CHAPTER

13

Clinical Applications in Sensory Modulation Dysfunction:

Assessment and Intervention Considerations

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Sensory modulation dysfunction (SMD) is "a problem in the capacity to regulate and organize the degree, intensity and nature of response to sensory input in a graded and adaptive manner . . . [that] disrupts an individual's ability to achieve and maintain an optimal range of performance necessary to adapt to challenges in life" (Lane, Miller, & Hanft, 2000, p. 1). Behaviorally, children with SMD can exhibit overresponsivity as they actively seek or avoid sensory input in the environment, or hyporesponsivity and passivity as they fail to orient and respond to typical levels of sensory input in the environment (Miller & Lane, 2000; Dunn, 1997). In addition, *emotional problems* (e.g., anxiety, aggression, fearful and/or tantrum-like symptoms), and *attentional problems* behaviors (e.g., distractibility, impulsivity, disorganization, hyperactivity) frequently occur. SMD can severely impair daily occupations, routines, and roles, and occurs in mild to severe forms (Hanft, Miller, & Lane, 2000; Parham & Mailloux, 1996). Although the core deficit in SMD might be sensory (see chapter 4 of this text), functional problems (i.e., difficulties with social participation, self-regulation, perceived self-competence, and/or performance of home, school, or community tasks) are the usual basis for referrals for occupational therapy (Cohn, Miller, & Tickle-Degnen, 2000).

Responsivity refers to the behavioral response to sensation.

Reactivity refers to the physiological response.

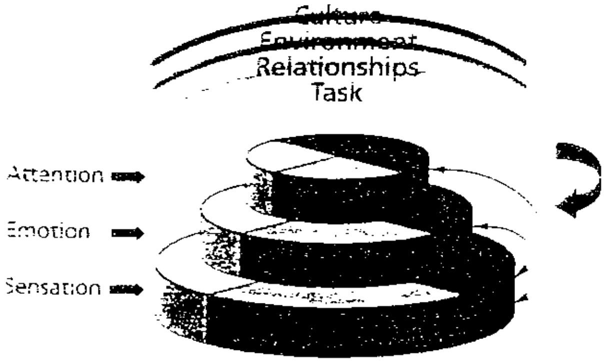


Figure 13.1. The Ecological Model of Sensory Modulation

light shading = underresponsivity
medium shading = normal responsivity (a match between the external and internal dimensions)
dark shading = overresponsivity
black = lability, severe overresponsivity alternating with severe underresponsivity

The Ecological Model of Sensory Modulation

Chapter 4 of this text, An Ecological Model of Sensory Modulation: Performance of Children with Fragile X Syndrome, Autistic Disorder, Attention-Deficit/Hyperactivity Disorder, and Sensory Modulation Dysfunction, details a conceptual model of sensory modulation. This model highlights four *external dimensions* (*culture, environment, relationships* and *task*) and three *internal dimensions* (*sensory processing, emotions*, and *attention*) that affect children with SMD (Figure 13.1). To frame the strengths and limitations of each child, clinicians consider each of these seven dimensions during assessment and intervention planning.

The two case studies in this chapter demonstrate how therapists used this model as a framework to guide assessment, evaluate results of assessment, and plan intervention, considering the supports and demands provided by the *external dimensions*, the types of sensory stimulation that caused the referral symptoms, and how the *sensory processing* problems might have been affecting the children's *emotion* and *attention* processes.

The Assessment and Intervention Process in SMD

The Assessment Process

Parham and Mailloux (1996) summarized the limitations and disabilities in SMD as:

1. decreased social skills and participation in play
2. poor self-confidence and self-esteem
3. difficulties with daily life skills and at school
4. anxiety, poor attention, and poor ability to regulate reactions to others
5. poor skill development in fine, gross, or sensorimotor domains

The assessment process includes a variety of scales that assess the internal and external dimensions that affect a child behavior and functional abilities, including both behavioral and physiological measures. (See Appendix 13-A for more detail about the assessments used in the Sensory Integration Dysfunction Treatment And Research [STAR] Center at The Children's Hospital in Denver, CO.)

At the STAR Center, the assessment process for children with SMD generally follows the sequence listed below.

1. Upon referral, parents receive by mail a detailed medical and developmental questionnaire, which they return prior to evaluation.
2. Clinicians use either the *Sensory Integration and Praxis Tests* (SIPT; Ayres, 1989) or the *Miller Assessment of Preschoolers* (MAP; Miller, 1982, 1988), and *First STEP (Screening Test for Evaluating Preschoolers;* Miller, 1993) to test the child.
3. Parents complete the *Short Sensory Profile* (SSP; McIntosh, Miller, Shyu, & Dunn, 1999), the *Parent Rating Scale of the Leiter International Performance Scale–Revised* (Leiter-P; Roid & Miller, 1997), and the *Child Behavior Checklist–Parent Rating Scale* (CBCL; Achenbach, 1991).
4. The parents receive a copy of the *Leiter–R Teacher Rating Scale* (Roid & Miller, 1997) to give to the child's teacher and return at the next visit.
5. The occupational therapist completes the *SMD Behavior During Testing Checklist* (see Appendix 13-B) and *Leiter–R Examiner Rating Scale* (Roid & Miller, 1997).
6. Investigators administer the Sensory Challenge Protocol, a controlled laboratory paradigm that gauges an individual's responsivity to 50 sensory stimuli, with 10 trials in five sensory domains, by continuously sampling the individual's electrodermal reactivity (EDR) after sensation (Miller et al., 1999). (See Appendix 4-B in chapter 4 for details of the Sensory Challenge Protocol.)
7. The therapist conducts and videotapes a parent interview (see Appendix 13-C).
8. The occupational therapist and the psychologist administer other scales (e.g., *Wechsler Intelligence Scale for Children—Third Edition,* Wechsler, 1991; *Multidimensional Anxiety Scale for Children,* March, 1997; March, Parker, Sullivan, Stallings, & Conners, 1997; *Vineland Adaptive Scales,* Sparrow, Balla, & Cicchetti, 1984).

9. The treating therapist reviews the parent interview tape and drafts the Goal Attainment Scale (GAS) (see sample GAS in Appendix 13-D). The therapist reviews the GAS with the parent during a joint session before initiating the intervention.

Electrodermal Reactivity to Sensation: Researchers hypothesize that SMD occurs when a disorder exists in the sympathetic nervous system (DeGangi, DiPietro, Greenspan, & Porges, 1991; McIntosh et al., 1999). Investigators measure SMD symptoms in the laboratory by administering sensory stimuli and examining the child's physiologic reactions, including electrodermal reactivity (EDR). The case studies in this chapter discuss the EDRs for two children with SMD. Figures 4.5a, 4.5b, and 4.5c in chapter 4 are examples of typical, hyperreactive, and hyporeactive EDR results.

As a final step in the assessment process, and in preparation for creating the intervention plan, the therapist reflects on the case by posing a series of self-reflective questions such as:

- How does the child perceive vestibular/proprioceptive information? Is the child a "movement seeker" or a "movement avoider"?
- How does the child perceive other sensory stimuli? Does the child seek or avoid tactile, auditory, visual, and olfactory information?
- What is child's emotional reaction in stressful situations? Does child withdraw, show aggression, or become tearful?
- What are the child's motor responses? Does child shut down, stop moving, become hyperactive?
- What affects the child's attention? Does child perseverate or become distractible, inattentive, and impulsive?

The process is iterative with constant questions about how the *external dimensions* affect the *internal dimensions* and how the child might be manifesting underlying neurological or physiological reactions in observable behaviors.

