
Developmental Dyspraxia and the Play Skills of Children With Autism

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MeSH TERMS

- apraxias
- autistic disorder
- play and playthings
- psychomotor performance
- sensation

OBJECTIVE. This study sought to investigate the impact of developmental dyspraxia on the play skills of children with autism spectrum disorder (ASD).

METHOD. The praxis abilities of 32 children with ASD (mean age = 7.5 yr) were assessed using two subtests of the Sensory Integration and Praxis Tests and the Planning and Ideas domain of the Sensory Processing Measure Home Form. Play and leisure skills were measured with the Vineland Adaptive Behavior Scales, Second Edition. Utilizing correlation coefficients, we investigated the relationship between developmental dyspraxia and the play skills of children with ASD.

RESULTS. Children with ASD demonstrated definite dysfunction in imitative praxis abilities, the generation of ideas, and participation in age-appropriate play and leisure activities.

CONCLUSION. Praxis problems in children with ASD greatly affect their successful participation in play and leisure activities.

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Autism spectrum disorder (ASD) is clinically characterized by persistent deficits in social communication and social interactions and restricted, repetitive patterns of behavior, interests, or activities (*Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. [DSM-5]; American Psychiatric Association [APA], 2013). Although it is well accepted that these primary symptoms greatly affect the child's ability to successfully engage in meaningful occupations, growing evidence suggests that associated deficits in praxis and play skills may also limit the child's participation and could undergird the persistent deficits seen in social interactions.

Praxis is the ability to conceptualize, plan, and successfully complete motor actions in novel situations (Ayres, 2005; Ayres & Cermak, 2011; May-Benson & Cermak, 2007). Praxis is a naturally emerging skill that develops as the child successfully interacts with people and objects in the environment and supports the child's ability to learn new skills by watching, imitating, and exploring (Ayres, 2005). *Developmental dyspraxia*, that is, failure to have acquired the ability to perform appropriate complex motor actions (Sanger, 2003; Sanger et al., 2006), has been investigated in the literature across several pediatric populations. Developmental dyspraxia is categorized around problems related to transitive gestures (pantomimed tool use), intransitive actions (symbolic gestures such as waving goodbye), imitative actions (such as imitating meaningless hand or body postures), motor planning, and difficulty conceptualizing novel ways to interact with objects.

Recent research has illustrated that children with ASD have difficulties with all categorizations of developmental dyspraxia (Dewey, Cantell, & Crawford, 2007; Dowd, McGinley, Taffe, & Rinehart, 2012; Downey & Rapport, 2012; Fabbri-Destro, Cattaneo, Boria, & Rizzolatti, 2009; MacNeil & Mostofsky, 2012;

May-Benson & Cermak, 2007; Miller Kuhaneck & Britner, 2013; Mostofsky et al., 2006; Smith & Bryson, 2007; Stackhouse, 2010; Stieglitz Ham et al., 2011). Some research has suggested that impairments in dyspraxia may contribute to the primary features of the disorder, including impaired social interaction and communication skills (Bodison & Mostofsky, 2014; Dowell, Mahone, & Mostofsky, 2009; Dziuk et al., 2007).

Play can generally be conceptualized as an enjoyable, self-selected activity in which people participate. From an occupational science perspective, play is viewed as an occupation in which children engage (Clark et al., 1991; Primeau, Clark, & Pierce, 1989; Yerxa, 1990) or as a means and goal of therapeutic intervention (Parham, 2008). Occupational therapy practitioners have long evaluated and treated the play skills of children using a variety of clinical observation tools, including the Revised Knox Preschool Play Scale (Knox, 1997, 2008), the Test of Playfulness (Bundy, Nelson, Metzger, & Bingamann, 2001), the Test of Environmental Supportiveness (Bronson & Bundy, 2001), and the Pediatric Interest Profiles (Henry, 1998, 2008). Across these clinical tools, play constructs of interest in occupational therapy center around the use and management of space and materials (Bundy et al., 2001; Knox, 1997, 2008); characteristics of play, including sensorimotor, object play, parallel play, pretense-symbolic play, and cooperative play (Bundy et al., 2001; Knox, 1997, 2008); the level of supports offered by people and the environment (Bronson & Bundy, 2001); and the interest, motivation, and level of participation in chosen activities (Bundy et al., 2001; Bronson & Bundy, 2001; Henry, 1998, 2008; Knox, 1997, 2008).

