic services often recommend occupational therapy to promote integration of sensory systems and to improve attention and arousal (Greenspan, 1992; Wieder, 1996).

In a recent national survey of 292 occupational therapists who work primarily in school systems, the respondents indicated that they most often used sensory integration approaches with children with autism (95% used sensory integration at least sometimes). The respondents also indicated that they were more competent in sensory integration than any other intervention approach; 69% reported expert level skill in sensory integration (Case-Smith & Miller, 1999). Although sensory integration is prevalent in practice, very few efficacy studies of this approach with children with autism have been published (e.g., Ayres & Tickle, 1980). Greenspan and Wieder (1997b) reported the results of a clinical program, of which sensory integration was one component. The children who participated in this intervention program varied by the degree of severity of symptoms. Those with severe involvement made the least progress. Many of those with fewer symptoms made outstanding progress and were functioning at developmentally appropriate levels at the end of the course of intervention.

Research Methods in Studies of Children With Autism

Two methodological problems must be considered when investigating the effects of intervention in children with autism. First, use of most standardized measures is inappropriate because these children are often noncompliant and unresponsive to instruction. Observational measures of behavior in the natural environment are more appropriate and valid; for example, scales that measure frequency or duration of specific behaviors during the child's natural play are more valid than tests that require the child to respond to specific instructions.

A second methodological problem relates to the unique behaviors these children exhibit and the wide variation in their behavioral responses and developmental levels. Group designs that combine scale scores often lose

information about the progress that these children can make through intervention. Effects for children who make considerable gains can be eliminated when combined with children who do not make gains through intervention (Ottenbacher, 1986). Single-subject design, where each child serves as his or her own control, permits the comparison of trends and variability of targeted behaviors during baseline and intervention phases within and across subjects.

Therefore, this study used a multibaseline single-subject design to examine the effectiveness of a preschool program that included occupational therapy emphasizing a sensory integration approach. With a time sampling method, engagement, mastery play, and interaction were measured in the study's baseline and intervention phases. By comparing data from baseline and intervention phases, we intended to answer the following research questions:

1. Did the participants demonstrate increased frequency of mastery play?
2. Did the participants demonstrate decreased frequency of nonengaged behaviors?
3. Did the participants demonstrated increased frequency of adult and peer interaction?

Method

Sample

Five boys with autism participated in the study. Two had additional conditions; J. F. had a bilateral hearing impairment for which he wore hearing aids, and A. C. had a bipolar disorder. Four boys were 5 years of age and one was 4 years of age at the time of entrance into the study. All attended one of two half-day special needs preschool programs in a Midwest rural school district and had active individualized education programs. Descriptive information about the participants is provided in Table 1.

Study Design

The study was initiated after the children had been on break for the winter (Christmas and Hanukah) holidays. Each had been without programming or therapy for a month. The teachers reported that the children consistently regress during the month at home, away from the structure of the preschool program. On their return to school, a 3-week baseline phase was implemented during which the children attended the preschool program but did not receive occupational therapy. Each week, they were videotaped in their classroom during 10 min of free-time play. Intervention was initiated the fourth week and continued for 10 weeks. The scheduling of baseline measures and initiation of intervention allowed for four baseline measures for T. D. and J. F. and three for the others. On the 8th week of intervention, T. D. began a 40-hr-per-week applied behavioral analysis program (Lovaas, 1987); therefore, his videotape measures were discontinued. The tapes were analyzed with the Engagement Check (Parsons, McWilliam, & Buysee, 1989).