The clinician takes into consideration the family's priorities for intervention. The intervention plan *always* reflects the family's priorities. To ensure that this reflective process includes the family's concerns and goals, the therapist asks her- or himself a series of questions such as: What inputs (sensory and/or compensatory) can we use to help the child master his or her life demands? What can we teach parents, teachers, or others to assist the child in achieving a regulated, "just-right" state, where he or she can learn, play, and relate? Having generated a diagnostic hypothesis related to the seven external and internal dimensions (see the Ecological Model of Sensory Modulation in Figure 13.1), the therapist then designs the first therapy session.

The Intervention Process With SMD

Therapists provide occupational therapy for children with SMD using a sensory integrative frame of reference that is guided by clinical reasoning (Miller, Wilbarger, Stackhouse, & Trunnell, in press; also see chapter 11 in this text, Clinical Reasoning and the Use of Narrative in Sensory Integration Assessment and Intervention, by Burke). The factors guiding intervention are a detailed analysis of the child's *internal dimensions* (sensation, emotion, and attention), an understanding of how the child's *sensory processing* problems might be related to difficulties with other internal dimensions, and insight into how the specific *external dimensions* (*culture, environment, relationships* and *task*) affect the child. In the authors' program, intervention begins in a direct service setting, providing individualized occupational therapy with a sensory integration frame of reference. Each session includes intensive parent education. When ready, the therapist, child, and parent design additional sessions that occur at home, at school, or in the community as dictated by the circumstances.

The STEP-SI clinical reasoning framework (Miller et al., in press) provides structure to the therapist's ongoing thinking process when constructing the direct intervention plan and making observations and decisions during intervention sessions. Each STEP-SI element represents a question clinicians ask before, during, and after each activity in therapy.

S How does the child's response to sensations during the therapeutic activity affect success?

T How do specific elements of the task that are required by the activity affect success?

E How do elements in the environment during the therapeutic activity affect success?

P How do predictability and repetition during the therapeutic activity affect success?

S How successful is the child in self-monitoring reactions during the therapeutic activity?

I How do interactions with the therapist, parent, and/or peers during the therapeutic activity affect success?

Each element can be either a support or a challenge to successful completion of an activity. The therapist uses clinical reasoning (Mattingly & Fleming, 1994; Mattingly, 1991) to analyze the child's responses and to interpret the child's action-reaction, which leads directly to the next activity.

Typically, occupational therapists are the professionals involved in treating SMD (Ayres, 1972, 1989). The objective of intervention is to afford the child sensory or compensatory methods of self-modulating his or her own reactions, first in the clinic and then in daily life situations. Best results seem to occur when children receive individual direct therapy combined with consultation in natural environments (i.e., home, school, and community). For example, in Figure 13.2 Erin and Eric, who are both in direct therapy for SMD, have gone on an outing with their therapist to the pumpkin patch. This activity provides excellent tactile and proprioceptive input within a natural context. Erin's and Eric's parents have accompanied them so that the therapist can use the pumpkin patch activity to show the parents how to use sensory techniques to assist the children in self-regulation.

Figure 13.2. Erin and Eric receive proprioceptive input during activities at the pumpkin patch.

Intervention is actually an ongoing diagnostic evaluation process in which the clinician considers the contributing factors to poor behavior regulation and explores the supports the child needs to maintain a modulated state in a variety of environments. The clinical reasoning involved in this type of intervention is an iterative process involving rehearsal, careful observation, and ongoing interpretation of responses. Each child is the clinician's "professor," teaching the professionals about him- or herself over the course of the intervention.

In direct intervention, the therapist and the parents work together to assess, support, and challenge the child's ability to modulate sensory information from his or her body and environment. The therapist might start with external dimensions that are supportive for the child, incrementally adding elements from external dimensions that serve to challenge the child. Then, with the assistance of the therapist, the child is guided to use his or her internal dimensions to regulate activities and be successful. Ultimately the child generalizes this ability so that he or she can maintain a modulated state of arousal without the therapist's support.

The activities often include gross and fine motor activities; however, the goal of therapy is not to improve motor skills (as it might be for children who have developmental motor disorders such as dyspraxia; see Cermak, 1991). For children with SMD, therapists consider intervention a "success" when the child can generalize the type of self-regulation he or she maintained in a clinic setting to the home, school, or community environments. For example, Jeremy came to therapy with severe symptoms of gravitational insecurity. During his direct therapy that occurred once a week for a year, he received intervention to help him integrate the vestibular overreactivity in an appropriate manner. His underlying neural processing might have been altered by direct therapy, and in addition he learned self-regulatory techniques that he could use in natural settings to maintain a modulated state of arousal. In Figure 13.3, Jeremy has gone outside the direct therapy setting to the park and is playing on the merry-go-round. He is able to maintain an appropriate arousal state using the sensory techniques he learned during therapy.

Figure 13.3. Jeremy begins to tolerate slow vestibular stimulation at the park with his therapist.

The children at the STAR Center are also enrolled in an occupational therapy effectiveness research study, consequently each receives occupational therapy for the same amount of time before outcomes are measured. Currently the effectiveness study protocol begins with 5 weeks of individual occupational therapy twice a week in a clinic equipped with suspended equipment, mats, balls, and a variety of swings and other typical sensory integrative toys and objects (Parham & Mailloux, 1996). Parents are present and active during intervention. Typically, after the first 5 weeks of intervention (10 sessions), the therapist/parent team has developed excellent hypotheses about which activities and modalities best promote adaptive, regulated reactions in the child. Then the therapist and parents address larger quality-of-life goals in natural contexts either in the direct service setting or in natural settings. Some parent/therapist teams elect to use all 20 sessions in direct service in the clinic setting.

The therapist and the parents collaboratively plan the remaining 10 sessions to include at least one home and one school visit. During sessions outside the clinic, the questions broaden from the effect of guided and controlled sensation, environment, relationships, and so forth, on activities in the clinic, to the impact of the child's internal dimensions on his or her ability to function well in natural environments. The remaining sessions can be allocated to additional direct service sessions in the clinic; work with parents, teachers, and/or other individuals in natural settings (i.e. babysitter, piano teacher, dance teacher, grandparents etc.); or to other community activities, such as going swimming, buying shoes, or going to a neighborhood playground. The exact nature of the second half of the sessions depends on the needs of the child and family. All children are retested for the effectiveness study at the end of 20 sessions using the initial assessment tools, with the exception of the SIPT. Children whose therapists and parents feel that they need further intervention either extend the treatment time or take a break and return for more intervention at a later time.

Case Study: Kamon

Referral Issues and Assessments

Kamon was an endearing 3-year, 6-month-old boy referred by his family counselor because of extreme oppositional behaviors when dressing. It sometimes took Kamon several hours to dress, and he frequently refused entirely. The family counselor was working on parenting issues and behavior modification, but no improvement had occurred in the dressing problem. Kamon's parents also were concerned because he refused to try most fine motor tasks.

The following sections give the results from MAP, First STEP, SSP, Leiter–P Rating Scales, CBCL, Goal Attainment Scale, and parent interview (all scores transformed to z-scores). Because Kamon refused to finish most fine motor activities on pretest and thereby completed only two MAP subtests, his therapist was unable to obtain final scores on pretest. The discussion below demonstrates how the Ecological Model of SMD served as a framework to synthesize assessment results.

External Dimensions Affecting Function

According to the Ecological Model of SMD, all four external dimensions created significant challenges for Kamon related to his presenting problems. In direct therapy sessions, Kamon's therapist explored each dimension and suggested methods of modifying external dimensions so that the dimensions could become supports rather than demands.

Culture

Kamon was limited by his sensitivity to sensation and withdrew if the sensory demands of his culture became too great. He had a large extended family (more than 40 people) who gathered for holidays and birthdays. At a recent event, Kamon hid under a bed as people arrived, and the family had to instigate an all-out search to find him.

