Playground Dynamics: Perceptual-Motor Behaviour and Peer Interactions of Young Children With Down Syndrome

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Abstract

The playground is a key environment where young children learn to navigate in both the physical and social world. However, little is known about how children with Down syndrome (DS) interact in the playground, engage with their peers, and whether the playground environment facilitates meaningful motor and social interactions. This paper addresses some of the factors that may impact the play behaviour of young children with DS. A brief review of the development of play in children with DS is presented. The underlying perceptual-motor and social competencies that may impact play behaviour are explored. Data on a pilot study that examines playground dynamics in a group of six young children with DS are presented and the implications for intervention are discussed.

The development of play in infants and toddlers with Down syndrome (DS) is thought to have a similar organizational structure to that of their non DS peers (Beeghly et al., 1989; Loveland, 1987), although at a slower rate (Beeghly, Weiss-Perry & Cicchetti, 1990). However, within this overall structure there are several distinctive characteristics and qualitative differences in the patterns of play behaviour in children with DS in comparison to their non DS peers. These include differences in attention and information processing which are present as early as in the first year. Infants with DS engage in significantly fewer social referencing looks (i.e., pointing, eye-gazing, and joint attention) that guide attention and action (Kasari, Freeman, Mundy, & Sigman, 1995; Landry & Chapieski, 1990). Infants with DS manipulate toys less often and show more passive behaviour in response to their mothers' efforts to direct attention (Landry & Chapieski, 1989). During free play, children with DS spend more time in passive behaviour, shift back and forth from play to passivity more often than typical children (Linn et al., 2000), display shorter sequences of goal-directed tasks and higher rates of toy rejection (Ruskin et al., 1994).

As children with DS interact with objects, people and the environment, a certain level of passivity and a general slowness seems to be a consistent feature of their interactional pattern or style (Wade, 1973; Henderson, 1985; Mundy et al. 1988). Cicchetti and Serifaca (1975) reported that smiling and other interactive behaviours (e.g., as showing things to mother) in children with DS were similar to those in other children. However, other authors (Jens & Johnson, 1982; Gunn et al. 1981; Legertee & Bowman, 1989; Loveland, 1987; Kasari et al., 1990) have noted a general "neutrality" of expressions in young children with DS.

In a comparative observational study on the spontaneous play in infants, Mundy et al. (1988) reported that the children with DS made fewer requests for either objects or assistance, and seemed to be less motivated to explore or to request information. In videotaped sequences of mother-child play with infants and toddlers from 20 to 76 months, Beeghly et al. (1991) also observed this characteristic.

Physical Activity

The play of toddlers and preschoolers often involves vigorous physical activity. At preschool in particular, "one cannot underestimate the physical fitness level and combination of motor skills required" (Dalley, 1985, p.14) to participate in the active games. When a child's motor skills are delayed or different from other children, their involvement in play and active games may be devalued or rejected by their peers (Bergen, 1988). Hulme and Lunzer (1966) and Krakow and Kopp (1983) have noted the effect of slower locomotion on social and explorative behaviours. Children may have difficulty keeping up with the others, fall more readily and be unsure when running, climbing or jumping. Games and equipment which require balance and co-ordination skills and rough and tumble play are often avoided (Watkinson & Muloin, 1988). In the playground (Titus & Watkinson, 1987; Watkinson & Muloin, 1988) and the classroom "milieu" (Malone & Stoneman, 1990), the moment in the play may pass too quickly for them to make a contribution, others may quickly do it for them, or their play may be redirected towards more passive activities. All this can have a cumulatively negative effect on the children's efforts to play and may lead to the child simply giving up and becoming an onlooker.

Perceptual-Motor Competence in Children with DS

Another aspect of development that can have a significant impact on the development of active play is perceptual-motor competence. Compelling

evidence shows that children with DS exhibit both motor and perceptual difficulties that jointly impact motor development. For example, when children with DS perform motor tasks requiring anticipatory actions, such as catching, their impairments appear to be attributable to difficulties in regulating the temporal aspects of their actions (Henderson et al., 1981; Savelsbergh et al., 2002). Charlton et al. (2002) reported that children with DS have difficulty in properly adjusting both the spatial and temporal aspects of their grasp as a function of object size or task goal. They suggest that difficulties in the use of the perceived object properties in action planning may point to a dysfunction in relating information about limb position with respect to the environment to task demands.