Table 1
Descriptive Information About the Participants

Participant	Age	Typical Behaviors	Individualized Educational Program Goals Related to Occupational Therapy
A. C.	5 years, 2 months	Demonstrates severe behavioral outbursts (often physical in nature), has difficulty transitioning from one activity to another, is comfortable only with sensory experiences that he controls, has expressive language, much of it echolalic	Improve readiness to engage in learning activities Improve prewriting skills Develop higher level play with manipulatives
T. D.	4 years	Is a picky eater, does not use utensils, has poor eye contact, has limited or no interaction with peers or adults, studies objects and places in a line, uses multisyllabic nonsense utterance, has very limited speech	Increase focus and attend to functional tasks Demonstrate increased use of tools Improve participation in group activities
J. F.	5 years, 1 month	Demonstrates bruxism, stares and rocks back and forth, shakes head, avoids eye contact with staff members, has limited or no interaction with peers, is beginning use of signs	Modulate behavior so that he can participate in classroom activities Engage in functional school fine motor skills Follow patterns, use simple stencils Zip his coat
J. M.	5 years, 2 months	Demonstrates tactile defensiveness to textures and foods, displays auditory hypersensitivity, has limited interaction with adults and peers, demonstrates self-stimulation behaviors such as tilting head and staring at spinning objects, has limited language	Modulate behavior so that he can participate in classroom activities. Trace letters and shapes independently Accurately cut with scissors
J. S.	5 years, 3 months	Demonstrates tactile sensitivity, has limited interaction with adults and peers, has limited eye contact and limited attention to task, tends to be aggressive in play, has limited language, uses deep guttural utterances	Modulate behavior so that he can participate in classroom activities Demonstrate higher level play with manipulatives

Intervention

During the 10-week intervention phase, each child received direct and consultative occupational therapy services emphasizing sensory integration. All therapy was provided by the second author, who was certified in the Sensory Integration and Praxis Tests, had 19 years of experience in occupational therapy, and had extensive training in sensory integration. The one-on-one services were provided in a room adjacent to the classroom. The sessions were approximately 30 min, based on the participant's tolerance. The activities of each session followed a sensory integration frame of reference (Ayres, 1972, 1979; Haack & Haldy, 1998; Koomar & Bundy, 1991; Williamson & Anzalone, 1997) and were specifically designed to meet the unique needs and goals for the child and the particular tolerance and interests of the child at that time. Vestibular stimulation was emphasized using suspended swings (e.g., the frog and bolster swings) and other therapy equipment that provided linear movement. Tactile (brushing) and proprioceptive input to trunk and limbs were routinely applied at the beginning and end of the therapy session. All therapy activities were playfully implemented and ranged from highly to loosely structured, depending on the unique needs of the child. The occupational therapist balanced intervention activities that provided strong somatovestibular input with those that helped the child learn to motor plan and generalize new skills.

The occupational therapist also provided consultation to the preschool teachers and recommended sensorimotor activities for the children throughout the intervention phase. She helped to establish a preschool environment that offered opportunities for specific therapeutic sensory input during the child's play. For example, a tent with a beanbag chair inside was placed in T. D.'s busy classroom to help him with sensory modulation. The teachers were encouraged to use the equipment available in the classroom to provide the children with vestibular, tactile, and proprioceptive input (e.g., slides, beanbag chairs, rocking equipment, sensory [sand and water] table). The preschool teachers routinely implemented the sensorimotor activities recommended by the therapist.

Instrument

Engagement, "the amount of time a child attends to materials, interacts with peers and adults, or otherwise remains involved with his or her environment in a developmentally and contextually appropriate manner" (McWilliam, 1984, p. 4), was measured in this study. Affective engagement is one of the most critical determinants of outcome for children with autism and is believed to relate to sensory processing (Greenspan & Wieder, 1997a). We used the Engagement Check (Parsons et al., 1989) to assess the children because it measures both spontaneous and responsive behaviors in the preschool environment and has evidence of reliability and validity (McWilliam & Bailey, 1995). The tool specifically measures the frequency of three categories of behavior: (a) mastery and nonmastery play, (b) nonengaged behaviors, and (c) interaction with peers and adults.

