Part Three:

Motor and Sensory Functioning

8

Assessment of Sensory Processing, Praxis, and Motor Performance

G. Gordon Williamson, Ph.D., O.T.R., Marie E. Anzalone, Sc.D., O.T.R., and Barbara E. Hanft, M.A., O.T.R.

This chapter discusses the domains of sensory processing, praxis, and motor performance. Sensory processing is the organization of sensory input from the body and the environment for use. Praxis is the ability to plan and sequence unfamiliar actions. Motor performance is the actual execution of the gross and fine motor coordination. This chapter provides general assessment guidelines that serve as the foundation for observing individual differences in sensory and motor functioning. It then presents qualitative and standardized evaluations for each of the three domains. The assessment process begins with an initial screening of the child. If findings are significant, qualified specialists need to conduct a more in-depth assessment. Extensive tables provide descriptions of available instruments and their sources. This discussion assumes that the child's vision and hearing have been previously evaluated for a primary sensory deficit.

GENERAL SCREENING AND ASSESSMENT GUIDELINES

This section provides general considerations for the screening and assessment of sensory processing, praxis, and motor performance. A screening provides an overall measure of the child's functioning in a particular domain and identifies whether there is a need for further assessment. A professional knowledgeable about child development from a variety of disciplinary perspectives is capable of conducting a screening. In contrast, when an assessment is necessary, a professional with specialized training in the area of concern is necessary. For example, a teacher could screen whether a child is having problems in fine motor control and sensory modulation, but an occupational therapist would be the most appropriate professional to complete the comprehensive assessment. The following guidelines, summarized in Box 1, establish important parameters for performing quality screening and assessment.

The key to assessment is to focus on *how* the child processes sensory information and manages environmental challenges and not to focus solely on the specific skills or milestones the child displays. This approach entails a dynamic *process* orientation to assessment in addition to a *product* focus typical of most developmental evaluations (Coster, 1998; Greenspan & Meisels, 1996). For instance, the milestone of building a block tower (product) may be analyzed in terms of the child's attention, task persistence, grasp patterns, problem solving, and other qualitative aspects

Box 1. General Screening and Assessment Guidelines

1. Focus on how the child processes sensory information using a dynamic *process* orientation.
2. Use parent interview and natural observation to gather information regarding sensory processing.
3. Do not look at the child in isolation, but observe the relationship between the child and the environment.
4. Remember that the influence of sensory input is not always immediately observable; there is cumulative effect and a latency of response.
5. Observe for autonomic signs of distress during or after sensory experiences.
6. Expect variability of responses to sensory input and behavior.
7. Keep in mind that sensory-based stereotypic behaviors serve different functions depending on the child's current sensory threshold.
8. Design the assessment process to provide the child with opportunities for choice, self-initiation, creativity, and flexible problem solving.

of performance (process). Likewise, assessment of repetitive rocking would include an analysis of what environmental conditions precede or follow this behavior. Such qualitative information enables the practitioner to understand the child and design meaningful intervention.

There are many ways to gather information regarding a child's capacity to process sensory information. The most effective methods are parental interview and natural observation of the child within the context of relationships, play, and functional activities. These primary approaches are supplemented by the administration of standardized tests. Observation of the following situations is particularly informative in understanding the child's sensory and motor processing: independent and social free play, mealtimes, bathing and other functional activities, structured and unstructured peer interaction, parent-child interaction, and transitions between activities.

An examiner does not look at the child in isolation during the assessment process, but at the relationship between the child and environmental challenges (Hanft & Place, 1996). The practitioner should avoid focussing on pathology and recognize that functional difficulties can arise from a poor fit between the child's needs and available resources. The fit may be complex, subtle, and dynamic. For example, a child who is distractible during play may be responding to glaring lights or a chaotic playroom instead of to internally driven impulsivity.

The influence of sensory input is not always immediately observed. There is both a cumulative effect and a latency of response. The response to sensation builds up over time and is cumulative (e.g., a child may be more sensitive to touch at the end of a long day rather than in the morning). Conversely, some children are slow to register input because of a high threshold but can rapidly become overloaded by accumulated sensation. Both of these tendencies makes it essential that any changes in the amount or type of sensory input provided to the child be done slowly and conservatively.

It is essential to observe the child closely after sensory experiences for autonomic

signs of distress (e.g., yawning, hiccuping, sighing, irregular respiration, color change, sweating, motor agitation, startling, pupil dilation) or changes in sleep/wake patterns (Als, 1986). If the child demonstrates autonomic signs of distress, the examiner should stop the activities immediately and determine the cause for the child's reaction. Consultation with a knowledgeable therapist is helpful for determining an appropriate course of action for the future.

Variability in a child's daily performance is common. At any time, the consistency of a child's behavior can be influenced by many factors, such as the degree of environmental stimulation, the child's current emotional state, general level of arousal, coping skills, accumulated sensory build-up, and the availability of a familiar caregiver. Children with sensory processing problems are more often variable than predictable in their performance day by day. Therefore, any assessment must allow for repeated observations over time.

Stereotypic and repetitive sensory-based behaviors serve different functions, based on the child's current sensory threshold (Anzalone & Williamson, 2000). A child who is hyperreactive at a given moment (i.e., with a low threshold for sensory input) may use hand-flapping to gain selective focus and to screen out the rest of the visual environment. The outcome can be calming and organizing. The child who is hyporeactive (i.e., with a high threshold for sensory input) may use this same behavior to increase arousal and activation. A third child may use hand-flapping to discharge tension. Practitioners must use their knowledge of sensory processing to understand these stereotypical mannerisms and rituals. Behavioral techniques that do not consider sensory needs may result in stereotypies that resurface in a different form. Inappropriate behavioral intervention would involve intrusive, highly adult-directed discrete trials when a child has major problems in sensory modulation. In such cases, it is a therapeutic error to interpret gaze avoidance or tactile defensiveness as willfully noncompliant behavior.

The examiner should not over-structure the assessment environment. The assessment process should provide the child with opportunities for choice, initiation, creativity, and flexible problem solving. During part of the time, the examiner needs to step back and avoid controlling the environmental conditions or initiating interactions. Direction from the examiner, although necessary for certain types of testing, can inhibit the child from expressing individual differences during qualitative observation.

Sensory Processing

It is important to evaluate two components of sensory processing as part of the assessment (Ayres, 1972; Fisher, Murray, & Bundy, 1991). First is sensory modulation, which is the ability to register, orient, and initially react to sensory stimuli. Second is the actual perception and discrimination of that input. Perception is the interpretation of sensory input in light of prior experiences and learning. Important to both modulation and perceptual discrimination are the sensory modalities and properties inherent in the stimuli themselves. Sensory modalities include the environmental senses (vision, hearing, smell, taste) and the body senses (vestibular, proprioception, touch). Proprioception is sensation from the muscles and joints that provide information about the posture and movement of the body. Vestibular receptors in the inner ear are responsive to movement of the body in relation to gravity.

When assessing sensory processing, it is essential to evaluate the child within the environment. The examiner must evaluate the

situational demands, goodness-of-fit between the child and the environment, and the sensory properties of the environment (Schaaf & Anzalone, in press). Such sensory properties include intensity and duration. Intensity refers to how powerful or arousing the stimulus is. For example, light touch is more intense than firm touch, and touch on the face is more intense than on the arm. Duration encompasses both the length of the actual stimulus (e.g., how long a sound persists) and the lasting effect of that stimulus within the central nervous system (e.g., rapid spinning resulting in motion sickness or a prolonged increase in activity level). Since each child experiences sensory input in a unique way, an individualized approach to assessment is indicated. The examiner must evaluate both the stimulus (i.e., the objective sensory input) and the sensation (i.e., a specific child's subjective appraisal of that input). Sensation is influenced by the task demands and the child's prior sensory experiences, current state of arousal, and affective state. For example, a light touch perceived as pleasant by one child might be considered threatening or painful by another.

The assessment process considers the behavioral expression of sensory processing in terms of the child's self-regulation of arousal, attention, affect, and action (Williamson & Anzalone, 1997). The child's sensory status moderates, and is moderated by, the child's state of arousal. Arousal is a child's level of alertness and the ability to maintain and transition between different sleep and wake states. The sensory status also influences the child's attention, which is the ability to focus selectively on a desired stimulus or task. Affect, which is the emotional component of behavior, is also influenced by sensory input through either the emotional response to a specific input (e.g., fearfulness in response to unexpected light touch) or through a global effect on behavior (e.g., the excitement of a child who has just gotten off a swing). Finally, action, which is the ability to engage in adaptive goal-directed behavior, is dependent upon sensory integration.

A child's ability to self regulate these processes depends upon the child's initial registration of sensory stimuli. Registration is the point at which novel sensory information is initially detected and the central nervous system activated. This point is considered the sensory threshold. Some children have a low threshold that results in hyperreactivity or sensory defensiveness. Their behavior is frequently characterized by high arousal, an inability to focus attention, negative or fearful affect, and impulsive or defensive action. Other children have a threshold that is very high, causing them to be hyporeactive to sensory input. Their state of arousal is usually decreased with a prolonged latency or an inability to attain focussed attention. Affect is typically flat, with a restricted expression of emotion that may interfere with social engagement. Their action tends to be passive and sedentary.

Perceptual discrimination is based upon the child's sensory modulation and higher order cognitive processes. The primary perceptual functions to be assessed in young children include visual, auditory, and tactile discrimination. Sample higher order perceptual skills include visual or auditory figure ground perception, visual-spatial relations, auditory memory, tactile localization, and stereognosis. Assessment of these functions is beyond the scope of this chapter, but is discussed in the clinical literature (e.g., Lezak, 1995; Schneck, 1996; Wetherby & Prizant, 2000).

Children with autistic spectrum disorders have sensory modulation problems present in two primary patterns: hyperreactive and hyporeactive. The profiles of each of these patterns provide a helpful framework for

understanding the behavioral patterns of these children. A specific child, however, may have a combination of symptoms and not fit clearly into any one category (Anzalone & Williamson, 2000).

Hyperreactivity

Children with *hyperreactivity* tend to have a low sensory threshold and a bias toward a sympathetic nervous system reaction. (Sympathetic responses are those that indicate activation of the central nervous system, such as increased heart rate and respiration.) These children have a restricted range of optimal arousal. Their arousal level tends to be high with a narrow, rigid control of sensory input. It is important to note that the observable behavioral arousal is not always the same as physiological arousal as reflected by measures such as heart rate and respiration. Some hyperreactive children may appear to be nonresponsive or under- aroused when, in fact, they are physiologically over-aroused (e.g., they may have either high levels of cortisol or elevated heart rate while appearing behaviorally inactive) (Miller & McIntosh, 1998; Porges, McCabe, & Yongue, 1982; Wilbarger & Wilbarger, 1991). In some children, this sensory overload becomes so threatening that they respond with an involuntary behavioral and physiological shutdown.

Children with hyperreactivity may overfocus their attention on detail (Kinsboume, 1983). This phenomenon serves a gate-keeping or screening function, excluding a more generalized sensory awareness of the environment. The affective range of these children is usually limited, varying from disconnection to sensory input to negative withdrawal. An exception is the positive effect often associated with spinning of self or objects. Action in children with hyperreactivity tends to be narrowly focused, with limited elaboration and inflexibility of behavior that often serves to control sensory input. Some of these children show little or no initiation of engagement. Others demonstrate repetitive actions; still others display surprising competence in very specific skills. Children with hyperreactivity may be very concerned about becoming disorganized and develop rigid routines, compulsions, and stereotypic patterns that help them maintain self-control. All these behaviors can be seen as adaptive at some level, as they are ways in which the children are trying to monitor and manage their registration and interpretation of sensory input so that they can maintain a level of comfort. These behaviors often interfere with interaction rather than foster it. Certain types of everyday sensation are actually painful for these children. The sound of a door slamming, unexpected laughter on a television soundtrack, or thunder can be so uncomfortable that the children will do everything they can to avoid experiencing the sensation again. Their rigid, controlling behaviors and rituals are understandable attempts to limit noxious sensory input, or at least to make the input predictable.

Hyporeactivity

Children with *hyporeactivity* tend to have a high sensory threshold; that is, they require a lot of sensory input to achieve arousal and activation. These children often have not registered novel sensory input; thus, they only have minimal information on which to base any interpretation. They do not learn from the environment because they have not noticed it. Their state of arousal is usually low or unmodulated. Attention is unfocussed or narrowly targeted to a specific type of sensory seeking to meet inner needs. Affect may be flat or uninvested, but may brighten with vestibular input. Action tends to be passive, aimless, and wandering. However, some children with hyporeactivity may have an insatiable craving

for a preferred type of sensory input and may seek it out in order to be "fueled." Spinning (rotary vestibular activity) is a favorite type of stimulation. Frequently, children with bland, disconnected affects become delighted once they start to spin. It should be noted that the sensory input that is the most arousing for these children is not necessarily the most organizing.

There are two important caveats in understanding the sensory modulation profiles of children with autistic spectrum disorders. First, a child who appears flat and unavailable may not be hyporeactive. As previously mentioned, some of these children are actually physiologically hyperreactive, and their behavioral shutdown is the opposite of their internal state. During an assessment, the examiner can differentiate between these two profiles by systematically decreasing sensory input, providing organizing activity, and observing behavioral responses over time. With decreased sensory input, the child who is truly hyperreactive will become calmer and more attentive, whereas the truly hyporeactive child may become more lethargic. Second, not all sensory seeking behaviors are associated with hyporeactivity. Some children with hyperreactivity or sensory defensiveness may engage in sensory seeking as a way to modulate their reactions to sensation (i.e., discharging tension or refocusing attention to organize themselves).

Mixed Patterns

A child with autism or pervasive developmental disorder (PDD) can have a *mixed pattern* of being hypersensitive in certain modalities (often auditory or tactile) and hyposensitive in others (frequently proprioceptive or vestibular). Likewise, a child may have variability of responses within a single sensory modality (e.g., a child may be hyperreactive to high-frequency sounds and hyporeactive to low-frequency sounds). A child can also be inconsistent over time in responding to the same stimulus. Variability among and within sensory systems is frequently linked to the child's shifting state of arousal, attention, and previous sensory experiences.

Some children have jumbling or distortion of sensory input and do not fit into the described clinical profiles. There is an erratic fluctuation in the registration of sensory input, somewhat like a volume switch being turned up and down repeatedly. For example, these children may hear only parts of words (e.g., the first part, the last part, or no consonants) or find that auditory or visual signals are intermeshed. Some adults with autism report seeing vibrations around a television set when it is on (Grandin, 1995; Williams, 1994).

Assessment of Sensory Processing

As previously described, sensory processing encompasses sensory modulation and perception. Sensory modulation precedes the more cognitive component of perception. This discussion focuses primarily on sensory modulation—the ability to register and orient to sensory stimuli. Assessment of sensory processing includes three complementary strategies: qualitative observation; parent interview; and, possibly, the administration of standardized instruments. Observation and parent interview are particularly important for screening, for enabling the practitioner to identify potential problems as well as the need for more in-depth assessment. A complete evaluation may require the skills of an occupational therapist with specialized training in sensory processing.

Qualitative Observation

Observation is the primary mode the examiner uses to identify problems and plan interventions for children who have difficulties in sensory processing. Examiners depend

less on standardized instruments because they do not reliably capture individual differences in this aspect of performance since sensory processing is so variable and dependent upon a child's prior experiences. In designing qualitative observations of performance, it is helpful for the examiner to contrast behavior in structured and unstructured situations. Unstructured situations may include individual free play, gross motor exploration, and activities of daily living. Structured tasks may include observation during formal evaluations and adult-controlled situations. The examiner should observe the child's performance in relation to the sensory demands of the environment (e.g., a child's increased arousal and impulsivity would be interpreted differently in a disorganized setting versus a quiet one).

Observation of the Child. The practitioner observes the child's reactivity during engagement in a variety of tasks as well as the child's global behavioral organization. Observation focuses on the influence of sensory input and its impact on the child's self-regulation of arousal, attention, affect, and action. Since the child's reactivity to sensory input is cumulative, the examiner should observe the child's behavior over time. For instance, a child may exhibit a temper tantrum in the late morning that is a result of sensory buildup over the course of 3 hours in a childcare center. Variability in performance is expected in these children and the assessment should document the range of response. The examiner should pay special attention to the sensory conditions that support optimal performance.

The following list provides questions that an examiner can use to focus observation on relevant factors related to sensory-based behavioral organization in the child.

Arousal

- What is the child's state of alertness and how does it change in response to different sensory experiences?
- Is the child able to transition smoothly between different states of alertness?
- Is the child able to sustain levels of energy and activity that support successful task engagement?
- Does the child have a narrow or wide range of optimal arousal?
- Does the child have a range of coping strategies that enable him to modulate sensory reactivity and arousal?

Attention

- Is the child able to maintain selective focus on relevant stimuli?
- Is the child able to shift attention between two or more targets or modalities?
- Is the duration of the child's attention span comparable to other children of the same age?
- When attending to tasks, does the child seem to be using more effort than other children of the same age?
- Does the child prefer or avoid certain sensory modalities?

Affect

- Does the child have an organized range of emotional expression?
- Is there a predominant emotional tone in the child (e.g., fearfulness, anxiety, defiance, or withdrawal)?
- Is the child available for social interaction with peers and adults?
- Will the child interact socially with peers and adults?
- Does the child have a playful disposition that reflects ease in the situation and supports learning and engagement?

Action

- Is the child able to formulate goals for play behavior that are appropriate to his or her developmental skills and environmental opportunities?
- Is the child able to solve problems encountered during exploration or play with creativity, flexibility, and persistence?
- Is the child's behavior characterized by consistent approach or avoidance of specific materials or tasks?
- Does the child have adequate motor planning and coordination for age-appropriate tasks?

Observation of the Context. In addition to observing the arousal, attention, affect and action of the child as they relate to sensory modulation, the examiner also has to examine the characteristics of the physical and social environments. It is the interaction of the child and the environment that produces the sensory-related behavior. The examiner should simultaneously observe the child and the context in order to determine the goodness-of-fit between the two elements (Williamson, 1993; Zeitlin & Williamson, 1994). Without an understanding of this connection, the practitioner can make incorrect clinical assumptions. For example, a child may demonstrate defensive behaviors such as gagging, spitting up, and facial grimacing during feedings. These behaviors could be interpreted as hypersensitivity in the oral area. However, closer examination of the environmental context reveals that the caregiver is feeding the child too quickly, which elicits the aversive reaction. The difficulty is not sensory-based, but rather an indication of inappropriate feeding technique. Therefore, the context in which a child is functioning contributes to an understanding of the sensory processing of the child. The examiner needs to appreciate the sensory attributes of the environment and how well they match the child's capacity for self-regulation and organization. A chapter appendix provides an observational form to assess the sensory-based characteristics of a school environment (Hanft & Place, 1996). The following questions can help focus observation on critical aspects of the physical and social environments.