Virji-Babul and Brown (2004) examined the movement strategies used by young children with DS as they crossed obstacles of two different heights – a "subtle" obstacle that was placed at a very minimum height off the floor and an "obvious" obstacle that was placed at a much higher height off the floor. Children with DS were able to successfully extract information about obstacle height and appropriately match this information to their movements. However, visual information about the obstacle was not used consistently to modulate movements early in the gait cycle. Greater step length variability was observed in response to the subtle obstacle suggesting that some form of anticipatory adjustments were being made. In contrast, there was very little variability observed in response to the higher obstacle. This finding, in combination with the observation that children with DS stopped in front of the higher obstacle for long periods of time, indicated that children with DS may be unable to use early visual cues about negotiating an obstacle and so wait until they reach an obstacle to extract the visual information needed to appropriately modulate their actions. This conclusion corroborates the findings of Charlton et al. (2002) and others and provides further evidence of difficulties in perceptual-motor coupling in DS.

Social Competence and the Impact on Peer Interactions During Play

One of the most important tasks of childhood is the ability to initiate and maintain peer interactions. During early and middle childhood, typical peer interactions include playing in groups, initiating play with a peer, maintaining play with a peer, requesting items, engaging in imaginative play with a peer, and forming friendships (Sigman & Ruskin, 1999; Guralnick, 1996). How well do children with DS engage in these types of play behaviours and peer interactions?

Children with DS are often portrayed as being very sociable but there is contradictory evidence of socially competent behaviour among children with DS (see Iarocci et al., 2006, for review). A number of studies have suggested that the lack of problematic behaviours and decreased activity in play groups and classroom settings may in fact be interpreted as an indication of sociability (Guralnick, 1989; Sinson & Wetherick, 1981; Terry-Gage, 1999). In group play, children with DS show no preference for social over non-social play (Sigman & Ruskin, 1999) and are less receptive of social initiations in comparison with typical peers (Sigman & Ruskin, 1999). Children with DS are also more apt to reject another child's initiation into play by pushing the child or walking away (Schlottman & Anderson, 1975) and have difficulty understanding and interpreting social situations, even if a peer continues to make repeated social initiations for play often leading to social isolation (Sinson & Wetherick, 1981).

Requesting toys and negotiating with other children about desired toys or objects are also skills that are challenging for children with developmental disabilities (Guralnick, 1995). Parents often describe their children with DS as less persistent than their typically developing peers, and this may deter the ability to negotiate with peers and request objects or toys from playmates (Spiker, Boyce, & Boyce, 2002).

Playgrounds: Negotiating the Physical and Social Environment

One of the primary environments for most young children is the playground (Watkinson & Dunn, 2001). Playgrounds can provide a rich environment for learning the fundamentals of both social interaction (Guralnick, 1990; Hartup, 1983) and motor skills. Yet, the demands of the playground and the information processing requirements in this setting are numerous: the complexity of outdoor play spaces, the fast-paced unstructured nature of play, the range of choices presented by the equipment and the associated motor skill requirements needed to play on the equipment. These environmental aspects of outdoor playgrounds may present a compounding set of problems for a child with poor perceptual motor skills. In addition, the complexities involved in negotiating relationships and establishing friendships, can make the playground a socially isolating (Smith, 2002) and physically challenging environment for children with DS.

To our knowledge, it seems that there has been no published work or studies that have examined both the motor and social behaviours in a playground setting in children with DS. One purpose of this preliminary study was to document how children with DS interact with their DS peers in a playground,

and analyze the level of motor engagement with playground equipment and within the playground environment. Our intention is to use this preliminary information to conduct a larger study and to develop a framework for designing appropriate interventions for children with DS.

Methods

Participants

Six children with DS (3 female, 3 male) between the ages of 6-7 years (mean age = 6.4 years) participated in this study as part of a larger creative dance intervention program (Jobling, Virji-Babul et al., 2006). Age equivalent scores based on the PPVT ranged from 2.7 years to 6.3 years (mean = 3.9 years). All the children were present with one parent.