He demonstrated most of his problems at home, despite the fact that both his mother and father were gentle, understanding, and well educated. Because home was "safe" for Kamon, he allowed himself to fall apart and express his feelings there. For example, frequently upon arriving home after school, Kamon would exhibit tantrums, crying, and screaming in response to simple requests by his parents.

Environment

Kamon was extremely sensitive to auditory and visual stimuli, and many family activities (e.g., TV) were troublesome. If the stimulus was too active, bright, or loud, Kamon would dissolve in tears. Leaving the house to shop, eat out, or go to church was stressful because Kamon frequently became overwhelmed and aggressive. Kamon spent most of his time at home playing alone.

Relationships

Kamon "refused" to interact with certain children because of his olfactory sensitivities. For example, he said that the hair of the girl in front of him at school "smelled," his personal rug at circle time was "too rough," and he felt "smothered" by other children. His low Aggressive score (CBCL, −3 SD) reflected his tendency to act out his problems at school. However, the support provided by Kamon's warm, caring teacher allowed him to flourish in school, so far. His parents were concerned that as demands for relationships increased, he might not adapt. A significant discrepancy existed between relationships at home, at school, and in the clinic. During the occupational therapy evaluation, Kamon was shy and withdrawn, rarely interacted with the examiner, and sat in his mother's lap. Low scores on Vineland Socialization domain (−2 SD), Leiter–P Social Abilities (−2.7 SD) and CBCL Social Problems (−2.4 SD) reflected these difficulties.

Task

Most fine motor activities (e.g., puzzles, coloring, building) resulted in tears and refusals. Kamon's parents were concerned that Kamon's refusal to participate in many activities would affect his kindergarten success. They were concerned about how his refusal to play with toys would affect his sense of competence and his friendships.

Internal Dimensions Affecting Function

Sensory Processing

Kamon's extreme hyperresponsivity to sensation showed in his SSP scores (total SSP −4.15 SD; Taste/Smell Sensitivity −5.5 SD; Tactile Sensitivity −4.33 SD; Visual/Auditory Sensitivity −3.0 SD) (see Figure 13.4). The parent interview highlighted the impact of Kamon's heightened reactions to sensations. The therapist hypothesized that Kamon's strong resistance to dressing might have a tactile basis. He was remarkably resistant to certain textures (e.g., fuzzy socks), to tags in clothing, to seams in socks. He would wear only loose-fitting pants, preferring shorts and short-sleeved shirts even in winter. His sensory hyperreactivity interfered with bathing, and he refused to have his hair brushed. Although Kamon enjoyed movement activities at home, he became disorganized and hyperactive when engaged in highly active tasks. His low Vineland score on the Daily Living Skills subtest (−1.9 SD) reflected these problems.

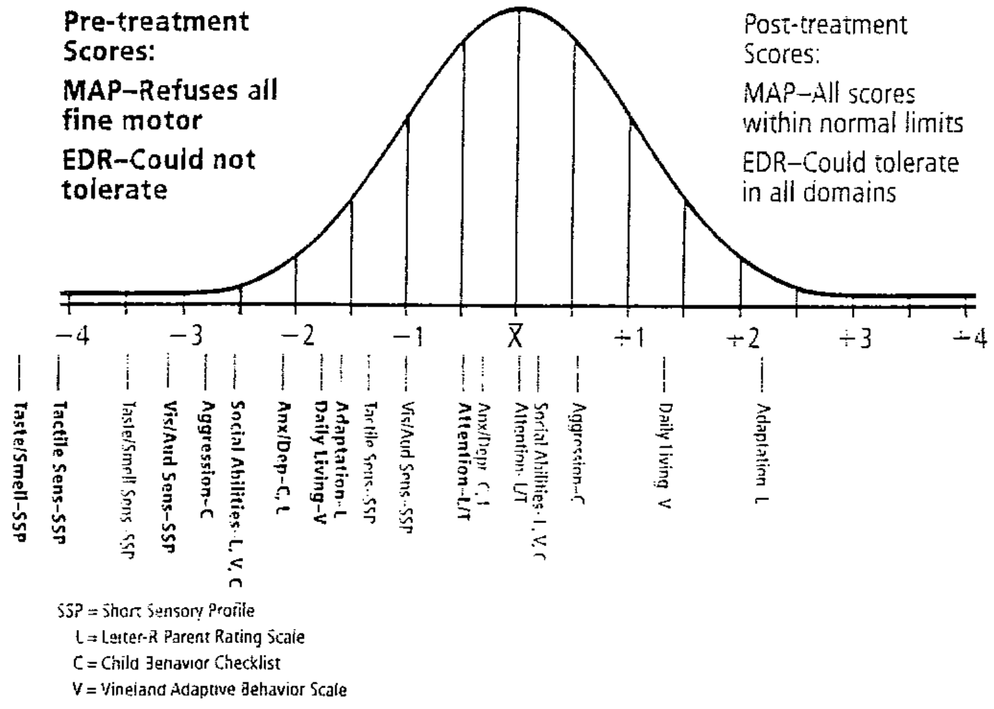


Figure 13.4. Examples from Kamon's pre- and post-treatment scores.

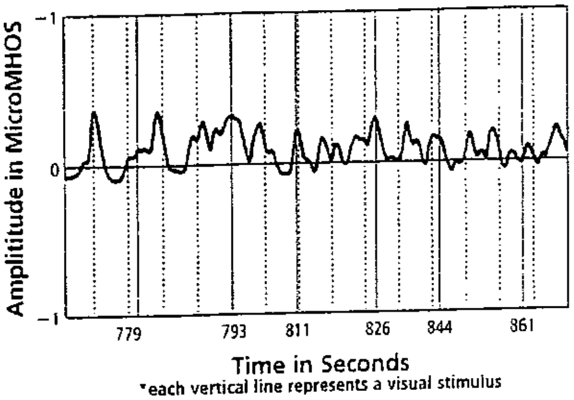


Figure 13.5. Sample from Kamon's electrodermal reactivity recording.

Kamon's sensitivities had an enormous impact on his diet, which was limited to mostly breads and cereals. He refused to be in the kitchen when his mother made dinner because of "bad smells" and refused to sit at the dinner table when it "smelled yucky." His visual and auditory sensitivities made it difficult for the family to spend time together on most activities. He cried upon hearing a hairdryer or shower. Clearly, Kamon's extreme sensory defensiveness was dramatically affecting daily living abilities.

Kamon's electrodermal reactions on the Sensory Challenge Protocol confirmed his physiological sensory reactivity (see Figure 13.5). His hyperreactivity is evident in the high amplitudes, many peaks after each stimulus, and no habituation. His behavior in the "space lab" was hyperactive, and he could barely tolerate the electrodes on his palms.

Emotions

Kamon had significant emotional problems, confirmed by scores on Leiter–P and CBCL. Parent interview and results from the *SMD Behavior During Testing Checklist* reinforced these findings. Parents and the examiner rated Kamon's Adaptation as significantly impaired (<−2 SD); his low Leiter–P score (−1.7 SD) on Moods and Confidence and Energy and Feelings confirmed his Anxious/Depressed score (CBCL, −2.5 SD) (see Figure 13.4).

Attention

Kamon's attention was normal during his occupational therapy assessment and at school (+.5 SD). He sat quietly and attended to stories or games at school and in the occupational therapy evaluation, although he refused to do tasks at which he might "fail." His scores from behavior and performance at home indicated difficulties, reflected in his inability to attend to board games, books, drawing, and so forth. Kamon's parents' rating of Attention on Leiter–P was −2 SD (see Figure 13.4).