Context

- What sensory input characterizes the physical and social environments (e.g., visual, auditory, tactile, proprioceptive, vestibular)?
- What are the sensory properties of the identified sensory systems (e.g., rate, intensity, and duration)?
- Does the environment require the child to form a response by organizing information simultaneously from different sensory systems?
- What is the quality of the physical environment in terms of temperature, lighting, noise, space, and related properties?
- What are the social characteristics of the situation (e.g., adult or peer, individualized or group, verbal or nonverbal, child- or adult-directed)?
- What are the specific environments, situations, or individuals that are particularly organizing for the child?
- Does the environment provide a routine that is reasonably predictable, consistent, and structured?

Parent Interview and Questionnaires. The parent interview supplements the examiner's observation of the child and context in providing important information regarding the child's ability to modulate sensory input in a variety of situations. The practitioner gathers information from the parents about the child's "sensory diet" (Wilbarger, 1995;

Williams & Shellenberger, 1996). The sensory diet is the profile of naturally occurring activities that occur throughout the day that provide sensory input and influence the child's regulation of arousal, attention, affect, and action. The profile provides data about the child's sensory tolerances and preferences as they are reflected in daily activity. It also identifies periods of behavioral organization and disorganization during the day and relates it to ongoing sensory experiences and environmental demands. Some situations that provide valuable insight into sensory modulation are bathing, mealtimes, disruptions in typical routines, and preferences in clothing or play. The following questions may generate a productive discussion with the parent or caregiver regarding a child's sensory processing and how it influences child and family functioning. These questions are designed to provide a starting point for an interview. They should be used selectively based on the presenting needs of the child and family.

Parent/Caregiver Observations

- What is a typical day like?
- What types of sensory activities does your child like and dislike?
- How does your child manage transitions and changes in daily routines?
- Is there a predictable time of day or type of activity when your child is most or least organized?
- Are your child's activities of daily living and self-care tasks limited by sensory or motor problems (e.g., does not tolerate textured foods, fearful during bathing)?
- Does your child have habits and routines that support daily functioning?
- How does your child respond to affectionate physical touch or handling?
- Does your child initiate exploration of novel as well as familiar situations?
- Does your child enjoy playing with other children?

The examiner can supplement semi-structured interviews with standardized questionnaires regarding the child's sensory and self-regulatory performance. The Infant Toddler Symptom Checklist (DeGangi & Poisson, 1995) addresses such areas as self regulation, attention, sleeping, eating, dressing, bathing, movement, language, vision, and emotional functioning in children between 7 and 30 months of age. The Sensorimotor History Questionnaire for Preschoolers (DeGangi & Balzer-Martin, in press) is a 51-item questionnaire that has been validated as a screening tool for 3-to 4-year-olds (see chapter appendix). This questionnaire categorizes behavior in terms of self-regulation, sensory processing of touch, sensory processing of movement, emotional maturity, and motor maturity. The Sensory Profile (Dunn, 2000 is a parent questionnaire appropriate for assessing sensory processing of children 3 to 10 years of age. Its 125 items address different sensory systems, activity level, movement, and emotional-social functioning. This questionnaire has been extensively studied with normative and clinical populations (Dunn & Brown, 1997; Dunn & Westman, 1997; Kientz & Dunn, 1997). The Short Sensory Profile (McIntosh, Miller, & Shyu, 2000) is an abbreviated version of the Sensory Profile with sound psychometric properties. The Short Sensory Profile has only 38 items in 7 subscales: tactile sensitivity, taste/smell sensitivity, under-responsive/seeks sensation, auditory filtering, visual/auditory sensitivity, low energy/weak, and movement sensitivity. The Functional Behavior Assessment for Children with Sensory Integrative Dysfunction (Cook, 1991) provides a way to use parent interviews to gather data regarding sensory-related activities of daily living.

Standardized Instruments. In addition to observation and parent interview, an

examiner can use standardized instruments to assess sensory modulation. Table 1 describes the relatively few standardized tools that are available. The Test of Sensory Functions in Infants (DeGangi & Greenspan, 1989) is a diagnostic, criterion-referenced test administered by professionals trained in child development and sensory processing. It is designed to assess infants and toddlers with regulatory disorders, developmental delay, and those at risk for learning disorders. The Early Coping Inventory (Zeitlin, Williamson, & Szczepanski, 1988) assesses the coping style of children 4 to 36 months of age. The coping behaviors of the children are observed over time in a variety of situations. This psychometrically sound tool is particularly sensitive to measuring sensory-based self-regulation and adaptation. The Sensory Integration and Praxis Tests (Ayres, 1989) are a diagnostic, norm-referenced test battery designed for school-aged children who are relatively high functioning. Sensory modulation is not directly measured on this instrument but can be inferred from qualitative observation. This battery requires extensive formal training for reliable administration and is dependent on the child having receptive language skills at the 4-year-old age level. It is typically not used for children with autistic spectrum disorders.

PRAXIS

Praxis is the ability to plan and sequence unfamiliar actions. It evolves from the interaction between the child and the environment and reflects the quality of sensory integration (Ayres,1985; Cermak, 1991). Praxis consists of three different components: (1) ideation, (2) motor planning, and (3) execution. *Ideation* is the ability to formulate a goal for action. It is the cognitive step of recognizing the multiple ways that toys, objects, or one's body can be used in play and learning

Table 1. Standardized Instruments for Assessing Sensory Processing

Name of Test	Age Range	Comments	Source
Test of Sensory Functions in Infants	4–18 months	Subtests include reactivity to tactile deep pressure and vestibular stimulation, adaptive motor functions, visual-tactile integration, and ocular-motor control.	DeGangi, G. A., & Greenspan, S. I. (1989) Western Psychological Corporation 12031Wilshire Blvd. Los Angeles, CA 90025
Early Coping Inventory	4–36 months	The instrument addresses sensorimotor organization, reactivity, and self initiation as the child copes with daily living.	Zeitlin, S., Williamson, G. G., & Szczepanski, M., (1988) Scholastic Testing Service 480 Meyer Road Bensonville, IL 60106
Sensory Integration & Praxis Tests	4 years, 6 months– 8 years, 11 months	12 subtests assess sensory and perceptual function in visual perceptual, visual, vestibular and postural, and somatosensory domains.	Ayres, A. J. (1989) Western Psychological Services 12031 Wilshire Blvd. Los Angeles, CA 90025

situations. For example, the child appreciates that there are a number of ways to play with a toy truck. *Motor planning* involves figuring out how to get one's body to carry out the goal for action. This step of planning and sequencing of motor tasks is based on the child's body scheme; that is, an internal sensory awareness of body parts, how they fit together, and how they move through space. Motor planning is active problem solving and reflects an inner, sensory awareness of one's physical self. *Execution* is the actual performance of the planned action. It involves gross and fine motor coordination to accomplish the task.

Children with dyspraxia may have difficulty with any one or a combination of these three components. A lack of ideation is noted if the child is unable to formulate new goals specific to situational demands. The child does not have an idea of what to do or is rigid or inflexible in goal formulation. With a deficit in motor planning, the child knows the purpose of the object or task but cannot organize motor patterns to interact effectively with the environment or solve the problem. Children may tend to be inactive or play in a limited, perseverative pattern (e.g., lining up toys). Children with autistic spectrum disorders tend to have a primary deficit in ideation and a secondary one in motor planning. Impairment in execution is relatively less common in children with autism.

Children with dyspraxia are typically clumsy with a poor body scheme. They do not know where their body is in space and have difficulty judging their relationship to objects and people. As a result, they are accident-prone and tend to stumble, bump into furniture or others, and break toys. They are generally poor in athletics. Since these children have difficulty in sequencing daily activities, they tend to be disorganized and disheveled looking. Due to their inflexibility in activity, they may perseverate and tend to prefer the familiar. Self-esteem is often poor as a result of frustration and repeated failure. They may be judged at times as manipulative and controlling. These behaviors reflect the child's use of language to compensate for the dyspraxia (e.g., distracting and redirecting attention away from the motor disorder). Problems in sequencing can include language, in which case organizational and educational deficits are generally present.

Observation of Praxis

The major means of assessing praxis is through observation of the child during novel gross and fine motor tasks. It is often observed that the child uses visual monitoring of movements to accomplish the skill. The examiner must provide a range of activities that require the control of large muscles as well as fine manipulation. Since children with dyspraxia often rely on familiar, overlearned activities, it is essential that any observation of praxis provide unexpected, flexible, and novel situations that challenge the child's ability to problem solve motor tasks. Observation focuses on *how* the child plans and sequences these tasks. The examiner should screen for the following behaviors during several observation periods.

Dyspraxia Indicators

- Inflexibility—perseverates on one aspect of the task and has difficulty in making transitions
- Lack of sensorimotor exploration
- Limited complexity of play
- Restricted problem solving of new tasks
- Low frustration tolerance
- Presence of "crash" solutions to terminate demanding activities (e.g., knocking down or throwing)

- Lack of organization in performance of activities
- Clothes in disarray and/or unfastened
- Poor quality of fine motor skills
- Poor temporal awareness and sequencing of daily living tasks
- Avoidance of group activities and peer play
- Preference for adult one-to-one interaction

A diagnosis of dyspraxia is not achieved with one observation but evolves over time. The examiner has to observe the child in numerous settings under diverse conditions to determine the nature of the problem. Is the breakdown in task engagement due to a sensory-motor deficit or other factors such as distractibility or impulsivity? Is this a sensory processing/practice deficit or primarily an issue of motor strength and coordination? Is the difficulty due to ideation, motor planning, and/or execution?

Assessment of Praxis with Standardized Instruments

As with sensory processing, there are few standardized instruments that are available for screening and assessment of praxis (see Table 2). Observation and clinical judgment are the most important factors in determining when praxis contributes to a performance deficit. For screening purposes, the Miller Assessment of Preschoolers (Miller, 1982) is a norm-referenced test that provides a few items directly addressing a child's motor planning. More formal standardized instruments for older children are the Sensory Integration and Praxis Tests (Ayres, 1989). This battery has specific tests that measure different components of praxis (e.g., postural praxis, sequencing praxis, oral praxis, constructional praxis, praxis on verbal command). As noted previously, this test is complex and requires certification through a formal training program.

MOTOR PERFORMANCE

Motor performance in the young child involves four interdependent components: neuromotor processes, and gross motor, fine motor, and oral-motor development. *Neuromotor processes* involve the underlying musculoskeletal elements that support movement, such as muscle tone and joint range of motion. *Gross motor* function incorporates those movements, postures, and skills of the large

Table 2. Standardized Instruments for Assessing Praxis

Name of Test	Age Range	Comments	Source
Miller Assessment of Preschoolers	2 years, 9 months – 5 years, 8 months	Developmental screening test that includes praxis items (imitation of postures and solving a maze).	Miller, L. J. (1982) Psychological Corporation 555 Academic Court San Antonio, TX 78204
Sensory Integration & Praxis Tests	4 years, 6 months – 8 years, 11 months	12 subtests assess sensory and perceptual function in visual perceptual, visual, vestibular and postural, and somatosensory domains.	Ayres, (1989) Western Psychological Services 12031 Wilshire Blvd. Los Angeles, CA 90025

muscles, whereas *fine motor* function is dependent on the small muscles of the arms and hands. *Oral-motor* function is based upon actions of the facial musculature for speech and eating. Table 3 provides further descriptions of each of these four components of motor performance.

There is more to assessment of motor performance than establishing the presence or absence of milestones and determining a

Table 3. The Four Components of Motor Performance

Component	Description
Neuromotor Processes	
Muscle tone	Muscle tension, ranging from hyper-to hypotonic, for maintaining posture and position of arms/legs for specific tasks
Range of motion	Extent of movement of each body joint, particularly arms, legs, trunk, and head
Postural stability and mobility	Holding positions and moving body parts to accomplish task (e.g., stabilize trunk and shoulders to squeeze toy with hands)
Symmetry	Use of both sides of the body in simultaneous or reciprocal action appropriate to the task at hand
Quality of movement	Degree to which child's actions are fluid and coordinated
Gross Motor Function	
Physical postures	Assuming and changing basic body positions for the task at hand (e.g., prone, supine, 4-point, sit, kneel, stand)
Physical skills	Actions dependent on large muscle movement (e.g., jumping, hopping, throwing a ball)
Functional mobility	Patterns of locomotion to move self from one point to another (e.g., rolling, crawling, creeping, walking, running)
Fine Motor Function	
Reach, grasp, and manipulation	Use of the arm/hand to secure, hold, and handle objects, toys, and utensils
Hand preference and bilateral coordination	Using two hands together, for stability and skilled manipulation (e.g., manipulatory exploration, using a fork, buttoning, writing with a pencil)
Visual-motor coordination	Coordination of visual perceptual information with action to guide the hand in skilled tasks
Oral-Motor Function	
Actions of the tongue, lips, cheeks	Coordination of sucking, swallowing, breathing, chewing, biting for eating, speaking, and self-exploratory play

developmental age. The *quality* of the child's motor performance is also a concern (e.g., a child's reach can be smooth and direct or tremulous). Many standardized tests provide a quantitative measure of the child's performance but fail to capture this qualitative aspect. It is often necessary for the practitioner to supplement findings with a clinical description of observations. Subtle differences in motor performance are important to note since they are often associated with early signs of behavioral and learning difficulties (e.g., low muscle tone and poor balance reactions are often seen in children who later exhibit learning or language disabilities).

A related issue is the need to evaluate the child's performance in terms of mobility and stability rather than as a compilation of motor skills. A child must be able to move part of the body with the active support of the rest of the body in order to develop gross and fine motor skills such as crawling, coloring, or buttoning. For example, in order to crawl, a child must move one hand and knee while the other hand and knee support the body weight. In the fine motor arena, this interplay between stability and mobility is equally important. For example, in order to color with a crayon, a child must be able to sit up and keep the head and shoulder steady (stability) while moving the wrist and fingers (mobility). This issue is critical since many children have inadequate stability to support functional movements (e.g., the preschool child who slouches in the chair during tabletop activities). Through the assessment, the examiner determines the adequacy of the child's mobility and stability functions during different motor tasks. The examiner always assesses motor performance in context and how the child organizes posture and movement to meet changing environmental demands.

Assessment of Neuromotor Processes

Assessment of neuromotor processes in young children focuses on muscle tone, range of motion, postural stability and mobility, symmetry, and quality of movement (DeMyer,1994; Piper & Darrah, 1994). These underlying neuromotor processes influence how a child assumes and maintains the positions needed to participate in play, self-help, and learning activities. Occupational and physical therapists have expertise in evaluating neuromotor processes using clinical observation and criterion-referenced scales. Other professionals can screen children to determine the need for an in-depth assessment of neuromotor functions. The following questions can guide the screening. A "yes" response to a number of these questions indicates the need for a comprehensive assessment. Concern is greatest if these risk indicators interfere with the child's acquisition of developmental skills.

Neuromotor Deficit Indicators

- Compared to peers, does the child have problems maintaining his or her posture during activity? Subtle examples of possible delays in neuromotor processes include leaning on the table for support, holding onto the wall to kick a ball, or lying on the floor instead of sitting during circle time.
- Compared to peers, is the child's muscle tone in the trunk and limbs too stiff or loose, resulting in restricted or floppy movement?
- Under the age of 3 years, does the child use one hand exclusively in play and self-help tasks? This may indicate a neglect of one body side or unusual muscle tone during a period when children are developing bilateral skills.

- Does the child fatigue easily and demonstrate poor endurance, especially during activities and gross motor play?

Table 4 lists criterion-referenced instruments useful for in-depth assessment of neuromotor processes. These tools require training to achieve reliability in administration and scoring. They are helpful for the early identification of emerging motor problems and soft neurological signs before the establishment of clear motor deficits or a definitive medical diagnosis. Understanding the neuromotor processes helps one to appreciate the reasons for a developmental delay or functional limitation in motor performance.

Assessment of Gross Motor Function

Gross motor skills affect how children coordinate their body positions, move fluidly from one location to another, and interact with people and objects. Assessment of gross motor skills focuses primarily on physical posture and skills as well as functional mobility and stability (Alexander, Boehm &

Table 4. Measures of Neuromotor Processes

Name of Test	Age Range	Comments	Source
Test of Infant Motor Performance	32 weeks gestation–4 months	Assesses the influence of postural control on head, trunk, arm, and leg movements	Campbell, S., Osten, E., Kolobe, T. & Fisher, A. (1993). Development of the Test of Infant Motor Performance. In C. Granger, G. Gresham (Eds.), *New developments in functional Assessment.* Philadelphia: W. B. Saunders
Alberta Infant Motor Scale	0–18 months	Observational and naturalistic assessment of ability within prone, supine, sitting, and standing positions	Piper, M., Darrah, J. (1994). *Motor assessment of the developing infant.* Philadelphia: W. B. Saunders.
Movement Assessment of Infants	0–12 months	Assesses muscle tone, reflexes, automatic reactions, and voluntary movement	Infant Movement Research PO Box 4631 Rolling Bay, WA
The Infanib	0–18 months	Consists of 20 items in 5 categories: spasticity, head and trunk, vestibular function, legs, French angles	Therapy Skill Builders 555 Academic Court San Antonio, TX 78204-2498
DeGangi-Berk Test of Sensory Integration	3–5 years	Measures three vestibular-based functions: postural control, bilateral motor integration and reflex integration	Western Psychological Services 12031 Wilshire Blvd. Los Angeles, CA 90025

Cupps, 1993; Bly, 1994). Table 5 identifies measures of gross motor function commonly used by occupational and physical therapists. There also are global developmental assessments that include major sections addressing gross motor development that are used by interdisciplinary professionals, but which are not referenced in this discussion.