Many studies have documented that children with ASD are less playful than typically developing children, demonstrating poor symbolic play and fewer pretend play activities (Hobson, Lee, & Hobson, 2009; Holmes & Willoughby, 2005; Jarrold, 2003; Jarrold, Boucher, & Smith, 1993; Lord et al., 2000; Wong & Kasari, 2012). We hypothesize that symbolic and social play rely on the praxis abilities of the child to conceptualize and plan how to interact in novel situations and to successfully imitate the actions of others. Therefore, we sought to investigate the impact of praxis on the play and leisure skills of children with ASD.

Method

Research Design

The data presented here are part of a larger prospective case-controlled research study. The institutional review

board of the University of Southern California approved this study, and all participants (children and caregivers) signed informed consent to participate. During this study, the sensory, motor, and praxis skills of 32 children with ASD (mean age = 7.5 yr) were assessed by an occupational therapist using multiple standardized measures, including two subtests of the Sensory Integration and Praxis Tests (SIPT; Ayres, 1989). In addition, parents completed the Sensory Processing Measure Home Form (SPM-H; Parham & Ecker, 2007) and the Vineland Adaptive Behavior Scales, Second Edition (Vineland-II; Sparrow, Cicchetti, & Balla, 2006).

Participants

Recruitment flyers were posted at three local clinics in Southern California. Informed consent was obtained from interested families, and two 1-hr visits were scheduled to complete the standardized testing and parent-completed questionnaires. Children met inclusion criteria if they were between the ages of 5 yr, 0 mo, and 8 yr, 11 mo, and had a diagnosis of autism as identified by a physician, psychologist, neurologist, or psychiatrist. Included categorizations of autism encompassed the diagnosis of ASD as described in the *DSM-5* (APA, 2013) and autism or pervasive developmental disorder—not otherwise specified as outlined in the fourth edition of the *DSM* (APA, 1994). Children with any comorbid diagnoses, including attention deficit disorder, oppositional defiant disorder, or anxiety, were excluded from this study. Table 1 summarizes participant demographics.

Measures

The SIPT consists of a battery of 17 subtests designed to assess the sensory integration and praxis skills of children 4 yr, 0 mo, to 8 yr, 11 mo, of age (Ayres, 1989). The SIPT was standardized on 1,997 children, and each subtest has very high interrater reliability ($r \geq .94$; Ayres 1989) and the ability to accurately discriminate between typical children and those with sensory processing difficulties

Table 1. Participant Demographics (N = 32)

Characteristic	M (SD) or n (%)
Gender	
Male	25 (78.1)
Female	7 (21.9)
Race/ethnicity	
African-American	2 (6.2)
Asian/Pacific Islander	10 (31.3)
White	18 (56.3)
Hispanic	2 (6.2)
Age, yr	7.5(1.4)

Note. M = mean; SD = standard deviation.

($p < .01$; Ayres 1989). The subtests of the SIPT cluster together to illuminate discrete patterns of sensory integrative dysfunction (Ayres, 1971, 1972, 1977, 1989; Mailloux et al., 2011; Mulligan, 1998; Roley et al., 2015), and for the purposes of this study, the tests of imitative praxis were used: Postural Praxis (PPr) and Oral Praxis (OPr). On each of the SIPT subtests, the child's raw performance scores are converted to z scores, and z scores lower than -1 are suggestive of areas of concern. The tests of imitative praxis were selected for this study because we hypothesized that children with ASD have difficulties imitating others, and we were interested in investigating whether these imitation problems correlated in some way with deficits in play skills.