Kamon's Intervention

Kamon's Goal Attainment Scale Objectives

1. to dress independently and in a timely manner
2. to demonstrate a typical number of tantrums for a child his age
3. to tolerate everyday noises without becoming upset
4. to have his hair brushed on a regular basis
5. to perform age-appropriate fine motor tasks

Parent Education

An important step in Kamon's intervention was parent education related to sensory modulation dysfunction. When Kamon's parents understood the sensory basis of Kamon's difficulties, they began to empathize with how life "felt" to Kamon. They were able to identify, avoid, or prepare better for situations that were threatening to Kamon. Kamon's parents began to understand that because home was "safe," Kamon was secure enough in this place to express his distress. Instead of viewing his home behaviors as his fault or as parenting problems, they realized that his good behavior at school was due to the care and shelter that they provided at home.

Direct Therapy With Sensory Integration Framework

The first step in direct service was to explore the effects of touch pressure/proprioceptive activities to establish whether Kamon would respond positively with calming and decreased sensitivity. His therapists focused on activities that he and his parents could do at home, providing a daily "sensory diet" (Frick et al., in press; Wilbarger & Wilbarger, 1991). Developing home activities was challenging because Kamon continued to "act out" at home.

Kamon attended individual occupational therapy twice a week for 5 weeks where he began to feel safe and try new activities, accepting small challenges. His strong *relationship* with his therapist was a tool that his therapist used to help him try novel games. The therapist provided touch pressure and proprioceptive input as well as vestibular games before novel activities, which helped to regulate Kamon's *sensory* reactivity. Kamon sought *predictability* and responded enthusiastically to pretend play. He did best when therapy followed a set routine. Each session started with massage and joint compression in a playful manner that he called "checking for and fixing broken bones" (massage, joint compression, and traction), a routine that Kamon's parents gradually transferred to his home routines.

Consultation at Home

For the second set of 10 sessions, Kamon's therapist and his parents decided to continue direct clinic-based therapy once a week, to have one school consultation, and to use the remaining four therapy sessions at home. In direct therapy, the therapist tried out games for home and then implemented them during the home visits. Kamon played the "broken-bones" game daily and told his parents, "That broken-bones game helps me get dressed." Kamon began to be aware of how much the games helped him, and he began to prepare himself for situations. Other play activities that provided deep pressure and proprioceptive input included beating up a tent filled with pillows, tug-of-war with a large piece of stretchy fabric, and being a "hotdog in a bun" (under a therapy ball).

During the therapist's home visit, Kamon, his parents, and the therapist visited the nearby park (Figure 13.6). The therapist helped the parents to understand how they could use many of the opportunities at the park to help regulate Kamon's tendency to become dysregulated. In this way, Kamon's parents could continue many of the therapeutic activities begun during his direct therapy sessions through home-based follow-up on their own.

Figure 13.6. Kamon receives deep pressure and proprioceptive input while playing with his therapist in the sandbox at a nearby park.

Consultation at School

Kamon's therapist observed him at school and provided his teacher with general information related to Kamon's underlying strengths and sensitivities and activities that would fit within a typical classroom. His parents suggested, and the therapist agreed, that Kamon should be allowed to enjoy his successes at school. The team felt that providing additional challenges in the school environment might lead to anxiety at school, so together with the teacher, they set up a routine that would not provide challenges at school.

Outcomes of Intervention for Kamon

Kamon made both qualitative and quantitative changes on testing after 20 occupational therapy sessions (see Figure 13.4, which displays both his pre- and postintervention scores on assessments).

External Dimensions

Kamon's therapist discussed the qualitative changes in the parent exit interview where his parents expressed delight and joy over the changes Kamon had made. However, they noted, "There is still a long way to go." They were thrilled that Kamon could join the family at most dinners and for family activities such as watching TV. After therapy, he could dress himself "most" days and allow his hair to be combed. His tolerance of new or frustrating situations had improved markedly. A significant difference after therapy was the consistent support and understanding that both parents were able to offer him. They no longer felt that something "bad" about their parenting had "caused" his difficulties, and they could help him self-regulate in public places.

Sensory Processing

Kamon's posttreatment lab results indicated a lingering physiological hyperreactivity (measured by electrodermal reactivity in the laboratory paradigm); however, his behavior in the "space lab" was remarkably different on posttesting. He tolerated all 5 sensory stimuli and allowed the examiner to administer all 10 stimuli in each sensory domain. Quantitatively, Kamon's scores on the SSP showed sensory improvements on all six subtests that had abnormal scores in the pretest condition (average improvement of .80 SD). After therapy, Kamon was able to self-regulate enough to complete the MAP evaluation, with all scores within normal limits. This was a marked improvement over his pretreatment status.

Emotion

At home, his behavior fluctuated. Certain weeks, he was emotionally labile with numerous tantrums; other weeks, he was a delight. However, his parents were optimistic because 5 out of the 6 preceding weeks he had shown "mostly positive behaviors."

Kamon's family decided to "take a vacation" from occupational therapy after the 20 sessions; however, they planned on returning a couple of months before he began kindergarten. They continued to follow through with Kamon's sensory diet and other occupational therapy adaptations at home and when they went as a family to community events and activities.

Case Study: Stevie

Referral Issues and Assessments

Stevie was an outgoing, attractive 5-year, 8-month-old boy with presenting problems of frequent angry outbursts with peers and siblings, extreme hyperactivity in quiet settings, and fear of new activities. He had significant school difficulties because of extremely disruptive and aggressive behaviors. His peers were afraid of him, and his kindergarten was considering expulsion. Stevie was assessed in the laboratory to measure his electrodermal reactivity during the Sensory Challenge Protocol, and the evaluating occupational therapist administered the SIPT, CBCL, SSP, Leiter–R Parent Rating, and Vineland scales. Qualitative measures included Goal Attainment Scaling and parent interview.

External Dimensions Affecting Function

Culture

Stevie's family had many demands for quiet, good behavior. For example, his family belonged to a church that met three times a week, during which there was "quiet worship time." His family stopped participating in church as a family, although both parents still went separately. Family gatherings presented the expectation that "children were to be seen and not heard." Stevie's family, unable to control his hyperactivity, coped by not attending most family events.

Environment

Stevie was upset by new and crowded environments. Stevie's family avoided taking him out of familiar environments. His family had not viewed the environment as an active element that they could manipulate to support Stevie.

Relationships

Stevie was aggressive with peers, siblings, and parents. Interpersonal relations were *always* challenging for Stevie, although he adored his parents, who spent immense energy structuring Stevie when he was near other children or adults.

Task

Stevie was an intelligent, talented little boy. He loved to play with toys that had moving parts and lights or sounds. Tasks were helpful in organizing Stevie's unregulated behavior if an adult could "catch" the disintegration in time.

Internal Dimensions Affecting Function

Sensory Processing

Stevie showed extreme hyporeactive vestibular and proprioceptive processing, manifested by continual sensation seeking. At his occupational therapy evaluation, Stevie was in constant motion, continually chewing on his shirt and other objects. His SIPT scores reflected his poor perception of vestibular and proprioceptive sensations (low scores in Standing and Walking Balance −1.5 SD, Postrotary Nystagmus −2.35 SD), as did his SSP score on Under-Responsive/Seeks Sensation (−4.33 SD). Figure 13.7 gives Stevie's assessment results before his therapy was initiated (all scores transformed to z-scores for comparison).