To obtain samples of play behaviors, each participant was videotaped once a week for 10 min during a free play period. The videotape clips were then transferred onto a master tape in random order, which allowed for scoring without knowledge of the sequence of the clips. The first author scored the tapes using the following time sampling technique: Every 30-sec interval, the tape was stopped and the child's behaviors were rated as present or absent in the categories of nonmastery and mastery play, nonengagement, adult interaction, and peer interaction. This procedure generated a score of 0 to 20 for each behavioral category for each videotape clip. The operational definition for each category (Parsons et al., 1989) is presented in Table 2. Examples of nonengaged behavior included staring, wandering, and stereotypic behaviors. Mastery play was goal-directed, purposeful play and included both functional and pretend (symbolic) play. Examples of interaction with adults or peers included gestures, working on a task together, speech, interdependent play, and reciprocal responses (taking turns).

The participant could demonstrate both interaction and play, but certain categories were mutually exclusive; for example, if the child was nonengaged, then he could not receive scores for interaction or play behaviors.

The first author scored all of the tapes twice to check accuracy. Five percent of the ratings were corrected. A second rater also scored the first 18 of the randomly ordered clips to evaluate interrater reliability. Agreement of the first and second rater was 90%. Following independent scoring, discussions between the two raters helped to clarify interpretation of behaviors according to the scale categories.

Table 2
Operational Definitions for Categories on Engagement Scale (Parsons et al., 1989)

Category	Definition
Mastery play	The child interacts with the physical environment in an exploratory or goal-directed manner. The behavior must be developmentally and contextually appropriate.
Nonengagement	The child is not interacting or is minimally interacting with the environment. Examples are unfocused staring or aimless wandering. This category includes interaction that is inappropriate for the context or the child's developmental level, for example, stereotypic behavior or spinning.
Adult interaction	The child is interacting with adults physically or verbally, using behaviors that are developmentally and contextually appropriate. The child's focus is on another person. Behavior is aimed at producing a social effect.
Peer interaction	The child interacts with peers physically or verbally, using behaviors that are developmentally and contextually appropriate. The behavior includes associative and cooperative levels of play. It also includes nonverbal active communication, verbal communication, interdependent play, and mutual organization.