Assessment of Fine Motor Function

Fine motor skills affect how children use their eyes and hands to manipulate objects, tools, and toys to engage in self-help and play activities, such as eating with a spoon, buttoning clothing, turning the pages of a book, and combing a doll's hair. Fine visual-motor skill

Table 5. Measures of Gross Motor Function

Name of Test	Age Range	Comments	Source
Gross Motor Function Measure	General	Assessment of motor function in five dimensions: lying/rolling; sitting; crawling/kneeling; standing; walking, running, jumping	Dianne Russell Dept. of Clinical Epidemiology & Biostatistics, Bldg. 74 Chedoke Campus McMaster University of Hamilton, Ontario Canada LSN 325
Peabody Developmental Motor Scales (PDMS) (revision underway)	0-83 months	Two scales measure gross motor skills (reflexes, balance, non-locomotor, locomotor, receipt/propulsion of objects) and fine motor skills (grasping, hand use, eye-hand coordination and, manual dexterity)	DLM Teaching Resources One DLM Park Allen, TX 75002
Bruininks-Oseretsky Test of Motor Proficiency (BOTMP)	4 years, 6 months–14 years, 6 months	Fine, gross, and visual-motor sections yield information in standard scores and age equivalents	American Guidance Service Circle Pines, MN 55014
Functional Independence measure for Children (WEEFIM)	6 months–7 years	Measures function in order to determine extent of care needed in: self-care, sphincter management, mobility, locomotion, communication, social cognition	Center for Functional Research U.B. Foundation Activities 82 Farber Hall SUNY – South Campus Buffalo, NY 14214
Pediatric Evaluation of Disability Inventory (PEDI)	6 months–7.5 years	Assesses functional abilities and performance in three domains: self-care, mobility, and social function	PEDI Research Group Dept. of Rehab Medicine New England Medical Center #75 K/R750 Washington St. Boston, MA 02111
School Function Assessment (SFA)	Grades K-6	Measures a student's performance of functional tasks (including eating, mobility, tool use and manipulation) that support participation in an elementary school program	Therapy Skill Builders 555 Academic Court San Antonio, TX 78204

Table 6. Measures of Fine Motor Function

Name of Test	Age Range	Comments	Source
Developmental Test of Visual Motor Integration (revised, 1997)	2 years, 9 months–19 years, 8 months	Looks at integration of visual perception and motor control; yields age equivalents, percentile ranking, and standard scores	Modern Curriculum Press 13900 Prospect Road Cleveland, OH 44136
Test of Visual Motor Skills (1986)	2–13 years	Measures ability to copy 26 different designs. Yields motor ages, standard scores, percentiles, and stanine scores	Children's Hospital of San Francisco Publications Dept. OPR-110 PO Box 3805 San Francisco, CA 94119
Developmental Test of Visual Perception (2nd ed.)	4–10 years	Subtests measure visual perceptual ability with two conditions: motor-reduced or motor-enhanced. Provides age equivalents, percentiles, and composite quotients	Western Psychological Services 12031 Wilshire Blvd. Los Angeles, CA 90025

***Note**: See also the following tests, as reviewed in the previous section on assessing fine motor function: Peabody Developmental Motor Scales (PDMS), Bruininks-Oseretsky Test of Motor Proficiency (BOTMP), Functional Independence Measure for Children (WEEFIM), Pediatric Evaluation of Disability Inventory (PEDI), and School Function Assessment (SFA).*

is also a factor in manual communication through gestures, sign language, drawing, and painting. Assessment of fine motor skills focuses particularly on reach, grasp, hand preference, bilateral coordination, manipulation, and visual-motor control (Henderson & Pehoski, 1995).

Table 6 identifies measures of fine motor function commonly used by occupational therapists and educators. In addition to these, there also are comprehensive developmental assessments that include major sections on fine motor development.

Assessment of Oral-Motor Function

Oral motor skills include the coordination of sucking, swallowing, breathing, chewing, and articulation. Assessment of oral motor development in young children focuses on the sensory and motor actions of the tongue, lips, cheeks, and respiratory system (Morris & Klein, 1987; Wolf & Glass, 1992; Oetter, Richter & Frick, 1988). Assessment of oral motor functions must be completed by professionals with specific training in this area, such as an occupational therapist or speech/language pathologist. Table 7 identifies measures of oral motor functional development commonly used by these practitioners. Other professionals can screen for the need for a comprehensive assessment by observing the child and answering the following questions. A "yes" response to more than one question indicates cause for a more comprehensive assessment.

Oral-Motor Assessment Indicators

- Compared to same-age peers, does the child have problems with speech or eating?
- Is there consistent or excessive drooling present, given the child's developmental age?
- When eating, does the child reject food based on texture or demand a bland or specific diet?
- Compared to same-age peers, does the child display excessive mouthing of toys, objects, clothing or furnishings?
- Are there significant disturbances in the parent/infant bond concerning the issue of feeding?

SUMMARY

In summary, this chapter addressed screening and assessment related to sensory processing, praxis, and motor performance. Qualitative observation and parental interviews were emphasized due to their importance in understanding the nature of the child's sensorimotor functioning. A dynamic process-oriented approach to assessment enables the clinician to capture subtle individual differences in performance. A primary concern is assessing the child within the context of environmental challenges and in the performance of functional tasks. The critical outcome of sensory and motor processes is to support functional participation in all aspects of daily life and not merely the achievement of developmental milestones. ■

Table 7. Measures of Oral-Motor Function

Name of Test	Age Range	Comments	Source
Clinical Feeding Evaluation of Infants	0-3 years	Clinical observations of the state of affect; motor control; oral-motor structures; suck, swallow, breathe; physiological control	Wolf, L., & Glass, R. (1992). *Feeding and swallowing disorders in infancy.* San Antonio. TX: Therapy Skill Builders
Pre-feeding skills	Early years	Nonstandardized qualitative assessment of structural and functional oral motor coordination and skills in the context of feeding	Morris. S., & Klein, M. (1987). *Pre-feeding skills.* San Antonio, AZ: Therapy Skill Builders
Neonatal oral-motor assessment scale	Neonate	Examines tongue and jaw movements during both nutritive and non-nutritive sucking	Braun, M. & Palmer, M. (1985). A pilot study of oral motor dysfunction in "at-risk" infants. *Physical and Occupational Therapy in Pediatrics, 5,* 13-25.

***Note**: Also see the following tests reviewed in the section on assessing gross motor functions: Functional Independence Measure for Children (WEEFIM), Pediatric Evaluation of Disability Inventory (PEDI), and School Function Assessment (SFA)*

REFERENCES

Alexander, R., Boehme, R., & Cupps, B. (1993). *Normal development of functional motor skills: The first year of life.* San Antonio, TX: Therapy Skill Builders.

Als, H. (1986). A synactive model of neonatal behavioral organization: Framework for the assessment of neurobehavioral development in the premature infant and for support of infants and parents in the neonatal intensive care environment. *Physical & Occupational Therapy in Pediatrics, 6,* 3-53.

Anzalone, M. E., & Williamson, G. G. (2000). Sensory processing and motor performance in autistic spectrum disorders. In A. Wetherby & B. Prizant (Eds.), *Communication and language issues in autism and pervasive developmental disabilities: A transactional developmental perspective.* Baltimore, MD: Paul H. Brookes.

Ayres, A. J. (1972). *Sensory integration and learning disabilities.* Los Angeles: Western Psychological Services.

Ayres, A. J. (1985). *Developmental dyspraxia and adult onset apraxia.* Torrance, CA: Sensory Integration International.

Ayres, A. J., 1989. *Sensory integration and praxis tests.* Los Angeles, CA: Western Psychological Corporation.

Bly, L. (1994). *Motor skills acquisition in the first year.* San Antonio, AZ: Therapy Skill Builders.

Braun, M., & Palmer, M. (1985). A pilot study of oral motor dysfunction in "at risk" infants. *Physical and Occupational Therapy in Pediatrics, 5,* 13-25,

Campbell, S., Osten, E., Kolobe, T. & Fisher, A. (1993). Development of the Test of Infant Motor Performance. In C. Granger, G. Gresham (Eds.), *New Developments in Functional Assessment*. Philadelphia: W. B. Saunders.

Cermak, S. A. (1991). Somatodyspraxia. In A.G. Fisher, E.A. Murray & A. C. Bundy (Eds*.), Sensory integration: Theory and practice* (pp. 137-171). Philadelphia: F. A. Davis.

Cook, D. (1991). The assessment process. In W. Dunn (Ed.), *Pediatric service delivery* (pp. 35-74). Thorofare, NJ: Slack.

Coster, W. J. (1998). Occupation-centered assessment of children*. American Journal of Occupational Therapy, 52,* 337-344.

DeGangi, G. A., & Balzer-Martin, L. A. (in press). The sensorimotor history questionnaire for preschoolers. *Journal of Developmental and Learning Disorders, 2.*

DeGangi, G. A., & Greenspan, S. I. (1989). *Test of sensory functions in infants.* Los Angeles: Western Psychological Services.

DeGangi, G. A., & Poisson, S. (1995). *Infant and toddler symptom checklist.* Tucson, AZ: Therapy Skill Builders.

DeMyer, W. E. (1994*). Technique of the neurologic examination: A programmed text* (4th ed.). New York: McGraw Hill.

Dunn, W. (2000). *The sensory profile examiner's manual.* San Antonio, TX: Psychological Corporation.

Dunn, W., & Brown, C. (1997). Factor analysis on the sensory profile from a national sample of children without disabilities. *American Journal of Occupational Therapy, 51,* 490-495.

Dunn, W. & Westman, (1997). The sensory profile: The performance of a national sample of children without disabilities. *American Journal of Occupational Therapy, 51*, 25-34.

Fisher, A.G., Murray, E. A., & Bundy, A. C. (Eds.) (1991). *Sensory integration: Theory and practice.* Philadelphia: F.A. Davis Co.

Grandin, T. (1995). *Thinking in pictures.* New York: Doubleday.

Greenspan, S. I., & Meisels, S. J. (1996). Toward a new vision for the developmental assessment of infants and young children. In S. J. Meisels & E. Fenichel (Eds*.), New visions for the developmental assessment of infants and young children* (pp. 11-26). Washington, D.C.: Zero-To-Three.

Hanft, B. E. & Place, P. A. (1996). *The consulting therapist: A guide for OTs and PTs in schools.* San Antonio: Therapy Skill Builders.

Henderson, A., & Pehoski, C. (1995). *Hand function in the child: Foundations for remediation.* St. Louis, MO: Mosby.

Kientz, M. A., & Dunn, W. (1997). A comparison of the performance of children with and without autism on the sensory profile. *American Journal of Occupational Therapy, 51*, 530-537.

Kinsboume, M. (1983). Toward a model of attention deficit disorder. In M. Perimutter (Ed.), *The Minnesota Symposium on Child Psychology, Vol. 16: Development and policy concerning children with special needs.* Hillsdale, NJ: Erlbaum.

Lezak, M. D. (1995). *Neuropschological assessment* (3rd ed.). New York: Oxford University Press.

McIntosh, D. N., Miller, L. J., & Shyu, V. (2000). Development and validation of the Short Sensory Profile. In W. Dunn (Ed.), *The sensory profile examiner's manual.* San Antonio, TX: Psychological Corporation.

Miller, L. J. (1988). *Miller assessment of preschoolers.* San Antonio, TX: Psychological Corporation.

Miller, L. J., & McIntosh, D. N. (1998). The diagnosis, treatment and etiology of sensory modulation disorder. *American Occupational Therapy Association Sensory Integration Special Interest Section Quarterly, 21,* 1-3.

Morris, S., & Klein, M. (1987). *Pre-feeding skills.* San Antonio, TX: Therapy Skill Builders.

Oetter, P., Richter, E., & Frick, S. (1988*). M.O.R.E.: Integrating the mouth with sensory and postural functions.* Oak Park Heights, MN: Professional Developmental Programs.

Piper, M., & Darrah J. (1994). *Motor assessment of the developing infant.* Philadelphia: W.B. Saunders.

Porges, S. W., McCabe, P. M., & Yongue, B. G. (1982). Respiratory-heart rate interactions: Psychophysiological implications for pathophysiology and behavior. In J. Cacioppo, & R. Petty (Eds.), *Perspectives in cardiovascular psychophysiology* (pp. 223-264). New York: Guilford Press.

Schaaf, R. C., & Anzalone, M. E. (in press). Sensory integration with high risk infants and young children. In E. Blanche, S. Smith-Roley, & R. Schaaf (Eds.), *Sensory integration and developmental disabilities.* San Antonio, TX: Therapy Skill Builders.

Schneck, C. M. (1996). Visual Perception. In J. Case-Smith, A. S. Allen, & P. N. Pratt (Eds.), *Occupational therapy for children* (3rd ed.). St. Louis, MO: Mosby.

Wetherby, A., & Prizant, B. (Eds.) (2000). *Communication and language issues in autism and pervasive developmental disabilities: A transactional developmental perspective.* Baltimore, MD: Paul H. Brookes.

Wilbarger, P. (1995). The sensory diet: Activity programs based on sensory processing theory. *American Occupational Therapy Association Sensory-Integration Special Interest Section Quarterly, 18(2),* 1-4.

Wilbarger, P., & Wilbarger, J. L. (1991*). Sensory defensiveness in children aged 2-12: An intervention guide for parents and other caretakers.* Santa Barbara, CA: Avanti Education Programs.

Williams, D. (1994). *Somebody somewhere.* New York: Times Books.

Williams, M. S., & Shellenberger, S. (1996*). How does your engine run?: A leaders' guide to the Alert program for self-regulation.* Albuquerque, NM: Therapy Works.

Williamson, G. G., & Anzalone, M. E., (1997). Sensory integration: A key component of the evaluation and treatment of young children with severe difficulties in relating and communicating. *Zero-To-Three, 17,* 29-36.

Williamson, G.G. (1993). Coping frame of reference. In P. Kramer & J. Hinojosa (Eds.). *Frames of reference for pediatric occupational therapy.* Baltimore, MD: Williams and Wilkins.

Wolf, L., & Glass, R. (1992). *Feeding and swallowing disorders in infancy.* San Antonio, TX: Therapy Skill Builders.

Zeitlin, S. & Williamson, G.G., Szczepanski, M. (1988). *Early coping inventory.* Bensenville, IL: Scholastic Testing Service.

Zeitlin, S., & Williamson, G. G. (1994). *Coping in young children: Early intervention practices to enhance adaptive behavior and resilience.* Baltimore: Paul H. Brookes.

Appendix A

OBSERVATIONAL FORM FOR ASSESSING THE SENSORY-BASED CHARACTERISTICS OF A SCHOOL ENVIRONMENT

School Observation: Environment*

Student observed:_____ Age:_____ Date: _____

Activity:_____ Environment observed: _____

The following questions help identify environmental factors that facilitate or interfere with learning. Observe all relevant spaces of the student's environment, such as classrooms, gym, cafeteria, bathrooms, playground, and hallways.

Observation of the General Environment

Room Arrangement	Observations
1. Room size and shape adequate for task?	Yes No
2. Furniture/equipment arrangement?	Diagram room on blank sheet
3. Varied space available?	Intimate 6″–18″ Personal 1½′ – 4′ Social 4′–12′
4. Space for personal belongings?	Describe:
5. Active and quiet spots?	Yes No

Traffic Patterns	
1. Clearly defined pathways?	Yes No
2. All areas and materials accessible?	Yes No
3. Any architectural barriers?	Yes No
4. Time and distance student covers:	Describe:

Routines	
1. Adequate structured/unstructured time?	Yes No
2. Toileting, drinks, snack?	As needed Scheduled

Materials created by Barbara Hanft and Patricia Place.

145

Observation of the Sensory Environment

Auditory	Observations
1. Sounds in and out of observed setting?	Describe:
2. Unique acoustical features?	Carpet Cinder block Other

Visual	
1. Adequate light?	Yes No Source: _____ Natural _____ Fixtures
2. How is color used?	Highlight Guide Background Other:
3. Intense glare on materials?	Yes No
4. Unique visual features?	Describe:

Tactile/Kinesthetic	
1. Flooring	Tile _____ % Carpet _____ % Other _____ %
2. Use of textures in furniture/materials?	Describe:
3. Light touch from others?	Describe:
4. Unique tactile features?	Describe:

Movement	
1. What movement/breaks are permitted?	Describe:
2. Who moves through this space and how efficiently?	Describe:
3. Unique movement features?	Describe:

Observation of a Particular Learning Environment

Intent of Space	Observations
1. What is this space intended to facilitate?	Learning, resting, playing? Fine motor, gross motor, language, academic, social, self-help? Independent, cooperative? Intent unclear?
2. Clear boundaries?	Yes No
3. Enough space?	Yes No
4. Necessary materials easily accessible?	Yes No
5. Materials/furniture enhance performance?	Yes No
6. Time student is seated and/or in same position?	Time: _____ Seated _____ Same position

Recommendations for improving student performance:

Appendix B

SENSORIMOTOR HISTORY QUESTIONNAIRE FOR PRESCHOOLERS[1]

Sensorimotor History Questionnaire for Preschoolers[1]

Name of Child: _____

Gender: ❑ M ❑ F

Date Completed: _____

Birthdate: _____Age:_____

Completed By: _____

DIRECTIONS: The questionnaire may be administered by a parent, teacher, or therapist familiar with the child's functioning in the areas measured by this questionnaire. The questionnaire has been validated on 3- and 4-year-olds but may be administered to 5-year-olds as well. Sum the scores for each subscale, then enter the scores in the boxes at the bottom of the page. Children showing suspect performance in any one or more areas involving sensory processing or motor planning should be referred to an occupation therapist for further testing of sensory integration and motor skills. Children showing suspect performance in the general behaviors and emotional areas should be referred to a clinical psychologist or early intervention professional familiar with testing and treating problems in these areas.

Subscale	Normal	At-Risk
A. Self-Regulation: • Activity level and attention	0-2	3-6
B. Sensory Processing of Touch	0-2	3-9
C. Sensory Processing of Movement: • Underreactivity • Overreactivity	0-2 0	3-4 1-7
D. Emotional Maturity	0-2	3-10
E. Motor Maturity: • Motor planning and coordination	0-3	4-15

A. Self-Regulation (Activity Level and Attention)

Is your child: YES (1) NO (0)

1. Frequently irritable? YES (1) NO (0)
2. Frequently clingy? YES (1) NO (0)
3. Overly active and hard to calm down? YES (1) NO (0)
4. Overly excited by sights, sounds, etc.? YES (1) NO (0)
5. Distracted by sights and sounds? YES (1) NO (0)
6. Restless and fidgety during times when quiet concentration is required? YES (1) NO (0)

TOTAL:_____

B. Sensory Processing of Touch

Does your child:

1. Dislike being bathed or having his hands, face, or hair washed? YES (1) NO (0)
2. Complain that other people "bump" into him? YES (1) NO (0)
3. Dislike textured foods (chewy, crunchy) and avoid new food textures? YES (1) NO (0)
4. Prefer certain clothing and complain about tags in clothing or that some clothes are too tight or itchy? YES (1) NO (0)
5. Frequently bump or push other children and may play too rough? YES (1) NO (0)
6. Prefer as little clothing as possible or prefer long sleeves and pants, even in warm weather? YES (1) NO (0)
7. Seem excessively ticklish? YES (1) NO (0)
8. **Overreact** or **underreact** to physically painful experiences? (Circle which one) YES (1) NO (0)
9. Tend to withdraw from a group or seem irritable in close quarters? YES (1) NO (0)

TOTAL:_____

C. Sensory Processing of Movement

The first part of this section pertains to children who are underreactive to movement stimulation, the second part to children who are very sensitive or intolerant of movement in space.