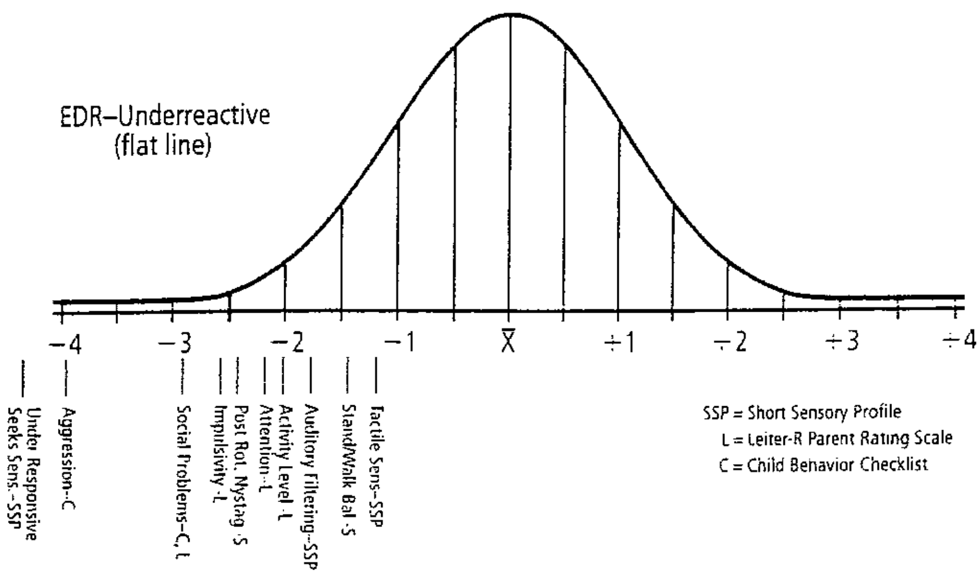
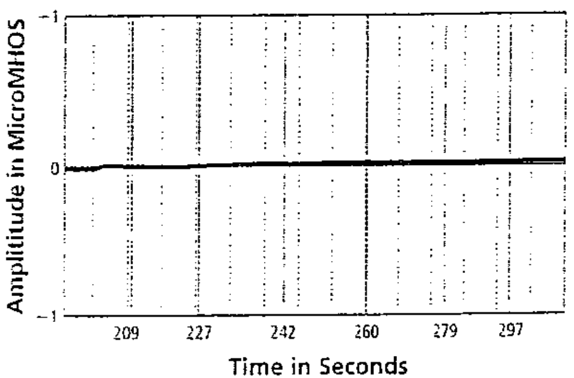


Figure 13.7. Stevie's pretreatment scores on assessments.



*each vertical line represents a visual stimulus

Figure 13.8. Sample from Stevie's pretreatment electrodermal reactivity recording.

Stevie demonstrated a hyporeactive "flat-line" profile on EDR (see Figure 13.8). Children with sensory modulation dysfunction sometimes exhibit this type of EDR recording. It shows no amplitude and no peaks and thus no habituation. Behavioral hypotheses regarding "shutdown" reactions might be valid, although the objective data related to the meaning of the flat-line profile in children with SMD is still under investigation. Additional research is required to evaluate the neurophysiologic and behavioral correlates of this profile.

Though hyporeactive in vestibular and proprioceptive processing, Stevie demonstrated mild sensory defensiveness in tactile and auditory systems. Certain clothing textures bothered him, and he was uncomfortable with grooming tasks (washing face, combing hair, cutting nails). He became fidgety and giggly during the tactile tests on the SIPT and had more difficulty attending to those subtests than others. His mild sensitivity to touch and auditory sensation were also reflected in his SSP scores (Tactile Sensitivity −1.33 SD; Auditory Filtering −1.7 SD).

Emotions

Scores on the Leiter–P and CBCL concurred with the information from Stevie's parents' interview. Stevie had pronounced difficulties in emotion regulation, particularly in social situations (CBCL Social Problems −3 SD; Leiter–P Social Abilities −2.5 SD). Stevie's parents reported that his aggression seriously affected his school and home life (CBCL Aggressive score −4 SD) (see Figure 13.7). He fought with peers at school and in the neighborhood. Agemates were terrified of Stevie and avoided him. If not supervised, Stevie would bite, push, and kick his sister. He had difficulty transitioning between activities and situations, becoming angry and aggressive. His "short fuse" and low frustration tolerance put his parents in a constant state of hypervigilance in case he "blew up." When upset, he stuttered and could not perform simple tasks. Stevie's parents could not separate Stevie's manipulative behaviors from true functional disabilities.

Attention

Stevie showed poor attention accompanied by hyperactive, impulsive behavior (Leiter–P Activity Level −2 SD; Impulsivity −2.5 SD; Attention −2.2 SD) (see Figure 13.7). Stevie was constantly in motion, seeking intense vestibular and proprioceptive input, which distracted him from attending to tasks for more than a minute. In school, his teachers viewed him as hyperactive and disorganized (teacher rating on Leiter–P of −3 SD on Activity Level and Organization). During his occupational therapy evaluation, Stevie needed repeated cues to focus on tasks. He had difficulty listening, and needed instructions repeated often. When overwhelmed, he demonstrated difficulty completing a thought or explanation.

Stevie's Intervention

Stevie's Goal Attainment Scale Objectives

1. to improve ability to self-regulate emotions, resulting in consistent emotions from day to day
2. to increase social participation at home and school by decreasing aggressive behavior with peers and siblings
3. to improve ability to transition between activities and settings
4. to increase self-confidence and improve abilities to perform age-expected tasks by helping him to self-regulate during tasks requiring skill
5. to improve parents' understanding of difficulties and behaviors and provide tools for parents to use when unregulated behavior occurs

Direct Therapy

Stevie had direct occupational therapy using a sensory integration frame of reference twice a week for 8 of his 10 weeks (16 of 20 sessions, the typical number of visits approved by managed care). After that time, his course of intervention changed to once-a-week direct therapy, alternating home and school intervention/consultation.

In Stevie's first therapy session, he resisted entering the occupational therapy clinic, using inappropriate and aggressive language and attempting to hit, bite, and kick his therapist. Clearly, therapy was just like any other new transition to Stevie. His therapist used his reactions to transitioning into therapy therapeutically. In the beginning of the therapy sessions, she focused on helping Stevie learn tools to self-regulate and adapt to this change.

The *task* of blowing bubbles mesmerized Stevie. The therapist utilized the component of *predictability* as Stevie sat blowing bubbles, keeping the door open so he could see into the clinic and watch his therapist playing with the toys and equipment. Eventually, Stevie edged into the clinic area and hesitantly tried a few activities, selecting deep pressure activities (being picked up and squeezed, rolling on a large air mattress, and being buried with weighted pillows). When Stevie's first session was over, he was eager to return.

At his second session, Stevie easily entered the occupational therapy clinic. The therapist again consciously selected *predictability* as a therapeutic tool, having Stevie play only those games he'd played in his first session for half of the second session. Though Stevie resisted anything new, the therapist used *sensation* to ready Stevie for new challenges. Lifting Stevie up and providing firm hugs helped him calm and lessened his resistance to new activities. A safe, *fun* place was clearly essential to Stevie, although his therapist made small changes in the *environment* each week that allowed incremental challenges to the difficulty of *tasks.*

By the third week (sessions five and six), Stevie had identified the clinic as a secure place, and his *relationship* with his therapist permitted him to try challenging activities. For example, using pretend play and having Stevie control the situation, the therapist could engage Stevie in pretend war games that allowed him to express his aggressive tendencies. The therapist showed Stevie how to control his outbursts by using sensory techniques such as deep pressure and proprioception for calming.

On frequent occasions, an upsetting experience at home or demands in his *culture* (e.g., visiting his grandparents, going to a frenetic birthday party) caused aggressive outbursts and increased resistance in the subsequent occupational therapy session. The therapist tried to reenact many of these scenarios during therapy and led Stevie through several alternative outcomes. One parent was always present in the clinic, so his parents also became familiar with alternative strategies for interacting and preventing his aggression, which seemed to calm effectively with sensory input in vestibular and proprioceptive domains.