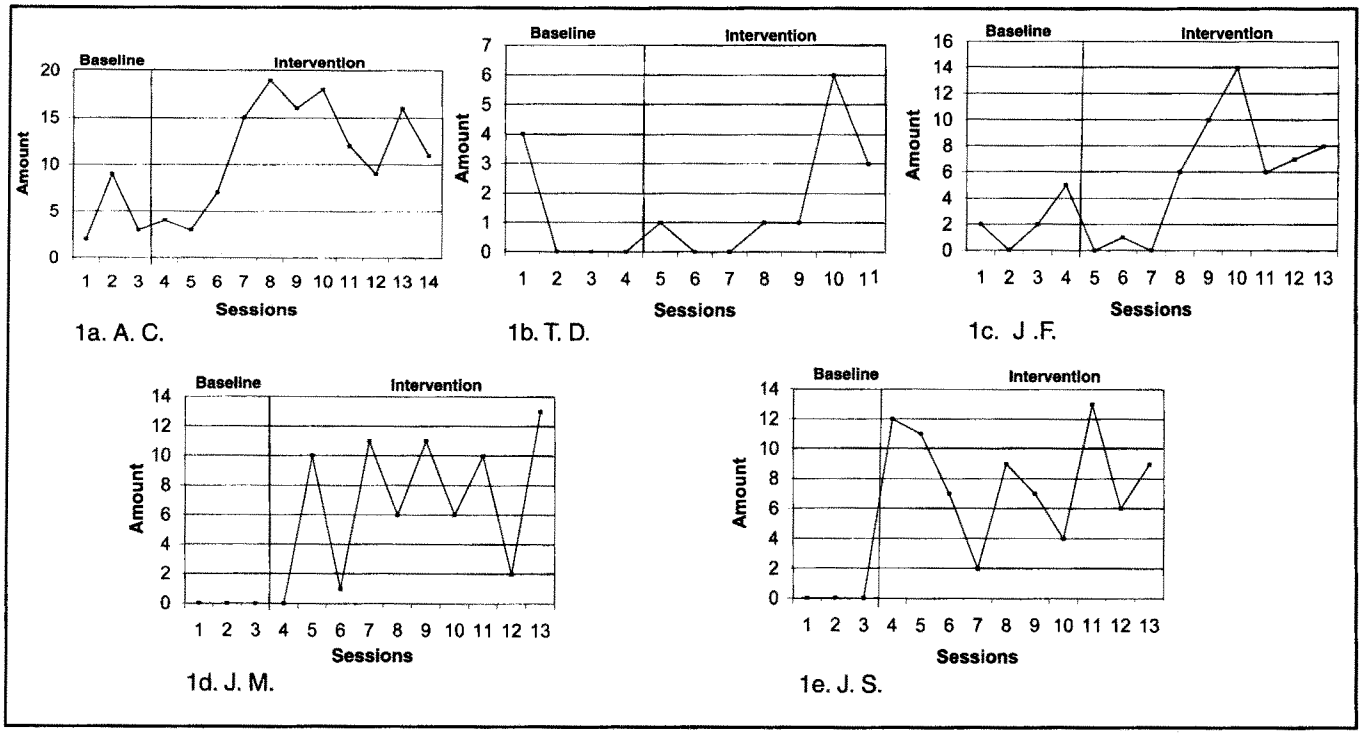

Figure 1. Mastery play.

Data Analysis

Weekly summary scores for the four behavior categories were plotted to create line graphs. Means were computed for each phase, and regressions (slope for the lines) were computed using the data points for each phase. The regression equations determined correlation coefficients for the points within the phase and the slope of the line for those points. Data from baseline and intervention phases were compared using the Wilcoxon signed rank tests to estimate differences in the means for each phase.

Results

Mastery Play

Data for nonmastery play are not reported because it is difficult to interpret whether increased nonmastery play indicates that intervention has been effective. Mastery play mean scores and slopes for baseline and intervention phases are presented in Table 3, and all data are shown in the line graphs (see Figures 1a–e). Results of the Wilcoxon signed rank tests indicated that changes were significant for A. C., J. M., and J. S. During baseline, A. C. demonstrated mastery play about 10% of the time and about 50% of the time during intervention. Initially, he exhibited periods of noninvolvement and was nonengaged. His play during intervention increased and included imaginative play with toy animals and computer play with games. J. M. and J. S. demonstrated no mastery play during their baseline measures. Most of their activity during baseline consisted of nonpurposeful play (e.g., moving objects back and forth repeatedly, stereotypic movements with objects, basic sensory exploration of a toy by moving in hands). During the intervention phase, their mastery play increased and was exhibited about 40% of the time. Their mastery play during intervention could be characterized as functional play and involved activities such as driving a car along a track, playing simple matching games, playing in the sand, or constructing simple objects.

Nonengaged Behaviors

The means and slopes for baseline and intervention phases are presented in Table 4, and line graphs of the data are presented in Figures 2a–e. All of the participants except one (J. F.) demonstrated significantly decreased nonen-

Table 3
Mastery Play: Mean Scores and Slopes for Baseline and Intervention Phases

	Baseline		Intervention		
Participant	*M*	Slope	*M*	Slope	*p* value[a]
A. C.	2.0	0.50	9.0	0.79	.025
T. D.	2.5	−1.2	8.0	0.68	.206
J. F.	2.5	1.1	9.0	1.17	.13
J. M.	0	0	8.5	0.58	.011
J. S.	0	0	7.0	0.58	.003

[a]Results of the Wilcoxon signed rank tests.

Table 4
Nonengaged Behaviors: Mean Scores and Slopes for Baseline and Intervention Phases

	Baseline		Intervention		
Participant	*M*	Slope	*M*	Slope	*p* value[a]
A. C.	4.33	2.0	1.0	−.27	.011
T. D.	7.5	−1.2	3.43	−.29	.036
J. F.	3.75	−0.7	3.0	−.73	.148
J. M.	8.0	−1.0	2.8	−.73	.024
J. S.	4.7	−3.0	1.3	−.007	.031

[a]Results of the Wilcoxon signed rank tests.