Does your child:

1. Prefer fast-moving carnival or playground rides or spinning equipment, but does not become dizzy or seems less dizzy than others? YES (1) NO (0)
2. Frequently ride on the merry-go-round where others run around to keep the platform turning? YES (1) NO (0)

3. Especially like movement experiences at home such as bouncing on furniture, using a rocking chair, or being turned in a swivel chair?	YES (1)	NO (0)
4. Enjoy getting into an upside-down position?	YES (1)	NO (0)

TOTAL:_____

Does your child:

1. Tend to avoid swings or slides or use them with hesitation?	YES (1)	NO (0)
2. Seem afraid to let his feet leave the ground (getting up on a chair, jumping games) and prefer to be very close to the ground in play?	YES (1)	NO (0)
3. Fall down often and have difficulty with balance (e.g., when climbing stairs)	YES (1)	NO (0)
4. Fearful of heights or climbing?	YES (1)	NO (0)
5. Enjoy movement that she initiates but does not like to be moved by others, particularly if the movement is unexpected?	YES (1)	NO (0)
6. Dislike trying new movement activities or has difficulty learning them?	YES (1)	NO (0)
7. Tend to get motion sickness in a car, airplane, or elevator?	YES (1)	NO (0)

TOTAL:_____

D. Emotional Maturity

Does your child:

1. Play pretend games with dolls, cars, etc., with sequences or plots to the game (e.g., the doll gets up, gets dressed, eats breakfast)?	YES (0)	NO (1)
2. Engage you in games that he makes up or wants to play?	YES (0)	NO (1)
3. Seek you out for affection and play pretend games during which she will take care of a doll?	YES (0)	NO (1)
4. Play pretend games that involve assertiveness, exploration, or aggression (car races, soldiers fighting, or a trip to grandma's house)?	YES (0)	NO (1)
5. Understand rules such as to wait for you to say it is safe to cross the street?	YES (0)	NO (1)
6. Understand that there are consequences to his behavior (if he behaves nicely, you are pleased; if naughty, he will be punished)?	YES (0)	NO (1)

7.	Have difficulty getting over a temper tantrum (take longer than 10 minutes)?	YES (1)	NO (0)
8.	Have difficulty in playing with peers?	YES (1)	NO (0)
9.	Dislike changes in routine and prefer things to stay the same everyday?	YES (1)	NO (0)
10.	Seem unaware of dangers and take too many risks, often getting hurt?	YES (1)	NO (0)

TOTAL:_____

E. Motor Maturity (Motor Planning and Coordination)

Does your child:

1.	Use two hands for tasks that require two hands, such as holding down the paper while drawing or holding the cup while pouring?	YES (0)	NO (1)
2.	Have difficulty getting dressed?	YES (1)	NO (0)
3.	Avoid trying new play activities and prefer to play games that she is confident at?	YES (1)	NO (0)
4.	Have difficulty using his hands in manipulating toys and managing fasteners (stringing beads, buttons, snaps)?	YES (1)	NO (0)
5.	Seem clumsy and bump into things easily?	YES (1)	NO (0)
6.	Have trouble catching a ball with two hands?	YES (1)	NO (0)
7.	Have difficulty with large muscle activities such as riding a tricycle or jumping on two feet?	YES (1)	NO (0)
8.	Sit with a slouch or partly on and off the chair?	YES (1)	NO (0)
9.	Have difficulty sitting still in a chair and seem to move very quickly (runs instead of walks)?	YES (1)	NO (0)
10.	Feel “loose” or “floppy” when you lift him up or move his limbs to help him get dressed?	YES (1)	NO (0)
11.	Have difficulty turning knobs or handles that require some pressure?	YES (1)	NO (0)
12.	Have a loose grasp on objects such as a pencil, scissors, or things that she is carrying?	YES (1)	NO (0)
13.	Have a rather tight, tense grasp on objects?	YES (1)	NO (0)
14.	Spontaneously choose to do activities involving use of “tools,” such as crayons, markers, or scissors?	YES (0)	NO (1)
15.	Eat in a sloppy manner?	YES (1)	NO (0)

TOTAL:_____

[1] Reprinted with permission from DeGangi, G. A., & Balzer-Martin, L. A. (in press). The sensorimotor history questionnaire for preschoolers. *Journal of Developmental and Learning Disorders, 2.*

9

Screening, Evaluating, and Assessing Children with Sensorimotor Concerns and Linking Findings to Intervention Planning: Strategies for Pediatric Occupational and Physical Therapists

Toby M. Long, Ph.D., P.T., and Kirsten M. Sippel, M.P.P., P.T.

As noted in Chapter 8 (this volume) by Williamson, Anzalone, and Hanft, pediatric physical therapists and occupational therapists have traditionally measured the skills of young children and provided intervention to them in three areas of development: sensory processing, praxis, and motor performance, each of which contain specific elements (see Table 1).

In the past, therapists have used evaluation, assessment, or screening findings to make decisions regarding the status of a child and to develop intervention plans. Often these decisions were made independently of findings from other professionals or without parental input. However, during the last 20 years, there have been significant changes in how therapists view their role in the measurement and intervention process. Three factors have influenced these changes.

Table 1. Elements of Sensorimotor Development

Areas	Elements
Sensory processing	Modulation Perception Discrimination
Praxis	Ideation Motor planning Execution
Motor performance	Neuromotor Fine motor Gross motor Oral motor

First, public policy and legislative initiatives have required therapists and other professionals to reassess basic methods of collecting developmental or behavioral information. The passage of Part B (PL 94-142) of the Individuals with Disabilities Education Act (IDEA) in 1975 required therapists working in educational systems to serve children within an educational framework, work in a multidisciplinary team, and recognize the inter-relatedness of motor skills to other areas of development. In 1986, Part H[1] of IDEA (PL 99-457) expanded services to

[1]The 1997 Reauthorization of IDEA realigned the Act: Part H is now called Part C. In further discussion in this chapter, the early intervention component of IDEA is referred to as Part C.

infants and young children and mandated that services be delivered in a family-centered manner. Therapists broadened their systems and strategies of gathering information about a child's performance and providing services to include collaboration with the family and other team members. Contemporary evaluation and assessment strategies, as well as intervention, how support collaboration among team members and the family, integration of findings across domains and environments, and the reporting of findings in a family-centered, culturally sensitive manner.

Second, research during the last 20 years has clearly indicated that the areas of development typically measured in a young child (e.g., behavior, motor, language, and cognition) are interdependent (Greenspan & Meisels, 1993). Biological, cultural, and environmental variables are recognized to support, facilitate, or impede the development of infants and young children. For therapy to be meaningful, therapists must not only be knowledgeable in how neuromotor development occurs but also in how it may be affected by sociocultural and environmental parameters. For example, muscle tone in a developing child may be affected if a caregiver does not encourage independent movement or holds or positions a child in certain ways (Cintas, 1995). Additionally, cognitive skills are enhanced if a child moves independently within the environment (Berenthal, Campos, & Barrett, 1984).

The third factor that has influenced the measurement process, the development of measurement instruments, and therapeutic intervention is the application of the dynamic systems perspective of motor development (Case-Smith, 1996; Piper, 1993). Traditional measurement instruments used by therapists are based on the neuromaturational theory of motor development advanced by McGraw (1945) and Gesell (1945). Early therapeutic strategies also used the neuromaturational theory as a framework. The neuromaturational theory is based on the assumption that, as the central nervous system matures, motor development will proceed in a hierarchial fashion. Accordingly, development occurs in a cephalocaudal and proximal-distal direction at a specific rate. As the infant develops, higher centers of the central nervous system inhibit lower centers so that voluntary movements can occur when reflexes are integrated.

Dynamic systems theory views the development of motor skills as emerging from the interactions of many subsystems within a specific task (Heriza, 1991). These subsystems include the musculoskeletal system (joint mobility, muscle strength, and static postural alignment), movement patterns (motor milestones, reflexes and reactions, coordination, balance, and endurance), functional performance, sensation (visual, vestibular, proprioceptive, auditory, and tactile), and perception. According to Heriza (1991), an assessment following a dynamic system paradigm should identify age-appropriate tasks, transition periods, the subsystems impacting movement, and contextual variations.

Chapter 8 provided a review of many tools available to pediatric physical therapists and occupational therapists to gather information regarding a child's sensorimotor development. The components of sensory processing, praxis, and motor development also are described. The authors have stressed the need to include parental interview and child observation as part of a comprehensive assessment strategy. The purpose of this present chapter is to provide a framework that will assist therapists in choosing the most appropriate measurement model and instrument for children with sensorimotor and sensory-processing concerns. Additionally, intervention models and approaches will be reviewed.

THE MEASUREMENT PROCESS

This chapter presents a general discussion of the similarities and differences among the processes of screening, assessment, and evaluation, followed by descriptions of five models used by therapists to gather information for clinical decision making. Additionally, several measurement instruments are described. These instruments were chosen because of their unique contributions to the processes of (a) identifying infants and toddlers who may have a developmental problem, (b) predicting which infants will continue to demonstrate problems throughout childhood, or (c) documenting change in the acquisition of developmental or functional skills or change in the performance of existing skills. A chapter appendix lists several additional instruments not discussed here or in Chapter 8 that are also available to therapists.

Purpose of Measurement

Measurement is the process of describing characteristics of an individual by gathering information in an organized manner. A variety of methods are used to gather information, including (a) interviewing parents and other primary caregivers, teachers, and health professionals involved in the care of a child, (b) observing the child in natural settings, and (c) direct testing of the child. Measurement is conducted for seven purposes, as shown in Table 2. The procedures, strategies, and types of tests chosen as measurement tools will be driven by the purpose of measurement and what type of information is needed.

The IDEA defines evaluation, assessment, and screening as they relate to early intervention and educational programs (IDEA, 1997). The *screening process* is used to detect if a child's behavior or skill development is at a level that places the child at risk for a developmental problem, concern, or delay. The screening process should be brief and the test used should be easy to administer by a variety of people (physicians, therapists, nurses, teachers, and in some cases, parents). To increase the likelihood that screening takes place on a regular and consistent basis, the procedure should be designed to be used in pediatricians' offices, classrooms, and community-based health and social service agencies, or on an out-patient basis. Additionally, screening instruments should be reliable and accurate (Gilbaide, 1995).

Table 2. The Purposes of Measurement

Purpose	Strategy
Identify risk	Screening
Diagnose	Evaluation
Determine eligibility	Evaluation
Plan intervention	Assessment
Determine change in functioning	Assessment
Determine efficacy of intervention	Assessment
Research	Evaluation

The *evaluation process* is more complex. Evaluations are used to help make a diagnosis, identify atypical development, or determine eligibility for services. Instruments used as part of an evaluation process are usually norm-referenced, standardized tools. Many of the tests measure a single developmental area, such as motor or language (Taylor, 1993), but others are comprehensive developmental scales covering more than one area of development. Evaluation methods include what Kirshner & Guyatt (1985) refer to as a "discriminative index." A discriminative index distinguishes between individuals or groups on specific dimensions, such as the acquisition

of developmental milestones. Discriminative measures are often used to determine if a child's behavior is typical for her age and are used to determine eligibility for services. Many of the tools traditionally used by therapists, such as the Bayley Scales of Infant Development-II and the Peabody Developmental Motor Scales, fall into this category.

Physical and occupational therapists are most often involved in the *assessment process*. Assessments often use comprehensive tools to delineate strengths and needs, develop appropriate intervention plans and strategies, and determine change in individual children. An assessment is most meaningful when it represents the child's typical performance (Shelton, 1989). Thus, the assessment process should gain information regarding the child's abilities and behaviors across domains and environments (Cicchetti & Wagner, 1990). Assessments use a variety of methods to gather information. Norm-referenced and criterion-referenced instruments are commonly used. The assessment process also gains valuable information through ecological and performance appraisals (portfolios). The emphasis in an ecological approach to assessment is on documenting the child's success in participating in activities and routines across domains and environments. The assessment is conducted in the child's natural environment; thus, the skills demonstrated also reflect the context of performance. Judgment-based assessments document the parents' and caregivers' perceptions of a child's performance. According to Kirshner and Guyatt (1985), an assessment can be "evaluative." An evaluative strategy is one that measures the magnitude of change in an individual over time on a specific dimension. The overall purpose of an assessment is to describe a child's strengths and needs to help design appropriate, individualized therapeutic intervention plans.

Approaches to Measuring Skills

In addition to classifying testing instruments according to their purpose, tools available to therapists can be classified according to how the information is obtained: informally, formally, or ecologically. *Informal* strategies gather information in a less structured format. Facility or therapist-made checklists, developmental skill level forms, and interviews are examples of instruments that obtain information informally. Informal measurement strategies are easy to administer, are flexible to meet a family's needs and schedules, and will often obtain information on the typical performance of the child. The information provided can be gathered by observation or through caregiver report. Due to the flexibility inherent in the informal classification, rigorous testing procedures that increase reliability and validity are often missing. However, using informal procedures initially will establish rapport with the family and delineate parental concerns.

Therapists are most familiar with *formal* measurement strategies. Norm-referenced, criterion-referenced, and curriculum-based measurement instruments are included in the formal classification. Formal strategies are most often used to discriminate those children who are showing atypical development or delays. Two advantages of formal instruments include an established criteria, and standardized administration and scoring procedures that increase the reliability, validity, and accuracy of the instrument. A commonly cited limitation of formal instruments is the lack of familiarity between the examiner and the child, which may limit the child's willingness or ability to demonstrate his capabilities (Greenspan & Meisels, 1993). Additionally, most formal tests do not take into consideration the context of performance. The Bayley Scales of Infant Development-II (Bayley, 1993) is an example of a formal, discriminative tool.

Ecologically based or naturalistic strategies are becoming more accepted by professionals as accurate methods to gather information regarding a child's behavioral repertoire. Ecologically based measurement strategies are designed to determine a child's ability to perform a functional activity rather than the child's capability to perform a skill. Ecologically based procedures take into consideration the physical, social, and psychological environment in which a task is performed. An ecological or naturalistic assessment provides qualitative and quantitative information about the child. Observing the child within the environment in which a skill needs to be performed increases the likelihood that the therapist will gain meaningful information. Also, naturalistic assessments provide opportunities for self-initiation, choice, and problem solving by the child. (See Williamson, Anzalone & Hanft, Chapter 8, this volume.) These capacities often are not observed during structured, formal testing. Evaluation or assessment strategies such as the Alberta Infant Motor Scale (AIMS) (Piper & Darrah, 1993), the Toddler and Infant Motor Development (TIME) (Miller & Roid, 1994), the Functional Outcome Assessment Grid (Campbell, 1993), and the School Function Assessment (SFA) (Coster, Deeney, Haltiwanger, & Haley, 1998) are consistent with the ecological classification, incorporating observation, family participation, and task-specific activities into the evaluation or assessment format. The ecologically based strategy is consistent with the contemporary view of motor development, recognizing the importance of context, task, and family or caregiver participation (Heriza, 1993; Gentile, 1987; Lyons, 1984). The naturalistic process emphasizes adaptive behavior and yields a description of a child's repertoire of behavior across skill domains. This type of measurement approach can be linked directly to program planning and is used primarily for assessment purposes.

Models of Measurement

This section discusses five models used to gather information about a child's sensorimotor performance. The bottom-up model is primarily used for evaluation purposes. Three of the models—top-down, routines-based, and arena—are more applicable for assessment procedures. The fifth model—the judgement-based approach—is used for both assessment and evaluation.

The Bottom-Up Model

Traditionally, therapists rely on a bottom-up perspective (see Figure 1a) to gather information about a child's motor performance (Campbell, 1993). The bottom-up perspective is a diagnostic prescriptive model where deficits are delineated in specific areas and a program is designed to remediate those deficits. This model is most appropriate for (a) evaluation, and (b) when designing interventions targeting impairments such as decreased joint range of motion or muscle weakness. This model is less helpful when designing functionally oriented intervention plans needed in early intervention and educational programs.

The Top-Down Model

As noted previously, assessment procedures are most often used for program planning. Therapeutic programs for children are functionally oriented and are geared to the accomplishment of outcomes. In the top-down model (see Figure 1b), desired outcomes guide the assessment process. Desired outcomes are statements that describe what the team (parents, caregivers, and professionals) would like to see happen with a child. Outcomes can be general ("I'd like to see Anna move around") or specific ("Ryan needs to walk from the bus to the classroom"). Assessment procedures that operationalize the

top-down approach answer the following specific questions (Campbell, 1993):

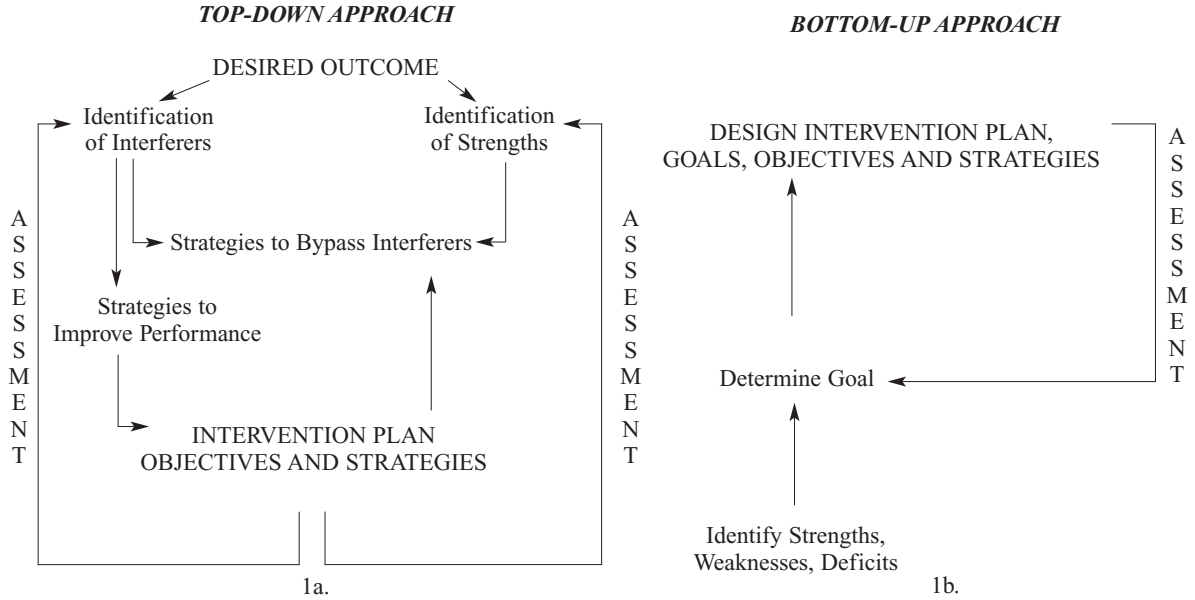
- What environmental factors and/or performance components are interfering with or facilitating a child's performance of the desired outcome?
- Into what specific objectives can the outcome be divided to minimize the immediate and long-term negative effects of identified interferers?
- What intervention approaches, models, and strategies will be used to promote immediate and long-term attainment of the desired outcome?

Currently, there are only a few tools available that operationalize the top-down approach. Thus, research related to the rigor of these tools is lacking.

The Routines-Based Model

As part of the family-centered intervention planning process, McWilliam (1992) promoted the routines-based model of assessment. Consistent with the top-down approach, a routines-based assessment model judges the capabilities of the child within everyday routines and activities. A routines-based assessment identifies those factors (child-specific and environmental) that interfere with or promote the performance of a specific functional task within a specific routine. For example, a therapist would assess a child's stair-climbing ability while the child is ascending stairs to go to his bedroom to take a nap or descending stairs to the basement playroom to obtain a toy, and would assess how a child scoops with a spoon during snack time. The use of routines to assess

Figure 1. The Top-Down and Bottom-Up Approaches to Assessment



behaviors is helpful for program planning because:

- Routines are meaningful to parents and caregivers
- The use of routines promotes the delineation of functional outcomes and intervention strategies
- Observation of a child across domains, contexts, and environments is most efficient when it involves naturally occurring routines

As noted in the top-down approach, the routines-based approach has strong clinical significance but lacks research supporting its use.