By week five (10th session), Stevie easily transitioned in and out of therapy even when changes to routine or upsetting events occurred at home before his therapy session. He was also able to begin *self-monitoring* when he began to get out of control, obtaining what he needed to reorganize himself (e.g., chewing bubble gum or rubber tubing, jumping activities, and fast movement). His behavior and mood became somewhat more consistent at home and school, but even after 5 weeks of direct intervention twice a week, his emotional intensity at school and home was still a significant issue.

In direct therapy, the therapist noticed that "heavy work" in oral motor activities had a significant calming effect. Eating is such a common, everyday activity occurring not only during mealtimes but also during snacks, so Stevie's therapist and parents devised an intensive oral motor program that encouraged Stevie to eat foods that were crunchy and chewy and foods that required "work," such as sucking pudding and gelatin through a straw.

Figure 13.9. Providing a crunchy, chewy, texture-full sensory diet improved Stevie's behavior dramatically at mealtime.

At the review session halfway through the 20 sessions, Stevie's parents and therapist agreed that Stevie still needed the intensity and direct support that the clinic environment was able to offer him. By the eighth week, the therapist and parents agreed that Stevie would benefit from a few consultation visits. His therapist used these visits to get a better idea of which *external dimensions* disorganized Stevie.

Stevie was one of those children who need such sensory intensity that direct intervention is the best way to satisfy their needs. With a child like Stevie, it can take 20 sessions or more to provide what the child needs. Stevie communicated that he was this type of child by continuing to seek intense vestibular and proprioceptive input throughout his first 16 sessions. He never seemed to "get enough" input, yet intense movement activities often overwhelmed Stevie, causing aggression. The therapist had to provide structure and proprioceptive input consciously and continually by selecting *tasks* and structuring the *environment* to help Stevie maintain control. Roughly one-third of each session consisted of training Stevie's parents to reason through and identify activities that provided the "just-right" intensity while still affording the structure that Stevie required.

Home Consultation

Once Stevie's therapist understood his internal needs and Stevie was able to transition into and participate in therapy without constant aggressive outbursts, parents and therapist collaborated on ways to incorporate these intervention strategies into daily routines. During the therapist's visit to Stevie's home in the 17th session, Stevie's parents and the therapist devised a plan to use the family's unfinished basement as a playroom for Stevie. The parents purchased a minitrampoline at a thrift store and made an air mattress by roping together inner tubes from Stevie's dad's garage business. Stevie's mother fashioned a huge pretend boat filled with blankets and pillows. They made plans to construct an indoor tire swing so Stevie could give himself the intense movement he craved, even though it was winter. Stevie's parents and therapist also developed a springtime plan to add a spinning swing and a climbing rope to the outside swing set.

Stevie's parents had seen immense changes in Stevie during the therapy sessions after movement and proprioceptive input began, so they were willing and creative in making accommodations at home. Because the therapist had trained them to understand *why* these adaptations could help Stevie, they began to realize that many of Stevie's aggressive behaviors were a result of sensory modulation dysfunction rather than an attempt to manipulate his parents. When his parents began to provide Stevie with the intensity of movement and proprioceptive information that he consistently sought, Stevie was able to handle transitions better and his aggression decreased considerably.

Outcomes of Intervention for Stevie

Stevie's changes during the 20 sessions of occupational therapy were immense, as reflected in scores on some of his tests (see Figure 13.10), yet Stevie was a child who wasn't "done" after the 20 sessions. Even *he* could articulate his feelings and said, "I feel better, a lot more in control." The largest and most meaningful changes were evident on Goal Attainment Scaling, and Stevie's parents discussed these improvements with the therapist in the parent exit interview. Stevie's parents were thrilled that he now could eat dinner with the family, show affection to his grandparents, and (usually) sit through a church service (while chewing vigorously—but quietly!). Although significant, life-changing improvements had taken place, the therapist recommended continuing occupational therapy to focus on improving peer relations, refining skills, and developing additional home program routines and activities.

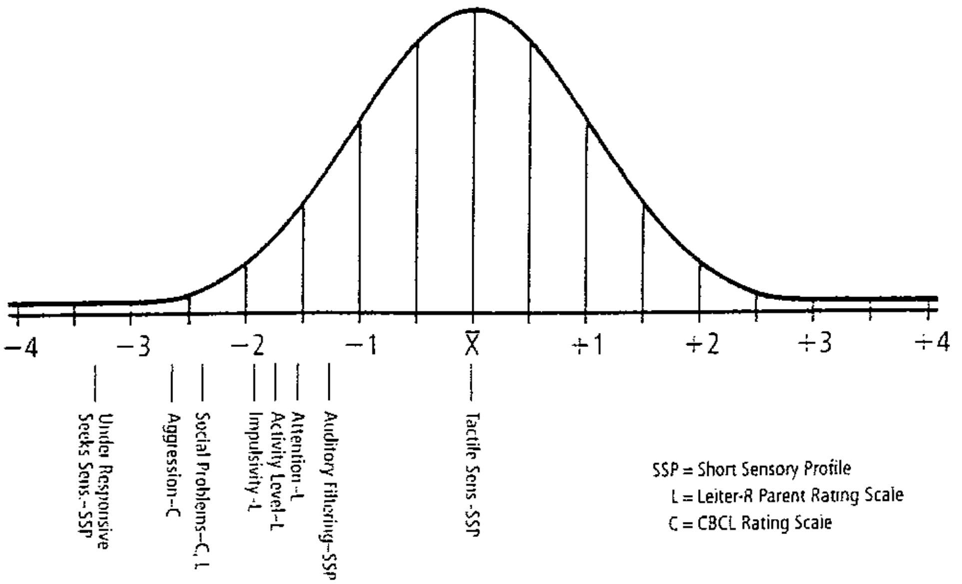


Figure 13.10. Stevie's posttreatment outcome scores.

EDR was undderreactive but did demonstrate some reactivity.

Conclusions and Discussion Points

The Ecological Model of SMD, in combination with the STEP-SI clinical reasoning framework, are useful tools for structuring and organizing the assessment, intervention, and clinical reasoning processes of occupational therapists who work with children who demonstrate SMD. The case studies demonstrate not only the usefulness of this approach but also its effectiveness. Several key factors regarding this approach are:

- Importance of considering external and internal dimensions of the model. Children with SMD can have atypical interactions in both *external and internal dimensions*. It is important to consider each element of the Ecological Model of SMD in evaluating and treating SMD. Therapists often receive referrals for emotional and attentional problems that occur in natural settings. These emotion, attention, and sensation problems often distinguish children with SMD from children with other types of sensory integration problems.
- Difficulty in therapy sessions. Children with SMD frequently demonstrate severe aggression, withdrawal, or other social/emotional disturbances, making direct therapy challenging. Developing a strong therapeutic alliance or relationship with both the parents and the child is vital to be able to use the trust the child and parents have in the therapist to help the child try new activities. Helping parents understand and articulate the underlying sensory processing problems that cause or contribute to the child's extreme behavior problems is essential to generalize the interventions outside the direct service setting. Once parents observe the changes in their child in center-based therapy, they frequently are willing to make more changes at home. In the authors' experience, the more the parents actively participate during the therapy, the more confident they become in adapting environments, tasks, and relationships at home and in natural settings in the community. This participation must be much more than being in the room observing the child and therapist; it should involve active problem solving by the parents.