Setting

As a group, the children and their parents spent 30-45 minutes on a preschool playground based at a children's rehabilitation centre, at the end of the creative dance program. The playground had a set of three preschool swings (with bucket seats and harness), a climbing castle with stairs, five spring animal toys with seats that had a spring attached to the base to provide a back and forth motion, a slide with stairs on one end and a platform attached to the top of the stairs and a roundabout.

Coding of Play Interactions

The playground activity was videotaped every week for six weeks. For the purposes of this study, three sessions were coded and analyzed. A trained observer coded the previously recorded videotaped play interactions for time spent on motor-based activities and time spend on peer interactions. Motor activity was coded for total time spent on each piece of equipment available in the playground (i.e., swings, monkey bars, etc.). The peer interaction behaviours were adapted from the scale used by Sigman and Ruskin (1999). Three levels of peer interaction was used: (1) non-social play (i.e., behaviours without a social component – the child plays alone either with no peer nearby or in close proximity of peer); (2) low level social play (i.e., child and peer are engaged in a similar activity but there is no social behaviour or child and peer are aware of each other during the same activity); (3) high level social play (i.e., child and peer are engaged in social play and interaction).

Results

What do Children With Down Syndrome do in the Playground?

As shown in Figure 1, this group of children spent approximately 90% of their time engaged in motor based activities with various pieces of playground equipment. These activities occurred with the child either playing alone (with parent close by but with no social interaction) or with a peer nearby. In contrast, only 15% of the total time was spent engaged in peer interactions. It is interesting to note that none of the children were observed in engaging in high level social play. All the peer interactions were coded as low level social play.

Figure 1. Percentage of total time spend on motor related, peer related and solitary play activities
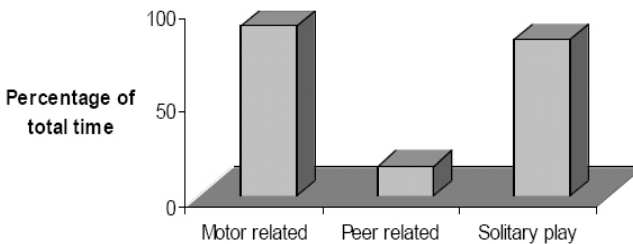
How Often do Children With DS Initiate a Social Exchange and with Whom?

Play initiations are the first step towards social involvement. Therefore the total numbers of social initiations to a peer and to a parent were compared over the time frames of the playground play time (see Figure 2). Overall, the children in this group initiated a social exchange approximately two and a half times more often to a parent than to a peer. It should be noted that some children in the group did not make any initiations to a peer. Only three out of the six children initiated social exchanges with their peers, twice during the play time.

Figure 2. Comparison of the number of social initiations with peer and parent
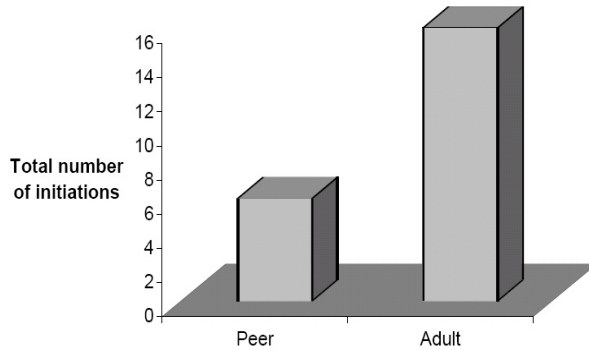
Engagement With Playground Equipment

Having determined that the children spend the majority of their time on motor based activities, the time spent on common playground equipment was analyzed. Figure 3 shows the breakdown of time spent in four of the most common pieces of equipment: preschool swings, slide, spring animals and other equipment (included play castle and roundabout). The children in this group spent over forty percent of their time on the swings – most children were pushed on the swings by their parent and none of the children were observed pumping their legs or attempting to swing independently. They were observed to swing passively.