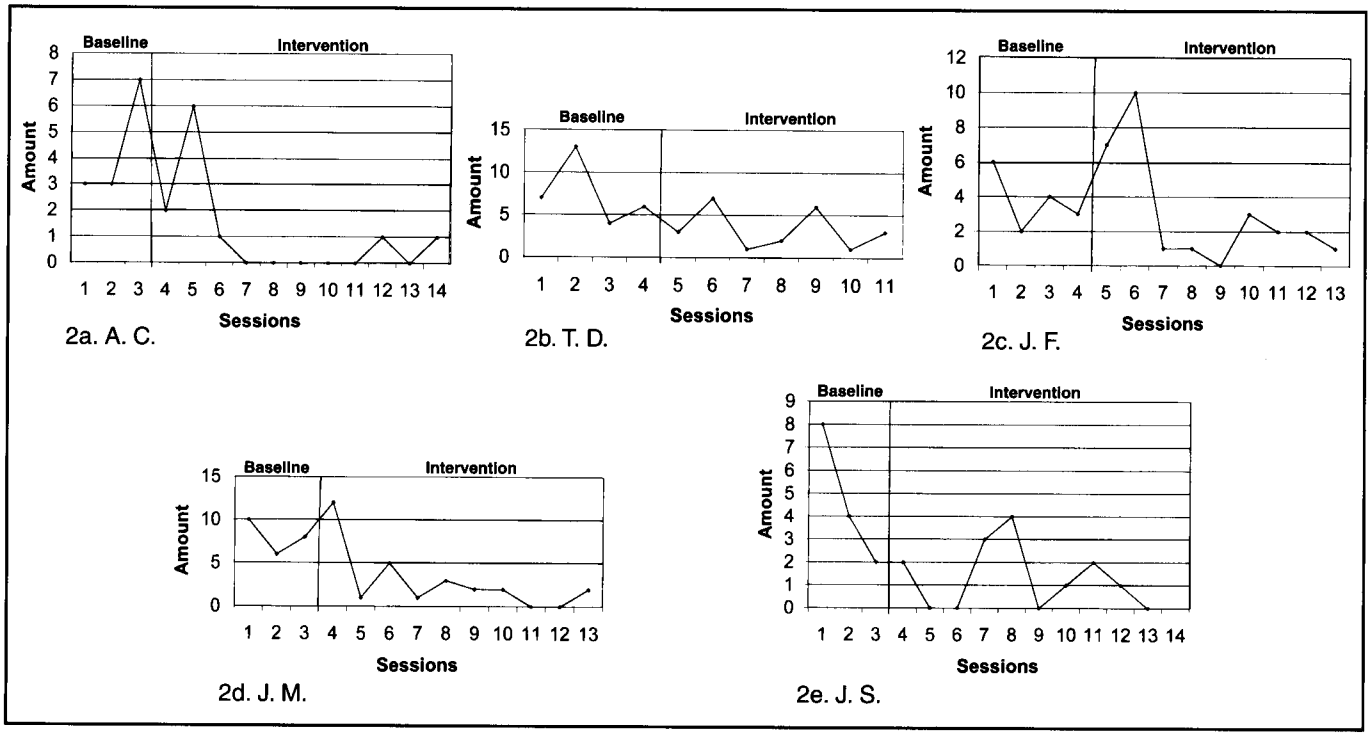

Figure 2. Nonengaged behaviors.

gaged behaviors. The mean for nonengaged behaviors across participants in the baseline phase was 5.65 or about 25% of the time. The mean for nonengaged behaviors during the intervention phase was 2.3 or about 10% of the time. For each child, specific behaviors were extinguished or decreased. A. C. and J. M. frequently wandered about the room or stared into space during baseline and were more actively engaged with toys during intervention. T. D. demonstrated many self-stimulation behaviors that involved vestibular and proprioceptive input (spinning, lying upside down in the beanbag chair) that decreased about 50% during the intervention phase. J. F. demonstrated a slight decrease in nonengaged behaviors that was not statistically significant; however, he had exhibited the fewest nonengaged behaviors initially.