- **Importance of family-centered care.** The parents of children with SMD sometimes feel guilty about being a bad parent and might have been accused by well-meaning relatives, friends, and neighbors of "spoiling" their child. They frequently hear, "Don't worry so much; he will grow out it," or "There's nothing wrong, you're overreacting." When parents receive a diagnosis for the problem, along with written, website, audiotape, or videotape information about the condition, their own ability to cope with the child often increases dramatically. The authors encourage development of their clinic's lending library with as many adult learning tools as possible so parents can check out materials that fit their learning styles. Whenever possible, the authors also help arrange parent-to-parent networking for support.
- **Importance of parent-to-parent networking.** To protect their children, families sometimes disengage from extended family, neighbors, and friends and do not receive the personal support they need. However, once the problem is diagnosed and parents understand that their children's difficulties are not their "fault," they can be more assured when explaining their child's problems to others. The more information parents have and can actually articulate, the better prepared they can be to advocate for their child. Therapists can consider training parents to talk knowledgeably about their child's condition as an active part of the therapeutic process.
- **Importance of using a clinical reasoning approach to intervention.** Using specific techniques and lists of sensory integration intervention ideas is a much easier way to treat children than the time-consuming process of using clinical reasoning to determine plan and implement intervention. However, it is the authors' contention that the only effective sensory integration intervention is occupational therapy focused on quality-of-life issues, using an ongoing process of clinical reasoning to design intervention. Using these guidelines, the therapist first sets a specific goal for each activity, subsequently questions whether the activity accomplished the goal, then thinks through what he or she could have done differently before or during the activity to increase the gains provided by the activity. Each success or failure of a specific activity should invoke a follow-up question by the therapist (e.g., This activity succeeded because . . . ? Consequently, I can make the activity more challenging by . . . ?; or, This activity failed because . . . ? Consequently, I can support the child to be successful by . . . ?) This is a challenging approach for the treating therapist. The process is an active, ongoing evaluation process moment to moment rather than a more passive, routines-based approach to intervention.
- **Importance of a multidisciplinary approach.** Because the sensory problems of SMD can lead to extreme behavioral and emotional dysregulation, collaboration with other professionals is critical in designing and implementing interventions for SMD. Occupational therapists understand the contribution of the sensory processing dimension and how it affects the other internal and external dimensions but may not be comfortable dealing with family issues that result, such as differences of opinion between parents in how to cope with the child's challenges. Although it may be difficult to find a counseling professional who is competent in family systems and who also understands SMD, it is critical to incorporate the expertise of other professionals, such as psychologists, behaviorists, and learning specialists for interventions with the array of complex issues that arise in treatment of SMD.
- **Difficulty determining duration and focus of intervention.** Determining the duration and focus for intervention is challenging, particularly if the number of sessions is limited (e.g., by a managed-care system). Often children make huge

initial gains but then show slower gains through home programs, school programs, and in natural community settings. Not all third-party payers are willing to support nondirect types of interventions outside the clinic, and not all interventionists feel comfortable with intervention outside of a direct-service setting. Deciding the amount and type of therapy needed and explaining and justifying these decisions to insurance companies and other professionals (doctors, teachers, other therapists), although frustrating, is critical.

- Importance of continuing research in SMD. Only recently has the professional literature begun to describe sensory modulation dysfunction. Practicing clinicians desperately need rigorous study designs to provide empirical data related to this disorder. Only through implementing and reporting well-controlled, rigorous studies will investigators be able to answer questions such as, Is SMD a valid syndrome? Does occupational therapy help ameliorate the condition? What are the underlying mechanisms in the disorder?

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APPENDIX

13A

Description of Assessments Used in Evaluation of SMD at the STAR Center at The Children's Hospital in Denver, CO

The *Child Behavior Checklist* (CBCL; Achenbach, 1991) measures social and emotional behaviors based on parent reports. The CBCL is widely used and its construct, content, and criterion validity are well established (Chen, Faraone, Biederman, & Tsuang, 1994; Elliott & Busse, 1992; Jensen, Wantanabe, Richters, & Roper, 1996; Macmann, Barnett, Burd, & Jones, 1992; Mooney, 1984). The CBCL subtests Withdrawn, Anxious/Depressed, Thought Problems, Aggressive, and Social Problems assess emotions; the Attention subtest assesses behaviors in the attentional domains.

Goal Attainment Scale: Using a system such as Goal Attainment Scaling (GAS) that is sensitive to individual variation is critical in SMD because symptoms vary widely (Ottenbacher & Cusick, 1990). A GAS is constructed for each child based on the parent(s)' priorities and goals on a five-point scale:

1	2	3	4	5
decline from current level	current level	expected outcome of intervention	better-than-expected outcome	long-term goal

At outcome, a GAS final score is calculated that represents the child's change (Kiresuk & Sherman, 1968). Appendix 13-D presents a sample goal from one child's GAS.

The *Leiter International Performance Scale—Revised* (Leiter-R; Roid & Miller, 1997) includes several well-standardized rating scales that include domains of attention emotion, and sensation. The Leiter-R parent rating subtests of Adaptation, Social Abilities, Mood/Confidence, and Energy/Feelings assess emotions, and the subtests Attention, Activity Level, and Impulse Control assess behaviors in the attentional domain.

The *Sensory Profile* (SP; Dunn, 1999) is a parent report measure of functional behaviors associated with abnormal responses to sensory stimuli, motor tasks, and emotions. Dunn and colleagues nationally standardized 125 items that fall into eight domains and nine factors (Dunn & Brown, 1997; Dunn & Westman, 1997).

A short version of the SP, the *Short Sensory Profile* (SSP; McIntosh et al., 1999), evaluates only sensory aspects of functional performance to discriminate specifically between children who are typically developing and those with SMD. The SSP construction, reliability, and validity, detailed elsewhere (McIntosh et al., 1999), demonstrate that the SSP adheres to recognized standards of reliability and validity (Miller, 1989). The SSP includes seven factors (subtests) and uses a scoring system based on the cumulative frequency distribution of the national standardization sample, transformed into z-scores. We used a conservative criterion to qualify children as SMD in our research project: total score <-3 SD, or scores on two or more subtests <-2.5 SD, or one subtest score <-4 SD. We analyzed performance in sensory processing to identify *sensitivities* (i.e., Taste/Smell, Movement, Visual/Auditory, and Tactile Sensitivity subtests), *sensory seeking* (Under-Responsive/Seeks Sensation subtest), and *hyporeactivity* (i.e., Low Energy/Weak subtest).

The *Vineland Adaptive Behavior Scales* (Sparrow et al., 1984) is the most frequently used norm-referenced scale of adaptive performance in published research. The Vineland is validated by many studies for accurate discrimination (.40–.70) of abnormal daily living skills (Altman & Mills, 1990; Douhitt, 1992; Rosenbaum, Saigal, Szatmari, & Hoult, 1995; Voelker, Shore, & Brown-More, 1990). In this study, we used the socialization abilities and daily living skills subtests to measure social participation and functional abilities.

The *Multidimensional Scale for Children* (March, 1997) is a norm-referenced anxiety scale, valid in separating children with and without anxiety disorders (classification accuracy 87%). The reliability is also excellent (.79–.93) (March, 1997; Parker & March, 1997).

To measure intelligence, the *Wechsler Intelligence Scale for Children–III* and/or the *Wechsler Preschool and Primary Scale of Intelligence* are administered (Wechsler, 1991).

Parents' Priorities, Resources, and Goals: Clinicians conduct semistructured, open-ended narrative interviews of parents prior to designing a child's intervention program. A qualitative study of interview themes noted five areas in which parents hoped for therapy changes: for their child they wanted to see (a) social participation, (b) self-regulation, and (c) perceived competence; for themselves, they wanted (a) tools to help their child regulate him- or herself and (b) feelings of competence about living with a child with SMD (Cohn, Miller, & Tickle-Degnen, 2000).