Figure 3. Percentage of time spent on playground equipment
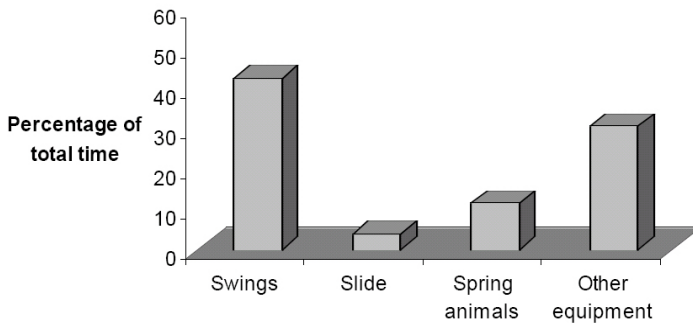
Task Analysis

What children do in the playground is greatly influenced by the context – the goals, strategies and choices that children make depend on the environment, the space available, the equipment and various other factors (Watkinson et al., 2001). An ecological task analysis approach considers the context in which a child may act and considers the task, the environment and the performer (Burton & Davis, 1996; Davis & van Emmerick, 1995). Using this approach, each child's motor activity was considered according to the specifics of the playground in which they were moving. Within this particular playground the environment was classified according to the following categories: non-grass surface, uneven grass surface and grass surface with an incline. Tasks were categorized into the following self-initiated motor tasks: walking, running, walking and balancing on one foot (e.g., when climbing over an obstacle or toy).

Table 1 (A) indicates the types of motor activities that the children were able to participate under different environmental conditions. As expected, the even surface was more conducive to a larger range of motor skills from walking, running and climbing. With the more challenging surface conditions, the children had more difficulty. Walking and running on an uneven surface and going up or down an incline was difficult for four out of the six children. Many of the children were observed to walk or run slowly with a wide based gait under these conditions with a slower movement speed. Balancing on one foot while climbing over an obstacle or getting into a stationary piece of playground equipment was difficult for three children and all the children required external support (either from a parent or by holding on to the equipment) to balance on one foot while on an uneven surface.

Table 1 A. Motor tasks commonly observed under different physical environmental conditions

Physical Environment	Motor Tasks
Even surface	· Walk · Run · Balance on one foot independently · Climb into tire swing · Climb into stationary play car · Crawl through tunnel · Climb up stairs to slide

(continued)

Table 1 A.   (cont'd)

| Uneven, grass surface | · Walk (some with wide base)
· Run (most with wide base) |
| Uneven, grass + incline | · Walk (all with wide base)
· Sit down and slides down inclines |

Social tasks were also categorized using the same approach. Table 1 (B) considers the tasks that the children were able to perform under three different social environments: solitary, child with peer and child with parent. The main differences between the child with peer and child with parent condition were the increased frequency of social initiations and limited conversations with the parent. There were a number of instances of inappropriate social interactions with peers, such as pushing and walking away. With the adult interaction there were more instances of inappropriate social behaviours such as yelling and feet stomping to get the parent's attention or to indicate a need.

Table 1 B. Social tasks commonly observed under different social environmental conditions

Social Environment	Social tasks
Solitary	· Monologues
Child + adult	· Eye contact · Increased social initiation · Limited conversation · Some inappropriate behaviours to indicate need (yelling, stamping of feet, walking away)
Child + peer	· Monologues · Minimal social initiations · Imitation of action · Minimal eye contact · Rejection of peer by pushing child or walking away

Discussion

Summary and Limitations

There are two key limitations in this study that make the interpretation of the results difficult. First, a group of typically developing children of the same level of functioning was not included. Thus no comparisons can be made of the motor and social behaviors between the children in this group and their typically developing peers. Second, the small sample size limits the generalizability of the findings. Despite these limitations, our data provide some interesting insights into the motor behavior and peer relations for this group of children with DS in a playground.

Overall, the main findings of this study were: (a) children in this group spent a greater amount of time in motor based activities in comparison to social activities in a playground setting, and that the primary motor activity was swinging – usually with the parent pushing the child on the swing; (b) the children tended to engage in solitary play in the playground initiating few social interactions with their other peers, and tending to favor interactions with their parent; (c) the tasks appeared to became more difficult as the environment became more complex – in both physical and social environments. In order to understand the nature of both the social and motor behaviors, the underlying social-cognitive processes and perceptual-motor processes must be examined.