Adult Interaction

Mean scores and slopes for baseline and intervention phases for adult interaction are presented in Table 5. The data are graphed in Figures 3a–e. Children received credit for interaction only if they responded to the adult by looking, gesturing, or speaking. On the basis of results of the Wilcoxon signed rank tests, only one of the five participants (A. C.) demonstrated significant improvement in adult interaction. A. C. interacted with adults about 25% of the time during the intervention phase and was consistently responsive when approached by adults. Two of the participants approached significant change (T. D., p = .082; J. S., p = .068). All intervention phase scores demonstrated high variability; this lack of consistency prevented an interpretation that changes were significant.

Peer Interaction

Table 6 and Figures 3a–e present scores for peer interaction. None of the children demonstrated significant improvement in peer interaction from baseline to intervention phases. A. C. and J. S. demonstrated slight improvement in peer interaction and at times entered into play activities with other children. They sustained their interactions for brief periods. Two participants demonstrated no interaction with peers across baseline and intervention phases. One (J. M.) demonstrated brief interactions with peers during intervention that did not represent a significant change from baseline. The mean for peer interaction

Table 5
Adult Interaction: Mean Scores and Slopes for Baseline and Intervention Phases

	Baseline		Intervention		
Participant	*M*	Slope	*M*	Slope	*p* value[a]
A. C.	.33	–0.50	5.82	0.89	.015
T. D.	0	0	3.71	1.71	.082
J. F.	0	0	1.33	0.23	.13
J. M.	1.33	1.0	2.5	–0.24	.068
J. S.	.33	0.50	8.5	–0.44	.146

[a]Results of the Wilcoxon signed rank tests.

Table 6
Peer Interaction: Mean Scores and Slopes for Baseline and Intervention Phases

	Baseline		Intervention		
Participant	*M*	Slope	*M*	Slope	*p* value[a]
A. C.	0	0	1.64	2.82	.146
T. D.	0	0	0	0	.50
J. F.	0	0	0	0	.50
J. M.	0	0	0.5	0.18	.256
J. S.	0	0	4.0	1.06	.469

[a]Results of the Wilcoxon signed rank tests.