Arena Assessment

The arena assessment, primarily used in early intervention, is the simultaneous observation of a child by specialists in various disciplines. The purposes of an arena assessment are to:

- Obtain an integrated, holistic view of the child
- Determine the interrelationship of skills across domains
- Decrease handling of the infant/toddler by multiple professionals
- Decrease repetitive questioning of the family

The arena assessment consists of five components (see Box 1) (Foley, 1990).

The arena assessment can streamline case management and promote integrated service delivery. The arena assessment, however, can be time consuming. In order for all members of the team to gain the information they need, preassessment planning is needed. Also, the model requires a great deal of collaboration among team members.

Box 1. Components of an Arena Assessment

Team: Multidisciplinary team where members are determined from the desired outcomes. Team membership will vary across children depending on purpose of assessment.

Facilitator: The individual team member who interacts with the child. The facilitator is usually determined by the team based on the needs of child, purpose of assessment, and family desires.

Process: The process is family driven and naturalistic. Although the process may vary depending on the needs of the child and family, it should obtain information on the physical, social-emotional, and psychoeducational capacities of the child.

Staffing: A working meeting in which the team (which may include the family) synthesizes and analyzes the information gained from the assessment.

Outcome: A thorough arena assessment should yield a qualitative and quantitative description of the child, delineating strengths and needs.

Judgment-Based Assessment

The judgment-based assessment format enables therapists to obtain task-specific information about a child from those individuals who observe the child's performance on a regular basis. Thus, asking parents and caregivers to fill out a form or answer a series of questions regarding the child's behavior would yield information that parents and caregivers (a) find meaningful, and (b) consider typical behavior for the child.

Measurement Instruments

In Chapter 8, Williamson, Anzalone, and Hanft discuss many tests used to directly evaluate or assess children on motor performance, sensory processing, and praxis. To avoid redundancy, the following section discusses only those tools that are specific to neuromotor and/or functional performance, and that are designed specifically to assist with program planning and documenting change over time. Additionally, all these tests have been specifically designed to capture a unique aspect of performance administered in a manner consistent with contemporary views of motor development, motor performance, and functional outcome.

Alberta Infant Motor Scale

The Alberta Infant Motor Scale (AIMS) (Piper & Darrah, 1993) was designed to identify infants up to 18 months of age who have gross motor delays. It can be used as a screening tool or as part of an assessment to measure gross motor skill maturation over time. The authors of the AIMS clearly indicate that the test should not be used for older children with known disabilities who are functioning below the 18-months-old level or to monitor progress of therapy in children with known disabilities. The AIMS is a criterion-referenced, standardized instrument with strong psychometric characteristics. The AIMS can be administered by a variety of health care professionals who have a background in infant motor development. Although scoring and interpretation are facilitated by detailed drawings in the manual and on the score sheet, use of the test requires extensive knowledge in normal and abnormal motor development. Test administration involves the observation of 58 items, divided among four positions: prone, supine, sitting, and standing. Within each position, three components of movement are evaluated: weightbearing, posture, and anti-gravity movements. Minimal handling of the child is required, and parents are encouraged to be the primary facilitators. Test administration typically requires 20 to 30 minutes to complete, but it can take as little as 10 to 15 minutes.

The AIMS is a practical tool and is efficient when performed by an experienced clinician. It yields information of clinical relevance to occupational therapists and physical therapists. The AIMS is unique in that it is one of the few tools that emphasize the *observation* of motor performance. This provides the child the opportunity to be evaluated in more natural environments, such as the home. It also allows the therapist to gather information on the child's typical motor performance.

Functional Outcomes Assessment Grid

The Functional Outcomes Assessment Grid (FOAG) (Campbell, 1993) is used by an interdisciplinary team to develop goals for children with disabilities in direct relation to the functional outcomes determined by the team, monitor change over time, and determine appropriate level of service. It is appropriate for all children with disabilities, regardless of their ages. The FOAG is based on the American Occupational Therapy Association's document, *Uniform Terminology for Occupational Therapy, 2nd Edition* (1994). Individualized observation of functional skill performance is conducted to determine which components (physical, environmental, behavioral, and sensory) are impacting positively or negatively on a child's performance of a skill. Each component is scored on a 5-point scale, from no problems to significant problems that impact on, or prevent, skill performance. Those factors that impact significantly on performance of team-established outcomes are targeted for intervention. The FOAG operationalizes the top-down model

of measurement as well as the routines-based model. It is highly useful for assessing children with complex needs whose development is known to be atypical and whose disability affects a broad spectrum of functional skills. It is most helpful when used as a collaborative team decision-making tool, facilitating integrated service provision. The FOAG directly links assessment to program planning and is individualized to meet the unique needs of the child.

Pediatric Evaluation of Disability Inventory

The Pediatric Evaluation of Disability Inventory (PEDI) (Haley, Coster, Ludlow, Haltiwarger, & Andrellas, 1992) determines functional capabilities and performance, monitors progress in functional skill performance, and evaluates therapeutic or rehabilitative program outcomes in children with disabilities. It can be used with children with and without disabilities who are from 6 months to 7.5 years of age. The PEDI is a norm-reference test with strong psychometric characteristics. The test is divided into subtests focusing on the three functional skills of self-care, mobility, and social function. Also, environmental modification and amount of caregiver assistance are systematically recorded. Information can be obtained through parent report, structured interview, or professional observation of a child's functional behavior. The PEDI is a reliable and valid assessment of functional performance in children with significant cognitive and physical disabilities.

School Function Assessment

The School Function Assessment (SFA) (Coster et al., 1998) is specifically designed to be used within the educational environment to assess function and to guide program planning for students with disabilities in kindergarten through grade six. Teachers and other providers of services in the educational environment judge a child's performance on nonacademic tasks divided among those areas assessing level of participation, amount of task assistance or modification, and level of performance in cognitive or physical tasks. The SFA is a criterion-referenced test, and it specifically links assessment results to the development of an Individual Education Program (IEP). It uses a judgment-based format to gather information on the typical performance of a child from the variety of individuals involved in the student's education. It yields detailed information across domains and environments and, thus, requires collaboration from those that know the student well.

Toddler and Infant Motor Evaluation

The Toddler and Infant Motor Evaluation (TIME) (Miller & Roid, 1994) was developed to measure functional movements in an infant as observed in the infant's natural environment. The TIME was designed to be used with children 4 to 42 months of age with suspected motor dysfunction, and to identify those with mild to severe motor problems. It identifies patterns of movements, evaluates motor development over time, and assists in intervention planning and treatment efficacy research. The TIME is divided into eight subtests: five of the subtests have been standardized and norm-referenced. The test records the child's spontaneous movements in various positions, the child's sequence of movements, and any abnormal movements. The parents interact with, handle, and position the child according to the examiner's instructions and guidance. The TIME can be used as a comprehensive motor evaluation or assessment tool. As an evaluation tool, the TIME can be used to identify a child with a motor dysfunction. Repeated measures can be taken with the TIME, thus making it useful for assessing

motor development over time as well as assessing treatment efficacy and/or motor maturation. The TIME is a valuable clinical tool. It is a tool that incorporates dynamic systems theory in the assessment of motor functions and development. It links a child's function, quality of movement, and motor skills. The TIME is comprehensive and detailed, providing excellent visual descriptors of the motor components that are being assessed. It primarily uses naturalistic observation to gather data, recognizing the importance of evaluating typical movements as they are impacted by the child's environment.

Test of Sensory Functions in Infants

The Test of Sensory Functions in Infants (TSFI) (Degangi & Greenspan, 1988) was developed to screen and quantify sensory processing and reactivity in infants. The test includes five subdomains of sensory processing: reactivity to tactile deep-pressure, adaptive motor responses, visual-tactile integration, ocular-motor control, and reactivity to vestibular stimulation. Infants between 4 and 18 months of age can be screened using the TSFI. This criterion-referenced test is most accurate in identifying infants between 10 and 18 months of age without sensory processing disorders or with sensory dysfunction. This age range is appropriate because definitive sensory processing dysfunction does not emerge until late in the first to second years of life.

The TSFI was designed to identify infants with sensory dysfunction. It can also be used with infants who have a known regulatory disorder or developmental delay. Because limited normative data are available, total test scores are used to make screening decisions. The individual subtests, however, can be used in conjunction with other standardized developmental and neuromotor tests when making diagnostic decisions and recommendations (DeGangi & Greenspan, 1988). Abnormal or at-risk scores on the TSFI indicate that a child has potential problems in sensory processing and should be referred for further evaluation or assessment.

The TSFI is the first test developed to screen infants for early sensory processing problems. Although additional data are needed in order to use the test as a diagnostic tool, individual subtests and test items can provide useful clinical information.

LINKING ASSESSMENT FINDINGS TO INTERVENTION PLANNING

Linking assessment findings to a specific intervention plan for a child with a neuromotor or sensorimotor dysfunction is a complex process. Use of traditional methods to gather information has often resulted in planning interventions for children with disabilities that are intensive, isolated, and deficit-based. Strategies based on a neuromaturational framework have dominated therapeutic intervention during the last three decades. Contemporary practice, however, is outcome oriented, with strategies that emphasize functional relevance. Planning intervention that is outcome oriented has four components. The first component is *assessment.* Through assessment strategies, the therapist determines what is facilitating or interfering with the child's acquisition of a specified outcome. Next, the therapist—in collaboration with the team—determines whether the focus of *intervention* should be remediation, prevention, promotion, compensation, or alteration. Third, the therapist determines the *model of service delivery,* which can be direct, monitoring, or consultation. Finally, the therapist determines the *type of strategy* that would best meet the child's needs. Because children with disabilities in sensorimotor or neuromotor skills have complex problems, a combination of approaches,

service delivery models, and strategies are most often used.

The purpose of intervention is fourfold. Therapists use a wide variety of strategies to (1) promote active movement, (2) promote functional skills, (3) prevent impairment, and (4) foster the integration of the child into society.

Most of the traditional strategies used by therapists (see Box 2) require direct, one-to-one application, which often take place in segregated settings such as clinics or assigned rooms in early intervention or educational programs. Although many of these strategies are useful in preparing a child for movement by relaxing tight muscles, strengthening weak muscles, or promoting motor milestone development, when used in isolation they have not been shown to increase function any more than nontherapeutic strategies (Warren and Horn, 1996). Additionally, generalization of skills practiced, facilitated, or learned during therapy has not been demonstrated using the traditional model of service provision.

Frames of Reference

A frame of reference often guides a therapist's selection of strategies used to treat children with sensorimotor dysfunction. The following discussion describes three broad frames of reference that therapists employ: neuromaturational, motor learning, and dynamical systems.

Neuromaturational

The traditional frame of reference used by most therapists is neuromaturational. Neuromaturational theory is based on the work of individuals such as Gesell (1945) and Shirley (1931). This theory promotes the concept that as a child grows and his central nervous system matures, skills or patterns of movement will unfold in a predictable, hierarchial manner. Treatment strategies based on this theory attempt to promote skills in children by following the sequence of skill development documented in developmental scales. This theory assumes that skills will unfold naturally in a normally developing central nervous system. As the nervous system matures, adaptive behaviors and skills will become increasingly complex. An emphasis of treatment using this model is the promotion of central nervous system maturation. The analysis of reflex integration, facilitation of equilibrium and righting reactions, and promotion of the components of motor skills are integral to strategies developed from the neuromaturational model.

Learning-Based

Although strategies based on the neuromaturational model continue to be the most commonly used, the learning-based models are often integrated into a holistic treatment program. The learning-based models may be arrayed along a continuum from strict behaviorism as promoted by Skinner to the more widely accepted schema theory promoted by Schmidt (1975). Most therapists readily employ basic learning theory strategies, such as providing multimodal feedback, arranging the environment to promote skill performance, and repeating actions to increase the likelihood that the behavior will be retained. The schema theory proposes that motor development emerges from a set of "rules" used by the individual to evaluate, correct, and update memory traces for a movement. General motor programs are responsible for organizing the fundamental components of the movement. In order for the general motor program to produce a movement, recall and recognition schema are used. Recall and recognition schemas are memories of the relationships between past movement (recall) and sensory (recognition) patterns and the movement

Box 2. Strategies Used by Physical and Occupational Therapists*

Neurodevelopment Treatment (NDT): Direct handling of children. Specifically designed for young children with cerebral palsy to facilitate normal patterns of movement.

Myofascial Release (MFR): Specific techniques performed by a therapist to release the binding down of the fascia. Goal of MFR is to change structure to allow functional change. Promotes structural change techniques followed by functional activities. Little to no scientific research to determine effectiveness.

Craniosacral Therapy (CS): Therapist applies gentle pressure through the craniosacral system to promote movement of cerebral spinal fluid and rhythm. Gentle, noninvasive manipulative technique. Used for variety of conditions and promoted for use with infants including newborns to diminish effects of birth trauma. Little to no research on effectiveness.

Massage: Variety of specific tactile techniques from gentle laying of the hands to more vigorous Swedish and Indian techniques. Used for a variety of children, including babies born prematurely. Research has shown a variety of physiologic benefits including gastrointestinal functioning, improved blood and lymphatic circulation, and weight gain in preterm infants. Also shown are improvements in decreasing tactile sensitivity, parent-infant bonding, calming, comforting, and respiration.

Strength Training: Strength training using standard progressive-resistive exercise protocols may relate to improvement in function. Sound research on strength in children with cerebral palsy, but minimal research investigating the effects of strength in children without other developmental disabilities, such as sensorimotor dysfunction.

Mobilization: Based on concept that immobility affects all systems necessary to produce movement. Is indicated if extra-articular connective tissue abnormally restricts joint motion. Little research done with children to indicate effectiveness.

Sensory Integration (SI): Used with children with mild to moderate sensory processing dysfunction. Treatment uses specific tactile, vestibular, and proprioceptive activities to promote adaptive responses. Goal is to improve the ability of the central nervous system to process and integrate sensory inputs.

Conductive Education (CE): Intensive programming using rhythmic intention and sequenced facilitation to enhance organization and production of intentional movement within educational and life tasks. Performed by a specially trained and certified conductor. Research from the Peto Institute in Hungary is quite positive.

Movement Opportunities via Education (MOVE): Comprehensive, activity-based curriculum for children with severe neuromotor dysfunction. Teaches basic functional motor skills. Process designed to have children acquire skills necessary for sitting, standing, and walking. Team works on same set of skills so that skills are reinforced and consistent.

*These are only a selection of strategies used by therapists. Therapists also use, for example, assistive technology, splinting, bracing, remediation, and teaching of specific skills.

desired. In schema theory, the development of fundamental movement patterns is emphasized to generate the ability to develop more sophisticated patterns. For example, once the motor pattern for walking is established, individuals expand that pattern to walk on various terrains and at various speeds. Schema theory contends that children with disabilities may have difficulty initiating a movement, completing the movement with accuracy or precision, or stopping a movement because of a lack in recall or recognition schemas.

Children with sensorimotor dysfunction typically have problems in accurately producing a movement or controlling the execution of a movement. In schema theory, this would be due to poorly established recognition patterns. Schema theory promotes a use of practice that has clear implications for the treatment of children with sensorimotor dysfunction. Specifically, schema theory predicts that (a) variable practice of a skill or action promotes the establishment of a schema, and (b) varied practice works as well as repeated practice in promoting accurate performance of a novel action. Thus, treatment for learning motor patterns and schemas would be more effective if the child practices and repeats skills in various situations, under changing conditions. The integration of therapeutic strategies into daily caregiving routines operationalizes this concept. Daily caregiving routines ensure that a skill is practiced within a meaningful context for the child. Performing activities within the context where they will be used and are needed increases the likelihood that the child will be interested and motivated in performing the task.

Dynamical Systems

The dynamical systems theory (Heriza, 1991; Thelan, 1990) is the newest theory to emerge in the physical and occupational therapy literature as a way to explain how development and motor change take place. The dynamical system theory proposes that a functional movement emerges from the interaction of a variety of subsystems with the environment. In the case of motor skills, these subsystems include sensory, neurological, musculoskeletal, emotional, psychological, and other variables. Thus, depending on the task, any one of these variables can create a barrier to the accomplishment of the task or be a facilitator of task development. In neuromaturational theory, the development of skills is explained as a sequence of skills that build on one another and emerge in stages. The dynamical systems perspective, however, proposes that a change in behavior occurs as a consequence of a change in one or more of the variables that can impact the skill. Also, the dynamical system perspective emphasizes that change in motor behavior most likely will take place during times of transition. Treatment based on this perspective focuses on analyzing the variables that are preventing or promoting a specific skill; changing the combination of inputs, contexts, and tasks that are important to produce a specific task; and timing treatment to coincide with periods of transition. Intense therapeutic input during these periods of transition is suggested as the most effective treatment strategy to produce changes in motor skill acquisition. Because the dynamical system perspective emphasizes the interaction of multiple systems with the environment, the importance of family and caregiver interactions with the child cannot be overemphasized.

Approaches to Intervention

As with assessment practices, contemporary intervention theory encourages therapists to reassess practices and approaches to intervention. Dunn, Brown, and McGuigan (1994) describe five approaches available to

therapists. These approaches allow therapists to design intervention strategies that target the specific needs of the child and the desired outcomes of the family. The approaches also provide a framework for the therapists to determine the intent of the intervention. Depending on the needs of the child, a therapist will most often use a variety of approaches and expect to change approaches as the needs of the child change.

Remedial

The remedial (or restoration) approach is the most familiar to therapists and is the basis for many of the more popular treatment strategies. Based on the traditional medical model of intervention, the remedial approach enables therapists to identify performance deficits and to seek to resolve them by facilitating age-appropriate sensorimotor capabilities. This approach may be appropriate for some children; however, using only an approach that encourages "average" development and "typical" movements may prevent other children from developing functional skills.

Compensation

The compensation approach is often used with older children, especially those with orthopedic disabilities or significant neuromotor dysfunction such as spastic type of quadriplegia. The purpose of the compensation approach is to use assistive technology, adaptive equipment, or other devices to allow a child to perform a skill that the child is not capable of performing or has yet to master. Compensation strategies also are used to prevent further impairment or disability as they are often used to bypass a barrier to the performance of a desired outcome. With young children, compensations are most often used in combination with other approaches. Compensation strategies also are used to promote development. For example, providing a child who has minimal or no expressive language with an alternative communication system (e.g., sign, gestures, or a communication board) will promote the child's receptive language development by providing him with the ability to communicate interactively.

Promotion

The promotion approach creates naturally occurring activities and routines to promote skill development. This approach is typically used in community-based activity programs designed for all children, and which are often based on the *Developmentally Appropriate Practice Guidelines* (Bredekamp and Copple, 1997). The environment and activities are designed to facilitate developmental skill acquisition. This approach is well suited for children with global developmental delays or weaknesses in specific skill performance areas. Enriched, stimulating childcare programs use the promotion approach and can easily integrate children with delays into the program. Other programs such as tumbling, dance, or library story time utilize a promotion approach.

Prevention

The purpose of the prevention approach is to prevent the development of secondary impairments or disabilities in children with known difficulties. For example, proper positioning of an infant with cerebral palsy is used to help prevent trunk malalignment, which the child has a high risk of developing. Encouraging small-object manipulation or coloring for toddlers and preschoolers who shy away from these activities may prevent them from developing visual-motor or handwriting problems later on.