The SPM-H is part of an integrated system of parent-completed rating scales that enables assessment of sensory processing differences, praxis problems, and issues of social participation in children ages 5 through 12 yr (Parham & Ecker, 2007). The SPM-H was standardized on 1,051 typically developing children and has internal consistency (α) estimates ranging from .77 to .95 and test-retest reliability estimates ranging from .94 to .98 (Parham & Ecker, 2007). The SPM-H consists of 75 items, each rated in terms of frequency on a 4-point Likert scale. The Likert scale raw scores are converted to t scores, and t scores greater than 60 are indicative of problems.

Although caregivers in this study completed the entire SPM-H, the primary domain reported here is Planning and Ideas. We specifically chose this domain for analyses in this study because it offers additional insight into the child's praxis abilities specifically related to the conceptualization, planning, and organization of movements to successfully complete everyday activities and unfamiliar motor tasks (Parham & Ecker, 2007). We also hypothesize that the conceptualization and planning of unfamiliar tasks are key challenges for children with ASD and the core issues in the development of symbolic and social play in this population.

The Parent/Primary Caregiver Rating Form of the Vineland-II is a rating system designed to measure four broad domains of adaptive behavior—Communication, Daily Living Skills, Socialization, and Motor Skills—in people ages birth through 90 (Sparrow et al., 2006). The Vineland-II was standardized on more than 3,000 people and has good test-retest reliability ($r \geq .73$; Sparrow et al., 2006).

Each of the 433 items on the Parent/Primary Caregiver Rating Form are scored by the caregiver on a 3-point Likert scale, with raw scores subsequently converted to v -scale scores for interpretation. v -scale scores that fall

between 1 and 9 are indicative of low adaptive behavior skills. We chose to focus on the Play and Leisure Time subdomain of the Vineland-II because its individual test items appear to most precisely assess symbolic play skills and the social relatedness of play. We hypothesized that this complexity of play and the use of leisure time are most problematic for children with ASD and are likely affected by developmental dyspraxia.

Data Analysis

We used two types of statistical procedures: descriptive statistics and an analysis of relationships using Pearson correlation coefficients. Descriptive statistics were computed for the demographic characteristics of the sample and the mean standard scores for PPr and OPr, the SPM-H, and the Vineland-II. Using the interpretive ranges for each of the measures, we used discriminative statistics to determine whether the children in the sample had deficits in any of the areas under study. To assess the relationships among imitative praxis, ideas and planning, and the play and leisure skills of children with ASD, we analyzed a matrix of Pearson correlation coefficients.

Results

Table 2 shows the mean scores and standard deviations and interpretive ranges for the measures of praxis and play skills used in this study. Interpretive score ranges are as follows: z scores less than -1.0 indicate dysfunction, t scores from 60 to 69 indicate probable dysfunction, and v -scale scores from 1 to 9 indicate a low adaptive skill level. On the tests of imitative praxis, the mean z scores for PPr ($z = -1.69$) and OPr ($z = -1.559$) were both below -1.0 , demonstrating that the children in this sample have substantial difficulties with imitative praxis abilities. The mean t score of 66.78 on the Planning and Ideas domain of the SPM-H indicates that the children in this sample have a probable dysfunction in generating ideas and plans for action in novel situations and with novel materials. The mean v -scale score on the Play and Leisure Time subdomain of the Vineland-II of 8.03 indicates that the children in this sample have low adaptive skills related to play.

The relationship between praxis abilities and the play and leisure skills of the children with ASD in our study are presented in Table 3. As hypothesized, the scores on the imitative praxis tests of PPr ($r = .536, p < .01$) and OPr ($r = .510, p < .01$) and performance on the Planning and Ideas items of the SPM-H ($r = -.400, p < .05$) were all significantly correlated with poor performance on the items of the Vineland-II Play and Leisure Time subdomain.