Fundamental Social-Cognitive Processes

The development of social strategies is dependent on fundamental social cognitive processes. Dodge et al. (1986) described key factors that drive peer interactions. These include attention to and encoding of relevant social cues, appropriate interpretation of cues, and generation and evaluation of potential strategies. These processes are influenced by the ability to regulate emotions and to develop shared understanding (Guralnick, 1999). Children with DS have difficulties in a number of areas that can disrupt these fundamental processes. These include difficulties with attention, information processing, language difficulties (Miller, 1987) and emotional regulation (Cichetti et al., 1991). Many of these fundamental processes are dependant on the ability to decode affective information. Several recent studies have show that individuals with DS may in fact have a selective impairment in the ability to process facial expressions (Kaiser et al., 2005; Kasari et al., 2001; Wishart & Pitcairn, 2000) and in the visual perception of the emotional states of other people (Virji-Babul et al., 2006).

Fundamental Perceptual-Motor Processes

In parallel to social strategies, motor strategies also depend on fundamental perceptual-motor processes. These foundational processes include motor adaptability (ability to modify motor patterns in relation to changing environmental tasks conditions) and perceptual-motor coupling. Perceptual motor processes depend on the ability to attend to and extract relevant cues from the environment, interpreting cues and generating appropriate motor strategies, and evaluating the strategies based on outcome of the task. Children with DS have difficulties in a number of these perceptual-motor processes that limit their ability to attend to and extract relevant physical and perceptual cues from the environment (Charlton et al., 2002; Virji-Babul et al., 2005). Taken together, these findings add to a body of literature that indicates that children with DS may have difficulties in extracting and processing relevant information from the environment – whether this environment is physical or social, leading to decreased engagement in play situations.

Implications for Intervention

The playground is undoubtedly a rich environment in which to learn fundamental tools for social interaction (Guralnick, 1990) and motor interaction. However, for children with DS these interactions may not occur naturally. We suggest that two broad strategies may be of benefit to take advantage of the playground experience:

1. Encourage early active engagement of parent-child dyad in the playground. It is well established that the ability to extract relevant emotional information, decode social cues and learn social rules are first learned within the parent-child dyad and then transferred to other social situations (Parke et al., 1992; see Guralnick, 1999 for review). In addition, the ability to initiate social interactions may also be learned through parent-child interactions. Children who are more likely to initiate social interaction with adults, are also more likely to initiate social interaction with peers (Sigman & Ruskin, 1999). Therefore parents need to model and encourage active engagement in the playground. Behaviours such as turn taking, sharing, attending, verbalizing and reciprocal interaction need to be encouraged. Communication needs to be developed where the child takes more and more responsibility and control over the interactions. Importantly there must be a clear distinction between teaching and playing during any interaction so that the child can develop a sense of competence and control (Jobling & Virji-Babul, 2004).

2. Structure the social and physical environment at the playground. Once the child has begun a process of understanding social rules, interactions in the playground can be facilitated by structuring both the physical and social environment (Arthur et al., 1999). Some pieces of playground equipment are not conducive to meaningful motor or social interactions. For example, in our study swinging on the swings was a passive activity with no social interaction and virtually no motor activity as most of the parents pushed the children on the swings. In contrast, swinging on the tire swing with a peer led to increased social interaction and communication as the children were facing each other and were engaged in a shared activity. The play castle was another example of a piece of equipment that promoted both communication and the beginnings of imaginary play. Parents can therefore encourage the child to engage in these types of equipment and limit the time spent on passive swinging.

Similarly, parents may need to pay increased attention to the social environment by focusing on the play, verbalizing and acknowledging the affective states of the child and the peer (Guralnick, 1999). Children may also need scaffolding from the parent to initiate and maintain social interactions with another child (Sigman & Ruskin, 1999).

Conclusion

This paper has highlighted the key components involved in social cognitive and perceptual-motor competence in children with DS. These abilities emerge in infancy and require scaffolding from parents to support the development of critical foundational skills. The playground can provide a rich environment in which to facilitate perceptual-motor skills, parent-child interactions and peer interactions.

Acknowledgements

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