Alteration

The remedial approach emphasizes the facilitation of skills not yet acquired by a child.

The alteration approach, on the other hand, emphasizes the development of skills that are most functional for a child by providing the child with an alternative environment in which to foster skill development and use. The alteration approach requires that the therapist and team weigh the importance of changing a child's aberrant behavior or the lack of skill against any given activity or environment. For example, Andrew is a child with sensory-processing deficits who becomes behaviorally disruptive when in a highly sensory-charged environment. His intervention team, however, has identified his poor language skills as the most immediate concern. Since Andrew's behavior can interfere with his ability to benefit from the language enrichment offered to him, his team has several options. The team members can decide to teach Andrew behaviors that are age appropriate (remedial approach) within the sensory-charged environment; they can change the environment by decreasing sensory stimulation (compensation approach); or they may decide to move Andrew to a minimal-sensory environment (alteration approach). Although the first two options may be appropriate and necessary, it may be more functional to find a better environmental match for Andrew so that his intervention can focus on his language development, which is the identified area of concern.

Models of Service Provision

In addition to identifying the various approaches to intervention needed by a child, therapists also must decide on the most effective and efficient service delivery model. As noted above, the traditional intervention model—the remedial approach—promotes direct one-to-one therapeutic interventions. Contemporary practice, however, promotes the use of three models of service provision: direct, monitoring, and consultation (Dunn & Campbell, 1991). These models allow the therapist to design a comprehensive intervention plan that takes into account the outcomes developed by the team, the individual strengths and needs of the child, family priorities, the environment, and other support factors.

Direct

Therapists most often use a direct service model of intervention. In this model, therapists provide one-to-one therapy, usually in a segregated setting (e.g., a clinic, a specially designed room within a childcare or educational program, or in a separate space within a classroom). Usually, the purpose of direct service is to provide intensive, remedial intervention to a child. Therapists use direct therapy to provide specialized therapeutic intervention strategies. Strategies are used to teach specific skills, introduce new behaviors to the child, change maladaptive behaviors, or to increase a child's tolerance to sensorimotor experiences.

Recent changes in research, legislative mandates, and societal attitudes about children with disabilities are creating a shift away from the provision of direct service to all children to an integrated service delivery program. Integrated programming is defined as:

- Specialized instruction
- Individualized to meet the unique strengths and needs of a child, within a naturally occurring environment
- With other children without disabilities
- Within the context that the skill is required (McWilliam, 1996)

Research comparing the benefits of integrated and direct service delivery has indicated little difference in the enhancement of skills in individual children (McWilliam, 1996). However, other benefits have been related to integrated therapy models. (See Advantages to Integrated Therapy, Box 3.)

Although changes in standardized testing scores were the same following interventions based on integrated or direct service delivery models, Cole, Harris, Eland, and Mills (1989) found that teachers preferred the integrated model. In teaching a child with severe motoric involvement how to use a microswitch, Giangreco (1986) found performance improved more during integrated programming than when teaching was conducted in isolation.

Obviously, more research needs to be done in this area, especially with children with various needs and conditions. It is clear, however, that the field is moving rapidly to develop programs that provide integrated therapy. In order to provide effective treatment within an integrated model, therapists require skills in putting into operation two additional service delivery models: monitoring and consultation.

Monitoring

Monitoring is a method to ensure that therapeutic strategies become infused into naturally occurring activities and are carried out throughout the day. Therapists monitor programming when they create and supervise the delivery of a plan that is carried out by someone else (Dunn, 1996). Monitoring can be used alone or in combination with direct service and consultation. Monitoring service provision may be as time consuming as direct service, especially initially. Therapists are required to ensure that any program or activity taught to another person is being carried out appropriately. Thus, monitoring requires therapists to

- Design the activities
- Teach the provider specific methods of integrating therapeutic strategies into existing routines
- Observe the provider performing the activities
- Adapt and update the activity as necessary
- Supervise the implementation, and *be responsible for documenting* the child's performance

Box 3. Advantages to Integrated Therapy

- Active participation is enhanced because service to children is provided in a familiar, comfortable, nonthreatening setting.
- Developmentally appropriate, naturally occurring settings are enriching and therapeutic.
- Natural environments provide routine cues and opportunities to provide therapeutic tasks within context.
- Functional behavior is supported because the child's actions reinforced within the natural context and by peers.
- Generalization of skills is enhanced because learning is taking place within the environment in which the skills are expected.
- Normalization is valued and enhanced. All children recognize that each child has strengths and needs and that specialized services can be beneficial to all.

Monitoring is beneficial because (a) it increases the amount of time a child is benefiting from a therapeutic strategy, (b) the strategy will promote generalization because it is being conducted within a naturally occurring activity, and (c) it provides continuous, ongoing reinforcement of the desired behavior.

Consultation

Monitoring service delivery requires that the therapist design the activities and therapeutic strategies that will be used by others to promote needed therapeutic skills. In consultation,

the consulting therapist assists another therapist in meeting jointly identified goals. The consulting therapist contributes her expertise to help solve a problem or dilemma for another provider of service to a child. Hanft and Place (1996) promote the use of collaborative consultation as the preferred method of consultation. Collaborative consultation is an interactive process in which various team members work together to generate creative solutions to a problem. As the field moves toward integrated, discipline-free program plans, collaborative consultation will help teams put into effect the plan for the child, within the structure of an inclusive setting. Collaborative consultation is also used within the traditional model of direct service delivery. Effective consultation has three critical elements: dynamic interaction among the team members, respect, and a belief that the consultation will help achieve a common goal. Consultative service provision accepts that children with disabilities present with complex problems and issues that can only be helped by creative use of the expertise provided by all team members. Collaborative consultants must free themselves from discipline-bound perspectives and be open to combining various systems and approaches to assist the child and family. Ideally, the solution to a specific challenge reflects a variety of approaches. Table 3 illustrates the use of the five service provision approaches and three models of service.

EFFECTIVENESS OF SPECIFIC MOTOR INTERVENTION

The effectiveness of therapeutic input for children with neuromotor and sensorimotor disorders has been of particular interest for the last 30 years. Generally, research that assessed specific developmental skill improvement has shown that therapeutic intervention had little effect on motor development. However, research has documented other nonmotor benefits for children receiving specific therapeutic intervention and when studies use a single-subject design. One of the earliest studies assessing the benefits of physical therapy for children with cerebral palsy (Wright & Nicholson, 1973) indicated that, although neuromotor performance was not necessarily enhanced by intervention, nonmotor benefits such as family competency, child happiness, sociability, and confidence were seen. Thus, there has been a recent emphasis on examining broader issues in development and functional capacity in children with known disabilities. Additionally, early research into the benefits of therapy for children with motor disabilities has indicated that therapy only minimally affected impairments in children with significant motor dysfunction (Shonkoff & Hauser-Cram, 1987). Based on this limited research base, physical and occupational therapists are encouraged to examine disability or the inability to perform a functional activity rather than to examine individual impairments.

Types of Intervention

For purposes of this section, the term "intervention" is limited to specific approaches used by therapists that purport to influence the neuromotor and sensorimotor processes to improve function, reach targeted outcomes, or promote developmental skill acquisition. Functional outcomes include performance on tasks related to developmentally appropriate tasks, interaction within the environment, and purposeful activity. Functional outcomes deemphasize change measured on standardized, norm-referenced tests of developmental skills. Functional outcomes include nonmotor benefits, such as decreased need for assistance by caregivers,

Table 3. Examples of Service Provision Approaches and Models

Service Provision Approaches					
Service provision models	Remediate	Compensate	Alter	Prevent	Promote
Direct	Facilitate neck extensor muscles so child can look at friends when playing	Fabricate a splint to enable the child to hold the cup at snack time	Select a community preschool based on the level of noise the child can manage	Facilitate weight bearing during infancy to prevent possible delays in walking	Provide a play program for the community for all children to attend
Monitoring	Supervise the teacher's aide to facilitate tone for reaching during a game	Supervise a feeding program that minimizes the time for eating and enables socialization	Work with parents to identify which community locations will be best for their family outings	Create a "positions alternatives" chart for the aides to prevent skin breakdowns	Oversee the development of a morning preschool routine that optimizes early development possibilities
Consultation	Teach classroom staff how to incorporate enhanced sensory input into play routines during free time	Provide the team with information from skilled observations that enables them to select the best play partner for a child	Work with parents to identify which community locations will be best for their family outings	Teach a parent a range-of-motion sequence to prevent deformities	Assist the child care provider to develop a comprehensive curriculum

Adapted with permission from Dunn, W. (1996). Occupational Therapy. In R. A. McWilliam (Ed.), *Rethinking pull-out services in early intervention: A professional resource* (pp. 267-313). Baltimore: Paul H. Brookes.

caregivers' sense of competence and confidence in caring for the child, and other related improvements.

Although many types of intervention were listed previously in Box 2, the most common form of intervention used with children with primary neuromotor deficits such as cerebral palsy is a neurofacilitation type. The most common intervention of this type is neurodevelopmental treatment (NDT). Intervention for children with primary sensorimotor deficits, such as those on the autistic spectrum, is considered sensorimotor intervention, the most common being sensory integration. Contemporary practice promotes a more task-oriented approach based on the systems or motor-learning perspective. This approach is less diagnosis (or deficit) dependent, and is consistent with the emphasis on functional outcomes rather than on facilitation of developmental milestones.

The following discussion reviews research published in the 1990s and which is related to intervention in the neurodevelopmental, sensorimotor, and task-oriented approaches. Readers interested in prior studies are referred to 1980s reviews of meta-analysis (Ottenbacher, Biocca, DeCremer, Gevelinger, Jedovic, & Johnson, 1986; Ottenbacher & Peterson, 1985; Shonkoff & Hauser-Cram, 1987) and qualitative reviews (Harris, 1987, 1988).

Neurodevelopmental Treatment

Recent randomized, controlled trials (Law et al., 1991; Palmer, 1990) examining the benefits of NDT produced results that are consistent with previous studies. Studies that utilized a group experimental design found little definitive support that NDT is any more beneficial than other types of intervention (such as general stimulation) in enhancing the attainment of developmental skills (Palisano, 1991). However, families whose children received this type of intervention were found to be more emotional and verbally responsive to their children and more confident in caregiving (Palmer et al., 1990). In this era of family-centered care and recognition of the importance of parent-child interactions, these findings support intervention. These findings are especially important for children with disabilities such as cerebral palsy. Studies utilizing a single-subject design, however, are more supportive of NDT in improving specific motor skills in children with cerebral palsy. Unlike traditional group designs, the single-subject design is concerned with individual performance on specific tasks, unique to the individual being treated. Embrey, Yates, and Mott (1990) found that improvement in specific components of gait could be seen in children receiving intensive intervention. Generalization of this single-subject design is limited, but the design shows promise as a strategy to indicate improvement in children whose disabilities make it difficult to identify them as a homogenous group.

The difficulty in establishing the efficacy of NDT is multifaceted. One primary problem is that NDT is an approach to treatment, rather than a series of activities. This approach, based on neurophysiological principles, is individualized to meet the needs of a specific child and is modified based on the response of that child. Thus, an assessment of the techniques is very difficult. Unlike medication or a specific surgical procedure, specific treatment techniques vary from therapist to therapist, further complicating the analysis of the approach. As noted, most studies examining the effectiveness of the NDT approach have used developmental skill acquisition tests or checklists to determine outcome. These tools may not be responsive to the changes produced by using NDT. Alternative measurement instruments, such

as the Gross Motor Function Measure (Russell et al., 1993), the TIME (Miller & Roid, 1994), or the use of goal attainment scaling (Ottenbacher & Cusick, 1989), may prove more helpful in determining if NDT can produce change over time in children with complex neuromotor dysfunction.

Learning-Based Models

Although there is only limited research on the learning-based (or task-oriented) approach used with children, available evidence indicates that this approach may be more useful in changing functional skills in children with significant motor disabilities. Horn, Warren, and Jones (1995) showed that developing activities targeting specific behaviors was successful in supporting the attainment of those functional behaviors. There also seemed to be a generalization effect in that movements not targeted, but assessed, improved. The benefits of this approach may be due to the principles of motor learning on which it is grounded (Larin, 1994). Motor learning indicates that motor performance is enhanced when children are afforded opportunities to experience and actively practice specific activities or tasks. The theoretical basis of the motor learning approaches provides evidence that should encourage therapists to examine the effects of integrating these principles into the development of motor skills, performance, and function.

Sensory Integration

Children with mild to moderate problems having a sensorimotor basis, such as dyspraxia or sensory-processing disorder, often receive sensory integration (SI). According to Ayres (1979), the theory of SI can be used to explain the relationship between sensory processing and behavior. For example, impaired sensory processing in children with autism has been linked to dysfunction in relating, arousal, interactions with others, and goal-directed play (Greenspan & Weider, 1997; Koomar & Bundy, 1991). It is these relationships that provide support for the use of SI with children with autism, as well as other significant disabilities. According to the theoretical constructs, children who receive sensory integration should improve in the following areas (Parham and Malloux, 1996):

- Adaptive responses
- Self-confidence and self-esteem
- Motor skills
- Daily living skills and personal-social skills
- Cognition, language, and academic performance

As with NDT, there is little empirical evidence of the effectiveness of SI or other strategies with a sensory component commonly used by therapists for children with a variety of conditions (Ottenbacher, 1991; Vargas & Camilli, 1999). Also similar to NDT, the literature regarding SI demonstrates the many challenges faced in reaching any consensus as to its effectiveness. Children across studies vary, outcome measures do not focus on the same information, and there is little control of the exact treatment techniques employed. Another unique limitation is that SI is a complex construct that theoretically is presented as a whole. In reductionist-type research, the SI construct must be broken down into individual component pieces. Consequently, research is evaluating the effectiveness of each component of sensory stimulation rather than the overall construct of SI (Ottenbacher, 1991). Additionally, most of the research on SI has studied children with learning disabilities although many more children have sensory-processing disorders, which may be amenable to the effects of SI.

However, even with these limitations, support exists for activities that are considered sensory integrative. Humphries, Wright,

Snider, and McDougall (1992) found that children with learning disabilities who received SI showed improved motor planning. Using a single-subject, multiple-baseline design, Case-Smith and Bryan (1999) showed that preschoolers with autism improved on specific, individualized activities to gain mastery in play and engagement. As with NDT, there appears to be accepted, theoretical support for treatment based on sensory integrative principles, with minimal empirical evidence. Because the SI treatment approach is so widely used by occupational therapists (Watling, Dietz, Kanny, & Mclaughlin, 1999; Case-Smith & Miller, 1999) it is of utmost importance that research be conducted to assess its attributes, effectiveness, and overall benefits to children with complex sensorimotor considerations and their families.

IMPLICATIONS

Children with developmental disabilities often have significant problems related to motor performance, even when their primary diagnosis is not motor-based. Motor planning, sensory processing, and motor delays are all seen in children on the autism spectrum or with mental retardation, learning disabilities, language processing difficulties, or other similar diagnoses. This is especially true in young infants because the lack of attainment in motor milestones is often the area initially seen as problematic. Consequently, physical and occupational therapists become the professionals who frequently provide the initial intervention. As early interventionists, they are in an ideal position to effect functional change by applying strategies based on sound theoretical principles in a functional manner.

Research on the effectiveness of intervention with children with significant sensorimotor disabilities is more successful when functional skills are targeted. According to Wolery (1996), functional skills include those behaviors that are:

1. Useful
2. Enable the child to be more independent
3. Foster learning more complex skills
4. Allow a child to live in a less restrictive environment
5. Enable the child to be cared for more easily

Infusing NDT, SI, and the learning-based system approach into daily caregiving routines and embedding strategies into natural environments increase the likelihood that children will obtain and retain functional behaviors. Although limited, there are some initial research findings that lend support to this service delivery model. McWilliam, Tocci, and Harbin (1995) found that when parents of children who were receiving direct, individualized, clinic-based therapy were asked what they valued most from the sessions, the parents said it was the information they received from the therapists. These same parents, however, were not comfortable in discussing what they felt their child could do at home as a result of the therapy. These findings indicate that families value the information therapists provide and use this information in caring for their children. They are unsure, however, what functional change is directly linked to a specific intervention.

Clearly, research is needed to determine the effectiveness of these treatment strategies. Research should include a variety of strategies that focus on a variety of areas. Although widely accepted as appropriate theoretical constructs, the basis of the theoretical perspectives of various intervention approaches should be examined to validate their usefulness in explaining sensorimotor and/or neuromotor dysfunction. This recommendation is especially relevant for the theoretical bases of NDT and SI. Both of these approaches and

their treatment techniques were developed from a neuromaturational view of development. Assessing their validity in light of the contemporary motor-learning and control theories, as well as in light of the systems perspective, may be helpful in establishing sound research hypotheses.

Clinical research examining the effectiveness of specific techniques must clearly describe the techniques and the intervention procedure. Because of the variation in treatment, concluding that an approach is effective or ineffective is misleading. Specific techniques may be more advantageous than others for certain populations of children. Additionally, the outcomes sought through treatment must be clearly defined in functional, measurable terms. Improvements in processing ability or postural control are goals that have little direct meaning to the child's daily caregiving. To be functional, outcomes should have a direct relationship to Wolery's five areas.

Finally, measurement tools need to be responsive to the changes seen during therapeutic intervention. Too often, standardized developmental tools have been used to determine change over time in children with known disabilities. As these tools were not developed to detect these kinds of changes, their value is limited. Use of functional tools such as the FOAG, the PEDI, or the SFA (as previously described) may prove more beneficial. Intervention outcome is linked directly to tasks on these systems; thus, relevance to the treatment strategies may be clearly identified.

SUMMARY

Significant changes in therapeutic interventions provided to children with sensorimotor dysfunction have occurred during the past 20 years. These changes have primarily occurred in methods of gathering information about a child's functional status and delivering appropriate, functionally oriented services. Therapists are revising traditional service delivery models to reflect the growing emphasis on providing integrated therapeutic services within inclusive settings. The physical and occupational therapists' expertise in neuromotor development, the effects of sensorimotor skills on function and other developmental areas, and the therapists' ability to task analyze all contribute to contemporary service delivery. In recognition of the overlap among service providers, integrated, discipline-free programming is becoming more common.

This chapter outlined models of information-gathering that therapists use to evaluate and assess infants and young children. It also reviewed several recently published measurement tools used by pediatric physical and occupational therapists. Instruments are used as one component of the measurement process to (a) screen children for potential developmental concerns, (b) evaluate children to determine diagnosis or eligibility for services, or (c) assess children to plan therapeutic intervention or to determine the effects of intervention.

Therapists should be aware of the purpose of each tool and the information they would like to gain from the tool prior to selecting an instrument. Therapists may need to use a variety of tools and strategies to meet their screening, evaluation, or assessment objectives.

In addition to the measurement instrument used to gather information, a comprehensive measurement strategy should encompass the principles developed by ZERO TO THREE, National Center for Infant, Toddlers, and Families (Greenspan & Meisels, ZERO TO THREE Work Groups on Developmental Assessment, 1996) (see Chart 1).

