

DSI in a Learning Disorders Clinic

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In her groundbreaking work *Sensory Integration and the Child* Jean Ayers estimated that 5-10% of all children had disordered sensory integration. Carol Kranowitz, in her more recent DSI classic *The Out of Sync Child*, places this number between 12-30%.

Although a precise tally of the number of children affected by DSI is difficult to come by for a variety of reasons, our own experience as physicians specializing in treating children with learning disorders leads us to agree with these authors that DSI is a vast, and vastly under-recognized, problem among pre-school and school aged children. In this article, we'd like to describe our experience with DSI in children referred to our clinic by schools, physicians, or parents for evaluation of learning problems.

DSI is *Common* in Kids with Learning Disorders

Using a set of diagnostic criteria combining patient history and clinical observation, we determined that of our last fifty consecutive patients, 52 percent had difficulties with sensory integration severe enough to contribute to their learning problems. The frequency of DSI varied markedly according to age. In our 30 children under age 10, 70% had DSI, while in children 10 and over, only 20% had DSI.

The reasons for this striking difference are not entirely clear. It is possible that the incidence of DSI diminishes with age because the sensory processing disorder tends to lessen or resolve. However, it is also possible that the sensory processing disorder persists, but that many children tend over time to develop compensatory strategies for dealing with it so that it no longer produces so many bothersome complications. Most experts in DSI lean toward the latter explanation. They feel that even in persons who have been treated with sensory integration therapy some signs of the disorder are still usually detectable, and that in untreated persons these signs are usually readily apparent.

Our thoughts are somewhere in the middle. In our experience, the persistence of DSI tends to vary according to its severity. Severely affected children (who are, probably not coincidentally, the ones most likely to have come to the attention of the occupational therapists who've done most of the research in this field) are likely to have the most persistent and troublesome symptoms later in life. On the other hand, children with mild to moderate symptoms may improve symptomatically, even without therapy, to show few or no signs of DSI as adolescents or adults. Even among more mildly affected children, though, therapy may be helpful in speeding progress and preventing emotional and behavioral complications that can persist lifelong.

Diagnosing DSI in the Clinic: History

Of the various historical and physical data we use to diagnose DSI, no one type is able by itself either to make or break the diagnosis. We tend to view the information as a

whole to see whether a pattern of sensory dysfunction and behavioral difficulties consistent with the diagnosis of DSI emerges.

Currently, we gather historical information on the children we see by having their parents answer a battery of 28 questions probing sensory seeking or avoidance, balance and motor issues, and energy level. Table 1 displays some of the most revealing data from the fifty children in our sample.

In our current sample, parents of children diagnosed with DSI were over five times more likely than parents of children without DSI to say that their child: had a weak grasp and floppy muscle tone; was insecure with slides and escalators; avoided rough play and playground equipment; or, had unexpected falls while sitting in a chair or playing.

This historical information is interesting in several respects. First, the importance of balance and gravitational security issues in children with DSI suggest why vestibular/proprioceptive therapy as pioneered by Jean Ayers has been so successful in treating children with this disorder.

Second, it is important to note how many children with DSI have difficulties in the areas of motor energy and motor weakness. Our observations along these lines have led us to place a higher priority on motor conditioning and strengthening than that accorded by some traditional therapies.

Third, this information is important because of what it suggests about the etiology of DSI. Our own suspicion is that many of these clinical manifestations of DSI may be due to a functional disorder of a specialized type of sensory nerve cell called "spindle afferents". Spindle afferents are important in regulating muscle tone, in muscle fatigue, and in spatial localization at the joints: all functions that are affected in DSI. (We hope to return to address what is known or suspected about the causes of DSI in a subsequent issue.)

Returning to the data, all of our questions about tactile sensitivities and most of our questions about auditory sensitivities tend to be endorsed by more of the parents of DSI kids. These questions, however, are not as specific for the disorder as the items mentioned above.

Most of the questions we've tested regarding sensitivity for vision, smells, tastes, and sensory-seeking behavior have not been either sensitive or specific in identifying children with DSI.

Interestingly, most of the questions we ask parents regarding mood, affect, social and emotional behaviors tend to sort poorly for kids with DSI. Only one item is consistently endorsed by more parents of DSI kids: "Has tantrums". In our current sample, 71% of parents whose child has DSI said "yes" to this item. Only 46% of other parents endorsed it.

Diagnosing DSI in the Clinic: Physical Exam

On physical exam, kids with DSI had low or abnormal muscle tone almost twice as often as kids without DSI. Almost sixty percent of our sample had unusually floppy or spastic muscle tone. Nearly forty percent had a condition called "scapular winging" in which the muscles of the back are too weak to hold the shoulder blades in place: roughly twice the frequency as in children without DSI.

The proprioceptive or "spatial-positioning" problems in children with DSI were reflected in their almost universal inability to feel the positions of their fingers in space. This condition, called "finger agnosia", affects just over half of our non-DSI population, reflecting the numbers of children we see with primary motor, graphomotor, and sensory problems. Still, it is almost twice as common in our patients with DSI. To understand what this condition means to a child, try to imagine what it must be like to attempt to write your name, draw a picture, button your shirt, or tie your shoes with fingers that don't know where they are in space or in what directions they're moving.

Third, although our parent questionnaires didn't demonstrate a clear difference in sensory seeking behaviors between kids with DSI and those without, our physical examination *did* show evidence of sensory seeking behavior in a full 85% of children with DSI. Only 54% of children without DSI showed such behavior. These activities included chair spinning, table and paper picking, fidgeting, kicking (table, chair, and examiner), crashing and bumping.

Finally, although our historical questionnaire did not show variations in impulsive or hyperactive behaviors that correlated with the DSI diagnosis, our examinations found marked discrepancies in such behaviors. Impulsive behaviors, such as grabbing items without asking, beginning test segments without waiting, and answering questions in an unplanned manner, were almost four times more common in children with DSI. Hyperactive behaviors, such as running around the exam room, jumping and crashing into things, and fidgeting, were over five times more common in kids with DSI.

Attentional difficulties, which were present in essentially all children in both groups, did not superficially differ between groups. These findings raise important issues regarding the relationship of DSI and ADHD, whose three cardinal manifestations are impulsivity, hyperactivity, and attentional disorder. Because this is such an important issue for parents, therapists, and educators, we are going to wait to address this topic until we can give it the detailed consideration it deserves in the next issue of SI Focus.

Conclusions

DSI is remarkably common in the children we see with learning problems, especially in children under 10. The obvious, indeed inescapable, conclusion is that DSI contributes significantly to the learning problems facing many of our children. We are encouraged by signs that this long neglected and profoundly important condition is finally beginning to receive the attention it deserves. We are optimistic that the future will bring many more advances in our understanding of this disorder and in our ability to help the children it affects.

Table 1: Questionnaire Items Endorsed

Questionnaire Item	DSI	Non-DSI
Unexpected falls out of chair or on playground	19%	0%
Floppy or loose muscle tone	29%	5%
Weak grasp	29%	5%
Doesn't like rough housing	19%	5%
Doesn't like messy play or splashing in water	29%	10%
Fatigues easily	52%	19%
Avoids physical closeness	19%	10%
Covers ears to loud noises	52%	29%
Has tantrums	71%	46%

Table 2: Clinical Exam Findings

Clinical Finding	DSI	Non-DSI
Abnormal Muscle Tone	58%	29%
Scapular Winging	38%	21%
Finger Agnosia	86%	52%
Hyperactivity	50%	9%
Impulsivity	31%	8%