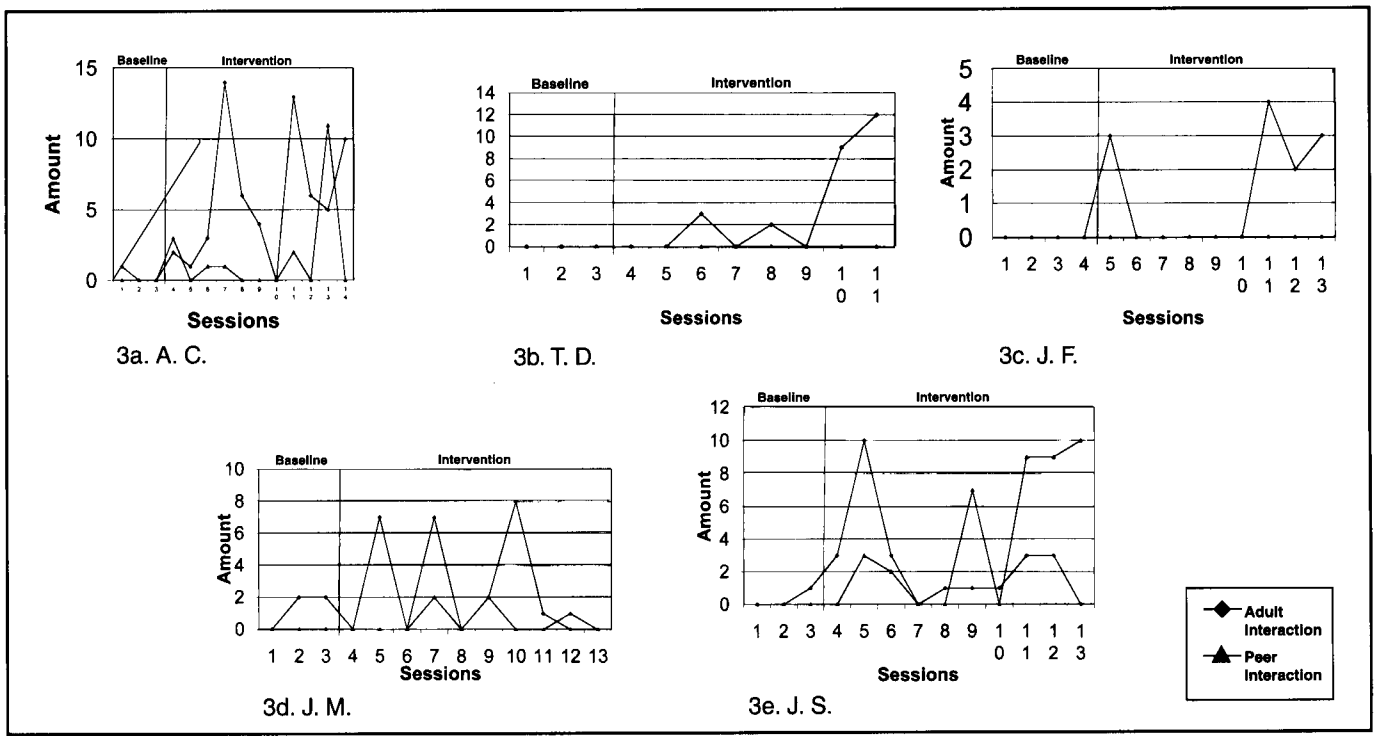

Figure 3. Interaction

for all of the participants was 0 during the baseline phase and 1.23 during the intervention phase.

Discussion

Mastery Play

Three of the five participants made significant improvements in mastery play, defined as goal-directed play that was developmentally and contextually appropriate. Initially, the children repeated the same single actions with toys; the three who made significant gains progressed to using a sequence of different actions. Consistent with Greenspan and Wieder (1997b), the participants who were less impaired demonstrated greater variety of purposeful play behaviors and fewer rigid and stereotyped play behaviors during a period of sensory integration intervention.

The increases in mastery play may relate to (a) improved motor planning or (b) reduced sensory defensiveness. Motor planning is essential for purposeful and functional play with toys (Ayres, 1972; Wieder, 1996). The sensory integration therapy provided to the children emphasized this aspect of play. During intervention, the children whose mastery play scores increased seemed better able to organize and plan goal-directed motor activity. The two children who did not make gains in mastery play continued to demonstrate motor planning problems, poor attention, and limited eye contact. Although these behaviors improved some during intervention, their behaviors remained variable and inconsistent.

Increases in play behaviors could also relate to reduced sensory defensiveness. When a child's tolerance of tactile input improves, he or she becomes more comfortable with and interested in manipulation of a variety of textures (Royeen & Lane, 1991; Williamson & Anzalone, 1997). The three children who improved in mastery play initially demonstrated tactile defensiveness. Given the emphasis of the occupational therapist's intervention, reduction in tactile defensiveness could be expected (however, this was not directly measured).