These principles recognize that the development of infants and young children is complex and requires an appreciation of the child's abilities within a functional context. The therapist needs to appreciate that

Chart 1. Principles of Assessment

1. Assessment must be based on an integrated developmental model.
2. Assessment involves multiple sources of information and multiple components.
3. An assessment should follow a sequence.
4. The child's relationship and interactions with his or her most trusted caregiver should form the cornerstone of an assessment.
5. An understanding of the sequence and timetables in typical development is essential as a framework for the interpretation of developmental differences among infants and toddlers.
6. Assessment should emphasize attention to the child's level and pattern of ongoing experience and to functional capacities, which represent an integration of emotional and cognitive abilities.
7. The assessment process should identify the child's current competencies and strengths as well as the competencies that will constitute developmental progression in a continuous growth model of development.
8. Assessment is a collaborative process.
9. The process of assessment should always be viewed as the first step in a potential intervention process.
10. Reassessment of a child's developmental status should occur in the context of day-to-day family and/or early intervention activities.

From Greenspan & Meisels with the ZERO TO THREE Work Groups on Developmental Assessment (1996). In S. J. Meisels & E. Fenichel (Eds.) *New visions for the developmental assessment of infants and young children*. Washington, D.C.: ZERO TO THREE, National Center for Infants, Toddlers, and Families.

the assessment or evaluation of neuromotor development can be influenced by the interaction of the child with significant others, the environment, and the infant's own neurobehavioral state. This is especially critical when establishing intervention priorities, outcomes, goals, and strategies. Collaboration with other professionals, family members, and caregivers of the child will increase the likelihood that the therapist's findings will reflect the child's capabilities across environments and her current capacities and strengths, as well as identify barriers to optimal development. Individualized assessment of a child's neuromotor skills should capture the child's movement patterns, components of movement, and the use of movement within a functional activity, as well as the child's sensory processing and developmental skills acquisition.

The chapter also discussed treatment of children with sensorimotor dysfunction. An emphasis was placed on service delivery approaches and models reflecting the evolving context of service delivery for all children. These models and approaches allow the therapist to develop a variety of treatment strategies that best meet a child's needs and reflect evolving frameworks on sensorimotor development and behavioral change. ■

Acknowledgments

The authors would like to thank Elaine Anderson, M.P.H., P.T., for her assistance in the preparation of this manuscript.

REFERENCES

Alyward, G. (1993). *Bayley infant neurodevelopmental screener.* San Antonio, TX: Psychological Corporation.

American Occupational Therapy Association. (1994). *Uniform technology for occupational therapy: Application to practice.* Rockville, MD: American Occupational Therapy Association.

Ayres, J. (1979). *Sensory integration and the child.* Los Angeles: Western Psychological Services.

Bayley, N. (1993). *Bayley scales of infant development-II.* San Antonio, TX: Psychological Corporation.

Berenthal, B., Campos, J., & Barrett, K. (1984). Self-produced locomotion: An organizer of emotional, cognitive, and social development. In R. Ende and R. Herman (Eds.), *Continuities and discontinuities in development* (pp. 175-209). New York: Plenum.

Bredekamp, S., & Copple, C. (Eds.) (1997). *Developmentally appropriate practice in early childhood programs, revised edition.* Washington, D.C.: National Association for the Education of Young Children.

Bricker, D. (1993). *Assessment, evaluation and programming systems for infants and children.* Baltimore: Paul H. Brookes.

Bricker, D., Squires, J., & Mounts, L. (1995). *Ages and stages questionnaires*. Baltimore: Paul H. Brookes.

Campbell, P. H. (1993). *Administration guide: Functional outcome assessment grid.* Philadelphia: Temple University Center for Research in Human Development and Education.

Case-Smith, J. (1996). Analysis of current motor development theory and recently published infant motor assessments. *Infants and Young Children, 9,* 29-41.

Case-Smith, J., & Bryan, T. (1999). The effects of occupational therapy with sensory integration emphasis on preschool-age children with autism. *American Journal of Occupational Therapy, 53,* 489-497.

Case-Smith, J., & Miller, H. (1999). Occupational therapy with children with pervasive developmental disorders. *American Journal of Occupational Therapy, 53,* 506-513.

Chandler, L. S., Swanson, M.W., & Andrews, M. S. (1980). *Movement assessment of infants.* Rolling Bay, WI: Infant Movement Research.

Cicchetti, D., & Wagner, S. (1990). Alternative assessment strategies for the evaluation of infants and toddlers: An organizational perspective. In S. J. Meisels & J. P. Shonkoff (Eds.), *Handbook of early childhood intervention.* New York: Cambridge University Press.

Cintas, H. L. (1995). Cross-cultural similarities and differences in development and the impact on parental expectations on motor behavior. *Pediatric Physical Therapy, 7,* 103-111.

Cole, K., Harris, S., Eland, S., & Mills, P. (1989). Comparison of two service delivery models: In-class and out-of-class therapy approaches. *Pediatric Physical Therapy, 1,* 49-54.

Coster, W., Deeney, T., Haltiwanger, J., & Haley, S. (1998). *School function assessment.* San Antonio, TX: Therapy Skill Builders.

DeGangi, G., & Greenspan, S. I. (1988). The development of sensory functions in infants. *Physical and Occupational Therapy in Pediatrics, 8,* 21-33.

DeGangi, G., & Greenspan, S. (1989). *Test of sensory functions in infants.* Los Angeles: Western Psychological Services.

Dunn, W. (1996). Occupational therapy. In R.A. McWilliam (Ed.), *Rethinking pull-out services in early intervention, (pp. 267-313).* Baltimore: Paul H. Brookes.

Dunn, W., Brown, T., & McGuigan, A. (1994). The ecology of human performance: A framework for considering the effect of context. *American Journal of Occupational Therapy, 48*(7), 595-607.

Dunn, W. & Campbell, P. H. (1991). Designing pediatric service provision. In W. Dunn (Ed.), P*ediatric occupational therapy* (pp. 130-159). Thorofare, NJ: Slack.

Embrey, D. G., Yates, L., & Mott, D. H. (1990). Effects of neurodevelopmental treatment and orthoses on knee flexion during gait: A single-subject design. *Physical Therapy, 70,* 626-637.

Foley, G.M. (1990). Portrait of the arena evaluation: Assessment in the transdisciplinary approach. In F. D. Gibbs and D. M. Titi (Eds.), *Interdisciplinary assessment of infants: A guide for early intervention professionals.* Baltimore: Paul H. Brookes.

Folio, M. & Fewell, R. (1983). *Peabody developmental motor scale.* Allen, TX: DLM Teaching Resources.

Gentile, A. M. (1987). Skill acquisition: Action, movement, and neuromotor processes. In J. H. Carr, & R. B. Shepard (Eds.), *Movement science: Foundations for physical therapy in rehabilitation.* Rockville, MD: Aspen Systems.

Gesell, A. (1945). *The embryology of behavior: The beginnings of the human mind.* Philadelphia: J. B. Lippincott.

Giangreco, M. F. (1986). Effects of integrated therapy: A pilot study. *Journal of the Association for Persons with Severe Disabilities, 11*(3), 205-208.

Greenspan, S. I., & Meisels, S. (1993). *Toward a new vision for the developmental assessment of infants and young children.* Arlington, VA: ZERO TO THREE, National Center for Clinical Infant Programs.

Greenspan, S. I., & Meisels, S. J., with the Zero-to-Three Work Group on Developmental Assessment (1996). In S. J. Meisels and E. Fenichel (Eds.), *New visions for the developmental assessment of infants and young children.* Washington, D.C.: ZERO TO THREE, National Center for Infants, Toddlers, and Families.

Greenspan, S. I., & Weider, S. (1997). An integrated developmental approach to interventions for young children with severe difficulties in relating and communicating. *Zero to Three, 17*(5), 5-8.

Haley, S., Coster, W. J., Ludlow, I. H., Haltiwanger, J. T., & Andrellas, P. (1992). *Pediatric evaluation of disability inventory.* Boston: PEDI Research Group, Department of Rehabilitation Medicine, New England Medical Center Hospital.

Hanft, B., & Place, P. (1996). *The consulting therapist: A guide for OTs and PTs in the school.* San Antonio, TX: Therapy Skill Builders.

Harris, S. (1988). Early intervention: Does developmental therapy make a difference? *Topics in Early Childhood Special Education, 7,* 20-32.

Harris, S. (1987). Early intervention for children with motor handicaps. In M. J. Guralnick & F. C. Bennett (Eds.), *The effectiveness of early intervention for at-risk and handicapped children* (pp. 175-212). Orlando, FL: Academic Press.

Heriza, C. (1991). Motor development: Traditional and contemporary theories. In M. J. Lester (Ed.), *Contemporary management of motor control problems: Proceedings of the II Step Conference.* Alexandria, VA: Foundation for Physical Therapy.

Horn, E. M., Warren, S. F., & Jones, H. A. (1995). An experimental analysis of a neurobehavioral intervention. *Developmental Medicine and Child Neurology, 37,* 697-714.

Humphries, T., Wright, M., Snider, L., & McDougall, B. (1992). A comparison of the effectiveness of sensory integrative therapy and perceptual-motor training in treating children with learning disabilities. *Developmental and Behavioral Pediatrics, 13*(1), 31-40.

Johnson-Martin, N. M., Jens, K. A., Attermeier, S. M., & Hacker, B. J. (1991). *The Carolina curriculum for infants and toddlers with special needs.* (2nd ed.) Baltimore: Paul H. Brookes.

Kirshner, B., & Guyatt, G. (1985). A methodological framework for assessing health indices. *Journal of Chronic Diseases, 38,* 27-36.

Koomar, J., & Bundy, A. (1991). The art and science of creating direct intervention from theory. In A. G. Fisher, E. A. Murray, & A. C. Bundy (Eds.), *Sensory integration: Theory and practice* (pp. 251-317). Philadelphia: F. A. Davis.

Larin, H. (1994). Motor learning: Theories and strategies for the practitioner. In S. Campbell (Ed.), *Physical therapy for children* (pp. 157-182). Philadelphia: W. B. Saunders.

Law, M., Cadman, D., Rosenbaum, P., Walters, S., Russell, D., & DeMateo, C. (1991). Neurodevelopmental therapy and upper extremity casting for children with cerebral palsy. *Developmental Medicine and Child Neurology, 33,* 379-387.

Lyons, B. G. (1984). Defining a child's zone of proximal development: Evaluation process for treatment planning. *American Journal of Occupational Therapy, 38*, 446-451.

McGraw, M. B. (1945). *The neuromuscular maturation of the human infant.* New York: Hafner Press.

McWilliam, R. (1996). How to provide integrated therapy. In R. A. McWilliam (Ed.), *Rethinking pull-out services in early intervention* (pp. 147-184). Baltimore: Paul H. Brookes.

McWilliam, R. A. (1992). *Family centered intervention planning: A routines based approach.* San Antonio, TX: Therapy Skill Builders.

McWilliam, R. A., Tocci, L., & Harbin, G. L. (1995). *Services are child-oriented and families want them that way.* Chapel Hill: Early Childhood Research Institute on Service Utilization, Frank Porter Graham Child Development Center, University of North Carolina.

Miller, L. J., & Roid, G. H. (1994). *The TIME: Toddler and infant motor evaluation.* Tucson, AZ: Therapy Skill Builders.

Newborg, J., Stock, J. R., & Wnek, L. (1984). *Battelle developmental inventory.* Allen, TX: DLM Teaching Resources.

Ottenbacher, K. (1991). Research in sensory integration: Empirical perceptions and progress. In A. G. Fisher, E. A. Murray, & A. C. Bundy (Eds.), *Sensory integration: Theory & practice* (pp. 385-399). Philadelphia: F. A. Davis.

Ottenbacher, K., Biocca, Z., DeCremer, G., Gevelinger, M., Jedovic, K. B., & Johnson, M. B. (1986). Quantitative analysis of the effectiveness of pediatric therapy: Emphasis on neurodevelopmental treatment approach. *Physical Therapy, 66,* 1095-1101.

Ottenbacher, K., & Cusick, A. (1989). Goal attainment scaling as a method of clinical service evaluation. *American Journal of Occupational Therapy, 44,* 519-525.

Ottenbacher, K., & Peterson, P. (1985). The efficacy of early intervention programs for

children with organic impairment: A quantitative review. *Evaluation and Program Planning, 8,* 135-146.

Palisano, R. (1991). Research on the effectiveness of neurodevelopmental treatment. *Pediatrics Physical Therapy, 3,* 143-148.

Palmer, F. B., Shapiro, B. S., Wachtel, R. C., Allen, M. C., Hiller, J. E., Harryman, S. F., Mosher, B. S., Meinert, C. L., & Capute, A. J. (1990). Infant stimulation curriculum for infants with cerebral palsy: Effects on infant temperament, parent-infant interaction, and home environment. *Pediatrics, 85* (Suppl.), 411-415.

Parham, L. D., & Malloux, Z. (1996). Sensory integration. In J. Case-Smith, A. S. Allen, & P. N. Pratt (Eds.), *Occupational Therapy for Children* (3rd ed.) (pp. 307-356). St. Louis, MO: Mosby.

Piper, M. (1993). Theoretical foundations for physical therapy assessment in early infancy. In I. J. Wilhelm (Ed.), *Physical therapy assessment in early infancy.* New York: Churchill Livingstone.

Piper, M., & Darrah, J. (1993). *Motor assessment of the developing infant.* Philadelphia: W. B. Saunders.

Russell, D., Rosenbaum, P., Garland, C., Hardy, S., Lane, M., Plews, M., McGavin, H., Cadman, D., & Jarvis, S. (1993). *Gross motor function measure.* Hamilton, Ontario: Children's Developmental Rehabilitation Program at Chedoke-McMaster Hospitals.

Schmidt, R. A. (1975). A schema theory of discrete motor skill learning. *Psychological Review, 82,* 225-260.

Shelton, T. (1989). The assessment of cognition/intelligence in infancy. *Infants and Young Children: An Interdisciplinary Journal of Special Care Practice, 1,* 10-25.

Shirley, M. M. (1931). *The first two years: A study of twenty-five babies. Vol. 1: Postural and locomotor development.* Minneapolis, MN: University of Minnesota Press.

Shonkoff, J. P., & Hauser-Cram, P. (1987). Early intervention for disabled infants and their families. *Pediatrics, 80,* 650-658.

Taylor, R. L. (1993). Instruments for the screening, evaluation, and assessment of infants and toddlers. In D. M. Bryant & M. A. Graham (Eds.), *Implementing early intervention: From research to effective practice.* New York: Guilford.

Thelan, E. (1990). Coupling perception and action in the development of skill: A dynamic approach. In H. Block and B.T. Berenthal (Eds.), *Sensorimotor organization and development in infancy and early childhood* (pp. 39-56). Dordrecht, Netherlands: Kluwer Academic.

Vargas, S., & Camilli, G. (1999). A meta-analysis of research on sensory integration treatment. *American Journal of Occupational Therapy, 53,* 189-198.

Warren, S. F., & Horn, E. (1996) Generalization issues in providing integrated services. In R. A. McWilliam (Ed.), *Rethinking pull out services in early intervention: A professional resource* (pp. 121-143). Baltimore: Paul H. Brookes.

Watling, R., Dietz, J., Kanny, E. M., & Mclaughlin, J. F. (1999). Current practice of occupational therapy for children with autism. *American Journal of Occupational Therapy, 53,* 498-505.

Wolery, M. (1996). Early childhood special and general education. In R. A. McWilliam (Ed.), *Rethinking pull out services in early intervention: A professional resource* (pp. 182-215). Baltimore: Paul H. Brookes.

Wright, T., & Nicholson, J. (1973). Physiotherapy for the spastic child: An evaluation. *Developmental Medicine and Child Neurology, 15,* 146-163.

Appendix

ADDITIONAL MEASUREMENT INSTRUMENTS USED BY PEDIATRIC PHYSICAL THERAPISTS AND OCCUPATIONAL THERAPISTS

Name	Purpose	Areas Assessed	Age Range	Clinical Relevance
Ages and Stages Questionnaires, (Squires, J., & Bricker, D., 1999)	• Determine development through parental report	• Communication • Gross motor • Fine motor • Adaptive • Personal-social	4-60 months	• Cost effective monitoring system for high risk infants
Assessment, Evaluation and Programming System for Infants and Children (Bricker, D., 1993)	• Determine level of functioning • Develop intervention plans • Monitor effects of intervention	• Fine motor • Gross motor • Adaptive • Cognition • Social • Communication	1 month to 3 years	• Administered during naturally occurring events, routines, and activities • Direct link to programming • Allows for observation or direct testing • Takes into consideration task adaptations/ modifications
Batelle Developmental Inventory (Newborg, L., Stock, J. R., & Wnek, L., 1984)	• Determine level of development • Determine eligibility for educational intervention	• Personal-social • Adaptive • Motor • Communication • Cognition	1 month to 9 years	• Includes adaptations for children with disabilities • Screening component • Limited number of items in each domain
Bayley Scales of Infant Development-II (Bayley, N., 1993)	• Determine level of development • Determine eligibility for early intervention	• Cognition • Motor • Behavior	1-42 months	• Predictive value is moderate • Most widely used tool in infant research

Continued

Name	Purpose	Areas Assessed	Age Range	Clinical Relevance
Bayley Infant Neurodevelopmental Screener (Alyward, G., 1993)	• Screen for potential delay or neurological impairments	• Neurologic • Receptive • Expressive • Cognitive	3-24 months	• Incorporates neuromotor items into developmental scale • Takes into consideration caregiver report • Especially relevant for NICU follow-up
The Carolina Curriculum for Infants and Toddlers with Special Needs (2nd ed.) (Johnson-Martin, N. M., Jens, K. A., Attermeier, S. N. & Hacker, B. J., 1991)	• Determine level of performance across dimensions	• Cognition • Communication • Gross motor • Fine motor • Self-help	0-36 months	• Criterion-referenced • Curriculum cross-referenced to measurement instrument
Movement Assessment of Infants (MAI), (Chandler, L. S., Swanson, M.W., & Andrews, M. S., 1980)	• Provide a uniform approach to the evaluation of high risk infants	• Muscle tone • Reflexes • Automatic • Reactions • Volitional movement	0-12 months	• Lengthy, great deal of handling of the infant • Risk profile for 4-month-old
Peabody Developmental Motor Scales (Folio, M., & Fewell, R., 2000)	• Determine developmental level	• Reflexes • Gross motor • Fine motor	0-72 months	• Scoring allows crediting of emerging skills • Activity cards available but of limited use

10

An Integrated Intervention Approach to Treating Infants and Young Children with Regulatory, Sensory Processing, and Interactional Problems[1]

Georgia A. DeGangi, Ph.D., O.T.R., F.A.O.T.A.

A variety of developmental therapies that therapists typically use to address constitutional and maturational problems in infants and young children are associated with regulatory difficulties involving sleep and eating problems, sensory reactivity, poor motor planning, and high irritability. These developmental therapies include (1) sensory integration therapy (Ayres 1972, 1979) to address the infant's sensory processing problems; (2) developmental therapy that emphasizes skills in communication, play, cognition, and movement; and (3) parent guidance approaches that integrate behavioral and developmental techniques to address sleep, mood regulation, eating, and attentional problems (DeGangi, Craft, & Castellan, 1991; DeGangi, 2000).