Table 2. Assessment Scores (N = 32)

Assessment	M (SD)
SIPT, z score	
Postural Praxis subtest	-1.691 (0.7643)
Oral Praxis subtest	-1.559 (0.7025)
SPM-H Planning and Ideas domain, t score	66.78 (9.28)
Vineland-II Play and Leisure Time subdomain, v-scale score	8.03 (3.814)

Note. Z scores < 21.0 indicate dysfunction; t scores of 60–69 indicate probable dysfunction; v-scale scores of 1–9 indicate low adaptive level. M = mean; SD = standard deviation; SIPT = Sensory Integration and Praxis Tests; SPM-H = Sensory Processing Measure Home Form; Vineland-II = Vineland Adaptive Behavior Scales, Second Edition.

Discussion

Our results indicate that poor scores on the tests of imitative praxis and the domain of ideas and planning significantly correlate with the ability of the children in the study sample to participate in age-related play and leisure activities. Specifically, the items on the Planning and Ideas domain of the SPM-H that were most consistently ranked as problematic included

- Difficulty imitating demonstrated actions (Item 72)
- Difficulty building to copy a model, such as using Legos (Item 73)
- Trouble coming up with ideas for new games or activities (Item 74)
- Playing the same activities “over and over” (Item 75).

On the Vineland-II, the play and leisure activities that were most problematic for the children in this study included

- Plays cooperatively with more than one child for more than 5 min
- Plays with others with minimal supervision
- Uses common household objects or other objects for make-believe activities
- Plays simple make-believe activities with others.

On the basis of these findings, I propose that problems with imitation and the conceptualization of novel ways to interact with objects and materials can greatly affect the

Table 3. Pearson Correlations of Assessment Scores

Assessment	SIPT PPr	SIPT OPr	SPM-H Ideas	Vineland-II Play
SIPT PPr	—			
SIPT OPr	0.488**	—		
SPM-H Ideas	-0.686**	-0.685**	—	
Vineland-II Play	0.536**	0.510**	-0.400*	—

Note. OPr = Oral Praxis subtest; Play = Play and Leisure Time subdomain; PPr = Postural Praxis subtest; SIPT = Sensory Integration and Praxis Tests; SPM-H Ideas = Sensory Processing Measure Home Form, Planning and Ideas domain; Vineland-II = Vineland Adaptive Behavior Scales, Second Edition.

* $p < .05$. ** $p < .01$.

development of play skills in children with ASD. These praxis difficulties not only influence the child’s ability to share in imaginative play or make friends but can substantially alter the child’s ability to develop and understand relationships, the description of which comprises the core features of the disorder (APA, 2013).

Limitations and Future Research

These results are primarily limited in two ways. First, all children and families who participated in this study were recruited from a large, metropolitan area, making it difficult to generalize these findings to children in other geographic locations. Second, because of the limited standardized tools available to assess play skills, we relied on a parent-completed measure of play and leisure time use. Although parent-completed measures are commonly used and provide important insight, they are not the most ideal way to assess the quality of the child’s play or the specific client factors that might affect the child’s play skills.

Given occupational therapy’s long history of working with children who have developmental dyspraxia and atypical play skills, it is imperative that occupational therapy’s unique perspective be included in future studies. These studies should explicate the underlying factors affecting play and the relationship of these factors with the core features of ASD.

Implications for Occupational Therapy Practice

The results of this study have the following implications for occupational therapy practice:

- Children with ASD have praxis difficulties that affect their ability to fully participate in play and leisure activities.
- Although parent-completed questionnaires are commonly used to assess the play skills of children with ASD, they may not be sensitive enough to provide adequate insight into the quality of or underlying client factors contributing to the deficits in play skills.
- A comprehensive occupational therapy evaluation, including assessment of sensory integration and praxis skills, provides the most precise information to aid in the development of intervention programs to improve participation in play and leisure activities for children with ASD. ▲

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