Nonengaged Behaviors

All but one of the participants demonstrated fewer nonengaged (i.e., aimless, stereotypic, unfocused) behaviors during the intervention phase. Baranek et al. (1997) found that tactile defensiveness was related to stereotypic and rigid behaviors. In particular, the children with tactile defensiveness were more likely to demonstrate repetitive behaviors and visual stereotypies that are often associated with autism. It is sometimes speculated that the stereotypic, repetitive behaviors of the child with autism are an effort to attain homeostasis or to modulate his or her sensory systems (Frick & Lawton-Shirley, 1994; Huebner, 1992). Wieder (1996) suggested that children demonstrate stereotypic self-stimulation or sensory-seeking behavior to increase arousal and meet their own needs for homeostasis. During the intervention phase of the current study, the children played more with toys and demonstrated fewer nonengaged behaviors. This improvement in connectedness may reflect better integrated sensory systems; that is, improved sensory modulation or improved motor planning (Williamson & Anzalone, 1997). Because the child's sensory integration was not directly measured, this association remains tentative and indirect at best.

Interactions With Adults and Peers

One of the participants (A. C.) demonstrated significant improvement in interacting with adults; two (T. D. and J. S.) approached significance. The others continued to be nonresponsive to interaction attempts at times and needed to be enticed or wooed into interaction (Greenspan & Wieder, 1997b). Sometimes the teachers held the children in their arms to direct them or keep their attention. Grandin (1992) recommended this technique as a method to help calm and organize the child. Improved interaction can relate to sensory processing because the child is better able to respond to the adult, to organize a response, and to interpret the complex sensory information associated with social interaction (Huebner, 1992). Social abilities require assimilation of nonverbal and verbal information and an understanding of emotional expression. Interaction may be difficult for the child with autism because the multisensory nature of social stimulus is overarousing to the central nervous system (Dawson & Lewy, 1989). By the end of the 10 weeks of intervention, the participants' interactions with adults remained variable; only one consistently responded to and sustained interactions. Greenspan and Wieder (1997b) found that most (71%) of the children with autism who had attended their intervention program had intermittent abilities to sustain interaction. Almost one in four demonstrated consistent ability to sustain interaction using symbolism. Their intervention combined sensory integration therapy with child-centered play.

Of the five children in our study, two demonstrated interaction with adults more than 25% of the time during the intervention phase. However, the scores for interaction with adults should be interpreted with caution. The videotapes were made during free time, and having received no instruction, the adults were free to interact with the children. Almost all of the interactions on the tapes were initiated by the adults; therefore, the scores reflect that the children were able to appropriately respond to adults rather than initiate interaction with adults. At times, the scores were artificially lowered because the adults in the room were occupied with other children or activities. A larger sample of time would be needed to confirm these results.

None of the children improved in peer interaction. Other authors have found that peer interaction is minimal with children diagnosed with autism. Unlike adults, when a child attempts to interact with a peer who has autism and receives no response or reaction, he or she does not continue to pursue the interaction (Odom, McConnell, & McEvoy, 1992). Children quickly learn that a child with autism does not respond and they discontinue efforts to interact (Guralnick, 1992). The only child (J. S.) who entered and sustained some interaction with his peers during the intervention phase had more communication and play skills initially than the other participants had. Although not evident in the scores, in both phases he demonstrated interest in the play of other children and at times imitated their actions. Peers are perceptive of a child who attends to them and particularly of one who imitates their actions (Whaley & Rubenstein, 1994). These simple efforts to interact almost always reap the responses of peers (Guralnick, 1992).

Limitations

Generalizations from single-subject design are limited. In addition, the timeline for both baseline and intervention was brief (13 weeks total) because it followed the preschool year schedule. A follow-up evaluation would provide evidence regarding how well the changes in performance were sustained.

Data are incomplete for one child who entered Lovaas treatment. Staggered entrance into the study and different lengths of time for baseline and intervention phases would have increased the validity of our findings.

Summary

While participating in occupational therapy intervention with emphasis on sensory integration, the five children with autism in this study made gains in mastery (goal-directed) play and engagement. Improvements in frequency of interaction were minimal. The measure we used, which categorized the children's engagement while they played in the "natural" preschool environment, was able to capture these positive changes in purposeful play and nonengaged behaviors. Although our study method has limited external validity, the results support the beliefs of others regarding the potential behavioral changes that can occur in children with autism during intervention using a sensory integration approach. ▲

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