APPENDIX

13B SMD Behavior During Testing Checklist

Observations made during (name of test administered) ______________________

Behavior	Extreme Reaction	Moderate Reaction	Mild Reaction	Normal Reaction
Response to Sensory Stimuli				
Silliness or giggling during tactile tests	3	2	1	0
"Shutting down" during tactile tests	3	2	1	0
Withdrawal from or aversive reaction to tactile stimuli	3	2	1	0
Bothered by shield touching body	3	2	1	0
Bothered by having shield occlude vision	3	2	1	0
Complaints of feeling ill during or after PRN/spinning	3	2	1	0
Continues to spin on PRN board after test is administered	3	2	1	0
Distracted by items in visual field	3	2	1	0
Unable to keep eyes closed	3	2	1	0
Aversive response to routine noise	3	2	1	0
Distracted by outside noise	3	2	1	0
Attempts by the Child to Self-Regulate				
Excessive movement (rocking, bouncing in seat, tipping chair)	3	2	1	0
Puts things in or around mouth (food/nonfood)	3	2	1	0
Heavy or hard poking, pounding, slapping when responding	3	2	1	0
Needs more than typical number of breaks during testing	3	2	1	0

SMD Behavior During Testing Checklist (continued)

Behavior	Extreme Reaction	Moderate Reaction	Mild Reaction	Normal Reaction
Behavioral Disorganization				
Restless, fidgety, impulsive grabbing	3	2	1	0
Inability to stay seated	3	2	1	0
Overly talkative	3	2	1	0
Impulsive responses to test items	3	2	1	0
Poor focus on tasks, needs redirection	3	2	1	0
Lack of persistence, needs cues to persist	3	2	1	0
Difficulty entering or transitioning into testing room	3	2	1	0
Somatic Responses to Testing Situation				
Repeatedly requests to go to the bathroom	3	2	1	0
Complains excessively of being thirsty or hungry	3	2	1	0
Complains of being tired even though reportedly well rested	3	2	1	0
Complains of headache/stomachache/eyes hurt/not feeling well	3	2	1	0
Yawning	3	2	1	0

1. Observed but no modification by therapist needed to continue testing reliably
2. Interfered with testing; but with therapist's intervention and modification could continue test reliably (note modifications made)
3. Had to discontinue testing or felt performance was unreliable

Other Comments:

APPENDIX

13C

Parent Interview for Children With SMD

Child's name: ______________________

Child's ID #: ______________________

Parent's name: ______________________

Interview date: ______________________

Parent Interview

1. Tell me about [child's name: ____________]. I especially want to hear about the kinds of things that you enjoy about [child: ____________], what are his or her gifts and talents; what are his or her strong points.
2. What has led you to seek occupational therapy services for [child: ____________]? (If necessary: what have you noticed about [child's: ____________] development that concerns you?)
3. What do you know about sensory processing that has led you to seek occupational therapy for your child?
4. Tell me about [child's: ____________] abilities in:

   daily care activities

   playing

   making friends

   following directions

   communicating

   regulating his or her behavior:

   aggression

   anxiety

   activity level

   attention span

   sleep patterns

   self-esteem/confidence
5. Tell me what you notice about [child's: ____________]:

   reactions to sounds

   reactions to lights and other visual stimuli

   reactions to being touched

   reactions to smelling things

   reactions to moving in space
6. Tell me about your pregnancy, delivery, and [child's: ____________] early history.

7. Tell me about [child's: ____________] prior hospitalizations or medical problems.
8. Tell me about [child's: ____________] previous therapeutic interventions.
9. Tell me a little about who is in your family. What do you enjoy about your family the most?
10. Tell me what a typical day is like with your child.
11. (If in school) What is school (preschool) like for [child: ____________]? Is there anything that you would like to see changed about his or her school situation or the way he or she behaves or learns at school?
12. What are the barriers in [child's: ____________] world to his or her successful participation in meaningful activities?
13. What things do you think might help [child: ____________] to participate in those activities?
14. Has [child: ____________] had any traumatic experience that might affect his or her interventions?
15. What kind of equipment and/or toys do you have at home that [child: ____________] enjoys playing with? What kinds of activities does [child: ____________] do after school and on weekends?
16. What are your expectations and/or hopes for therapy? (Or what is it about [child: ____________] that you are hoping will change?)

APPENDIX

13D

Sample Goal Attainment Scale for Kamon

Name: Kamon

D.O.B.: 11/26/94

Age: 3 years 6 months

Sample Goal Attainment Scale for Kamon

Name: Kamon
D.O.B.: 11/26/94
Age: 3 years 6 months

*	Goal	1	2	3	4	5
1	Increase ease of and tolerance for dressing activities, (decreasing parent's involvement and the amount of time he needs to get dressed) by decreasing tactile defensiveness in body and head	Refuses to dress self/must be dressed by adult	Often has oppositional behaviors in dressing; sometimes can complete dressing in 2 hours if given assistance and redirection from an adult	Able to complete age-expected dressing activities within one hour; given preparatory sensory diet activities by an adult with prior set up and cues	Able to complete age-expected dressing activities within 30 minutes if given preparatory sensory diet activities with prior set up and occasional cuing by adult	Able to set up dressing, obtain sensory diet activities as needed, and complete age-expected dressing activities within 15 minutes
2	Increase ability to attend family events by increasing tolerance for everyday noises (decreasing auditory defensiveness)	Demonstrates behavioral distress for an hour after he is taken from situations where everyday noises occur	Removes self from noisy everyday situations (e.g., shuts door when hairdryer is running; avoids groups of children & parties)	Able to remain in presence of everyday group-type noise for an hour if an adult directs a sensory diet routine prior to & during the event	Able to remain in group situation for 2 hours in the presence of everyday noise after directed by adult to complete a routine sensory diet ahead of time	Able to remain in noisy group situation for 3 or more hours seeking self-selected sensory diet activities as needed
3	Increase ability to self-regulate and decrease tantrums at home especially when arriving home from school	Tantrums 10–20 times per day. Has a tantrum every day when arrives home from school even with sensory diet and behavioral interventions	Tantrums 5-10 times per day at home, especially when returning home from school or other outing	Tantrums 3–5 times per day & only 2–3 times per week directly after school; given adult-directed routine sensory diet 4 times a day & with special attention to sensory diet on the way home & immediately after getting home	Tantrums 1–2 times per day, only once per week directly after school; given adult-directed daily routine sensory diet and verbal encouragement to seek appropriate sensory tools after school	Tantrums once-twice per week, rarely directly after school; given adult-directed routine sensory diet. Beginning to seek his own sensory diet to help him remain regulated when returning home
4	Increase ability to play with other children by decreasing aggression that occurs when he "smells" others, or their normal, child like movement and touch come unexpectedly	Becomes combative during all play times with peers, so much so that friends no longer ask him over to play	Difficulty maintaining relationships with children his age. Identifies certain sensory aspects of children as the reason (e.g., "she smells" or "he touches me too hard")	Can have a friend over and participate in an age-appropriate manner for 1 hour if prepared by parent using sensory diet tools and parent supervises directly, suggesting sensory play as needed for regulation	Occasionally becomes combative during a play time with friend at home, but accepts parent-suggested sensory diet activities. Can play with supervision and sensory tools as needed for 2 hours	Can play for more than 2 hours independently without aggressive outbursts; seeks sensory diet activities for calming without parent cues when starting to feel aggressive
5	Improve praxis and perform age-appropriate fine motor tasks during school and play	Refuses participation in any fine motor tasks	Refuses to participate in most fine motor tasks or play with other children when fine motor skill is required	Engages in fine motor play for 5–10 minutes given preparatory sensory diet activities to hands and arms and a choice of two tasks	Engages in fine motor play for 10–20 minutes given short sensory diet preparation & a choice of two tasks	Engages in fine motor play for 30 minutes or more with sensory diet activities suggested by parent or teacher; beginning to seek own sensory activities to prepare for fine motor tasks

*Parents' priority for goals

Understanding the Nature of

SENSORY INTEGRATION

WITH DIVERSE POPULATIONS

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