Many infants and children with regulatory and developmental problems also have problems with social interactions, which are observed first in how the child interacts with family members and, later, with peers (Greenspan, 1992, 1997). When the problem is considered severe enough, a mental health professional provides services. Regulatory and regulatory-related relational problems may be addressed through (1) infant psychotherapy approaches that focus on dyadic parent-child interactions (Fraiberg, 1980; Greenspan, 1992, 1997; Greenspan & Salmon, 1995; Greenspan & Wieder, 1998); (2) directive interactional guidance such as that developed by MacDonough (1989); or (3) supportive counseling. The way in which these approaches are used vary greatly depending upon the presenting concerns, the population being treated, and the theoretical framework adopted by the treating therapists.

In this chapter, an integrated model of treatment is advocated to address both the child's constitutional problems and how these problems impact the family and the parent-child dyad. This expanded model of treatment includes:

- *Parent guidance* that focuses on management of sleep, feeding, and behaviors in the home environment.
- *Child-centered interactions* (i.e, "floor time," [Greenspan & Wieder, 1998])

[1] This chapter focuses on circumscribed self-regulation, sensory procesing, and motor-planning challenges. For many children with significant problems in relating, communicating, and thinking, these strategies will need to be considered in the context of a comprehensive program, as described in Chapter 4.

activity that fosters healthy parent-child interactions within the context of play.
- *Sensory integration therapy* techniques that promote organized attention, adaptive behaviors, and normalized responses to sensory experiences.

The parent guidance, child-centered activity, and sensory integration therapy techniques are blended together in treatment, with primary emphasis on meeting the immediate needs of both the parent and child.

This chapter describes this family-centered approach. It presents the elements of parent guidance, using examples of typical problems. Child-centered activity—or floor time—and sensory integration therapy techniques are discussed in their application to infants and children with sensory, emotional, and attentional deficits. Research examining the effectiveness of the child-centered activity approach is presented. Lastly, the chapter includes a detailed case example that incorporates the various elements of the treatment approach and modifications that may be needed depending upon the presenting problems.

THE FAMILY-CENTERED APPROACH: ADDRESSING THE CONCERNS OF PARENTS

Legislation and current research on family involvement in a child's therapy program point to the value of a family-centered approach to intervention. In this approach, play is increasingly recognized by professionals as an important medium through which parents can address the special needs of their child. Play is viewed as the arena in which children learn and practice new skills with the people most important to them (Schaaf & Mulrooney, 1989). Research suggests that when parents realize a sense of empowerment in making decisions, their stress and depression may be reduced and their sense of competence increased (Friedrich, Cohen, & Wilturner, 1988). Clinicians become consultants to the parents in this collaborative model of helping, and the parents' abilities are met with respect and confidence (Dunst, Trivett, Davis, & Cornwell, 1988).

Children who are fussy, irritable, and demanding are extremely challenging for parents. Oftentimes, parents cope by developing interaction patterns of under- or overstimulation. For example, parents who must often soothe and regulate their distressed child may find that they tend to retreat or "shrink from interaction" when their child is happy and content so as not to "rock the boat." In the case of the highly distractible child who appears to seek constant novelty, the parents may exacerbate the problem by presenting many activities or toys to their child to try to keep the child happy.

The family-centered approach recognizes the stress that coping with a difficult child places on the family. The parents often experience sleep deprivation and, as a result, they have little reserve for coping with an irritable child. Many times, parents report that babysitters cannot cope with the child's difficult behaviors, which compounds feelings of entrapment. Marital tension may be heightened as the parents feel overwhelmed by the problems of the fussy and difficult child or make accommodations that interfere with their own relationship (i.e., infant sleeping in parents' bed). In some cases, the father becomes peripheral to the family, working long hours to avoid a hectic home life and a constantly screaming infant. The danger of child abuse is very real.

An adequate support system is necessary to help a family cope with a difficult situation. More and more parents have no extended family in their geographic area. As a result, they have no one to help them or to

provide respite. Parent-baby groups have become an alternative support system for many families; however, many fussy babies cannot tolerate being in a playgroup situation, thus removing this option for the parent. Additionally, many parents take their children to baby gym or swim classes; however, these activities are often too stimulating for the regulatory-disordered child. As a result, many parents feel even more isolated and removed from the typical activities in which parents engage with their children. Sometimes, parents who try such options feel stigmatized by other parents because their child appears so out of control.

Depression is frequently a side effect of coping with the demands of parenting the fussy baby. Many mothers report feelings of inadequacy when normal parenting skills do not seem to work with their child. First-time parents often confuse their child's constitutional difficulties with their own parental inexperience, which exacerbates depression or feelings of helplessness. These feelings are compounded when the infant rejects being held and cuddled because of hypersensitivities to touch. Sometimes the parents learn to avoid sensorimotor activities that provoke their child's hypersensitive responses. For example, if the child dislikes swings and playground equipment because of extreme fearfulness of movement in space, a protective mother may guide her child away from movement activities. In some cases the parents may experience similar hypersensitivities, which compounds their responses to their infant who has similar constitutional difficulties.

In summary, a family-centered approach focuses on parental concerns, family stresses in coping with the difficult child, adaptive and maladaptive parent-child interaction patterns, and parental depression or marital conflicts that may be secondary to the child's constitutional difficulties. These issues may be addressed directly through parent guidance and the child-centered activity.

Parent Guidance

Approaches for infants and children with the range of developmental disorders involve a blend of behavioral management, supportive counseling, practical management techniques, sensorimotor activities, and developmental therapy to address specific constitutional problems (DeGangi et al., 1991). Parent guidance is an important component of the therapy process. It provides parents with emotional support in coping with their difficult child and is useful in developing effective strategies to set limits, manage the child's sleep, teach self-calming, and handle feeding problems. Although parent guidance is individualized, a variety of self-help books is often used to help parents in managing specific problems such as sleep or dietary problems (Carey & McDevitt, 1995; Daws, 1989; Greenspan, 1999; Greenspan & Salmon, 1995; Sears, 1985; Rapp, 1986; Turecki & Tonner, 1985). Although the relationship between food allergies and behaviors is controversial, the possibility of food allergies should be explored for those children who do not respond to behavioral management techniques. For example, it was recently reported that a significant number of infants who did not respond to behavioral techniques for sleeplessness did respond to a hypoallergenic diet that eliminated all milk products (Kahn, Mozin, Rebuffat, Sottiaux, & Muller, 1989).

Sleep problems are addressed by a combination of methods, including developing appropriate sleep-wake routines (Ferber, 1984). Since sleep problems are often accompanied by separation anxiety, separation games are practiced (e.g., chase games, peek-a-boo). Techniques to console the irritable child include addressing the child's sensory

hypersensitivities, developing the child's own capacity to self-calm, and reducing parental anxieties when crying occurs. Techniques for managing temper tantrums and helping the child to accept limits focus not only on the child's difficulties in expressing frustration and negative affect, but on helping parents develop a consistent plan in approaching the child's behaviors. Management of feeding problems focuses on inhibiting tactile hypersensitivities of the face and mouth, expanding the child's repertoire of foods, and addressing behavioral feeding problems such as refusal to eat and food throwing. Attentional problems are addressed by structuring the environment, reducing the child's hyper-arousal through sensory inhibition, and facilitating sustained attention by helping the child to elaborate on play. In addition, problems with communication and play are addressed through structured intervention by explicitly teaching parents how to promote face-to-face engagement, reciprocal interactions, two-way communication, and gestural or vocal signaling.

When therapy is initiated, the clinician seeks to help the parents understand their child's behaviors and how they as parents respond when the behaviors occur. The clinician discusses what techniques the parents have already tried to determine which ones may or may not have worked. Sometimes it becomes apparent that parental inexperience or mismanagement of behaviors exacerbates the child's regulatory difficulties. When this appears to be the case, it is important for the therapist to be supportive and nonjudgmental. It is also important for the therapist to determine if discrepancies exist between the ways in which the father and the mother manage their child's difficult behaviors.

Parent guidance takes the form of a working dialogue with the parents to develop the best match between the parents' concerns, the family lifestyle, and management techniques. Major emphasis is placed on developing problem-solving strategies from which the parents often develop insights about their child and themselves. For example, some parents may realize that they are over-controlling and cannot tolerate their child's overly active and loud behaviors. It is important to help such parents understand what underlies their child's difficulties and to help them develop strategies to help their child organize his behaviors before they become uncontrollable, yet at the same time provide him with opportunities for normal active exploration. Parent guidance blends the principles of behavioral management, supportive therapy, practical management techniques, brief psychodynamic therapy, family therapy principles, and sensory integration treatment.

Sensory Integration Therapy Approach

The family-centered approach addresses the constitutional problems of the children by incorporating the principles of sensory integration therapy (Ayres, 1972, 1979; Fisher, Murray, & Bundy, 1991). Concepts from sensory-integration therapy are integrated into functional activities, modifications of the environment, and play interactions with others. Sensory integration treatment techniques often involve desensitizing hyperreactivities; increasing the underreactive child's sensory awareness; organizing sustained attention; facilitating organized, purposeful activity; and promoting self-calming and modulation of arousal states through specific sensory inputs. The major principle underlying sensory integration therapy is the improvement of the child's ability to organize and process sensory input during self-directed, purposeful activities. The child's interest and motivation guide how the various sensory integration tasks are provided.

Sensory integration therapy provides a foundation for children experiencing sensory processing and attentional deficits. This therapy is provided within the contexts of the child-centered activity and parent guidance. Specific treatment techniques for desensitizing the hyperreactive child, organizing sustained attention and purposeful activity, and promoting self-calming and modulation of arousal states are derived from the sensory integration treatment approach. The next section describes the basic tenants of this philosophical approach.

The underlying premise of sensory integration theory is that the ability of the central nervous system to take in, sort out, and interrelate information received from the environment is necessary for purposeful, goal-directed responses. The major principle underlying sensory integration treatment is the improvement of an individual's ability to organize and process sensory input provided during meaningful events, thus allowing for an adaptive response to the environment. A child's ability to actively experience sensations while simultaneously engaging in self-directed, purposeful motor activity is essential to intervention. Sensory integration therapy facilitates an individual's ability to make adaptive responses to environmental stimuli, and these responses facilitate organization in the central nervous system by providing sensory feedback about a goal-directed event.

Self-directed and self-initiated actions differentially enhance central nervous system function and maturation (Kandel & Schwartz, 1985). In essence, approaches such as the child-centered activity allow a child to develop automatic functions of better self-organization and control. The child learns to develop appropriate motor responses to different sensory events based upon neural feedback and central nervous system organization (Clark, Mailloux, & Parham, 1985).

When children experience sensory integration dysfunction, they frequently benefit from occupational therapy input. The therapist works with the child and family to integrate sensory integration principles into the child's everyday living and play experiences. This is done by modifying daily routines, functional activities, play materials, and the manner in which important persons in the child's life interact with the child. It often includes making changes in the way in which the home environment is structured (e.g., reducing noise stimulation, providing small, enclosed spaces). The therapist often provides individualized sensory input to address specific atypical sensory responses. For example, the therapist may brush the child's skin with a surgical brush in specific ways to desensitize the child's tactile hypersensitivities, or she may introduce certain types of movement on suspended equipment (e.g., spinning) to normalize the child's responses to vestibular stimulation. These directed sensory integration techniques are very helpful in normalizing the child's sensory responses, but should be provided by a trained occupational therapist.

The sensory integration therapy approach advocated for use in the integrated therapy approach described in this chapter focuses on how principles from sensory integration therapy can be used to address the child's constitutional difficulties. This is done within the context of everyday activities and interactions with others. For example, when tactile hypersensitivities are present, activities are used that involve firm deep-pressure (e.g., mother and child wrapping up together in a big comforter), proprioception (e.g., embracing the child with firm contact with primary input on the child's back), and providing textured objects that will help organize the child's exploration. If a child is fearful of leaving the ground because of gravitational

insecurity, low-to-ground equipment such as an inner tube filled with interesting toys is introduced. Motor-planning activities are encouraged by focusing on how movement can be sequenced in play and through transitions in activities. The case study presented at the end of this chapter more fully depicts how the sensory integration approach is integrated into the child's treatment program.

Child-Centered Activity: Floor Time

Description of the Floor Time Approach

Addressing the emotional and interactional aspects of the parent-child difficulties that exist between the child and the parents is central for treatment. Floor time was developed by Greenspan (1979, 1989, 1992, 1997, 1999; Greenspan & Lourie, 1981; Greenspan & Salmon, 1995; Greenspan & Wieder, 1998), to foster growth in the context of integrating the different realms of the child's experiences (i.e., physical, emotional, and interactive/family). This approach focuses on using the inner resources of the child and parent. Using an experiential model, floor time is a form of infant psychotherapy that is adapted to the sensorimotor phase of development (DeGangi, 2000). The theoretical approach underlying floor time therapy is based on ego psychology as described by Greenspan (1979) and an object-relations theoretical framework (Winnicott, 1960). In this child-centered approach, infant psychotherapy focuses on the dynamics of the parent-infant interaction and parent insights concerning their relationship with their child or issues from their past, as well as the emotional needs of parent and child during interactions (Lieberman & Pawl, 1993).

Others have also applied principles of infant psychotherapy to the sensorimotor phase of development (Mahrer, Levinson, & Fine, 1976; Ostrov, Dowling, Wesner, & Johnson, 1982.) Wesner, Dowling, and Johnson (1982) described an approach which they term "Watch, Wait, and Wonder (WWW)" that is similar to Greenspan's floor time. In the WWW approach, the infant initiates all interactions and the parents seek to discover what it is that their infant is seeking and needing from them and the environment. In this process, the parents may become attuned to the child's constitutional and emotional needs, how the child wishes to communicate and interact, and the quality of their parent-child relationship. Helping parents recognize their projective identifications with their child is considered an important aspect of the treatment process. The WWW approach has been used successfully with mentally retarded and developmentally delayed children (Mahoney, 1988; Mahoney & Powell, 1988). It also has been used as a method to focus on unresolved relational conflicts of the mother involving the mother's projective identification with her infant (Muir, 1992).

Floor time focuses on improving the developmental capacities of the child within the context of the parent-child relationship. Relevant stages of emotional development outlined by Greenspan (1989, 1992) are used to help guide this process. These stages include engagement and disengagement with objects and persons; organized, intentional signaling and communication on verbal and gestural levels; representational elaboration of shared meanings; and symbolic differentiation of affective-thematic experiences. In this child-centered approach, constitutional problems of the child such as irritability, sensory hypersensitivities, inattention, and other problems of self-regulation are addressed through the medium of play with the parent. Insights gained by parents about their relationship with their child or issues from their

own past are addressed as they pertain to parenting and fostering the child's healthy emotional development and regulatory capacities.

In floor time, the parent is taught to provide daily sessions of focused, nonjudgmental attention. The frequency and duration of the intervention will vary depending upon the child's and the family's needs. During this time, the child is the initiator of all play and the parent is the interested observer and facilitator, elaborating and expanding upon the child's own activity in whatever way the child seeks or needs from the parent (e.g., to imitate, admire, or facilitate). The parent is nonintrusive and nondirective in his or her interactions with the child. In this approach, the parent is instructed to "watch, wait, and wonder" what the child is seeking and needing both from the parent and the environment, then respond accordingly (Wesner, Dowling, & Johnson, 1982).

The child's attention span and activity level dictate the direction that the play takes rather than an imposed structure or specific task demand presented by the parent. In this way, the child needs to refine his ability to attend and give affective signals while the parent learns to become a more sensitive responder. If the child's gestural or vocal signals are nondifferentiated, the parent may reflect their nonspecificity by imitating, then waiting until the child can again signal what he wants. The environment is organized to make available toys and materials that promote sensorimotor development and emotional themes in a safe area where there are no prohibitions or interruptions. For example, if a child has tactile hypersensitivities, textured toys and heavy objects are placed in the room together with other play materials. If the child has feeding problems, dolls and feeding utensils and mediums such as corn, dried beans, or water are set out. In general, the toys are childproof and developmentally appropriate. For example, for a 6- to 12-month-old, the play materials may be tableware, blocks, dolls, and tactile materials such as Koosh balls, whereas toys for a toddler may be toy telephones, a cradle with a doll, toy trains and cars, and blocks and balls. Extrinsic reinforcement, such as praise, is deemphasized. Instead, the parent reflects on the child's expressiveness by expanding on facial gestures, affect, or language cues. The parent is given permission to be an observer of the child and to respond to the child's cues. The medium of play offers parents space to ponder the nature of their relationship with their child and minimizes the need to do to, or for, their child.

During the time that the parent and child engage, the therapist acts as an attentive observer, modeling how to be a nonjudgmental observer of the parent-child relationship. In essence, the therapist provides for the parent what the parent provides for the child. Throughout the process, the therapist tries to convey a sense of respect for the caregiver's parenting ability. In challenging cases, the therapist may need to be more directive in helping the parent to follow the floor time structure. This issue is discussed more fully in a later section.

During therapy sessions, floor time is practiced for 20 minutes followed by a discussion between therapist and parent about the process. For some parents, 20 minutes is too long for them to tolerate this type of play with their child, in which case floor time is attempted for as long as the parent is able. The parents may be asked what they observed about their child. In addition, they may be asked questions about what it was like for them to play with their infant in this special way and how they felt during the playtime. The therapist's role is supportive, while seeking to help clarify and reflect on the parent's responses to the child and what the child's

behaviors might serve for the child. This process is important in order to address how the parents have adapted to the child's regulatory problems and to help parents become more aware of how the child might perceive their cues. Parental stress, depression, feelings of incompetence or displeasure with parenting, connections with the past (e.g., how parented), feelings elicited by the child's behavior, and family dynamics (including the impact of the child on marital relations) may be topics that emerge. If a parent is resistant to exploring personal issues and prefers to focus solely on the child, the therapist is respectful of this wish. The therapist may gently raise concerns about how the child's behaviors affect the parents and family.

Unlike more structured therapy approaches, floor time is a *process-oriented* model rather than a technique to be mastered. Some parents need considerable help in allowing their child to take the lead. They may have difficulty resisting the temptation to teach their child new skills, particularly when they are worried about lags in development. The therapist seeks to help the parents gain insights about their child's regulatory problems through what is expressed in the play context.

The underpinnings of this approach lie in the view that play— rather than direct instruction and skills training—is the medium by which a child learns, and that children learn best when actively engaged in the presence of a loving parent. As the child becomes the initiator of an interaction, intrinsic motivation and active participation in interactions and explorations are enhanced. The child experiences the parents' encouragement to act on her interests, which enhances the child's feelings of success, competence, and control. As a result, the child learns to develop internal control, and to engage in explorations with her environment and in interactions with others.

Through the medium of child-centered activity, parents become more sensitized to their child's behavioral style, developmental needs, and interests. For a child with significant sensory disturbances, this learning has far-reaching implications. For example, the infant with tactile hypersensitivities may avoid handling textured objects, reject new food textures, and experience physical discomfort when touched by others. Because of the underlying tactile hypersensitivities, the infant may exhibit difficulties in manipulating small objects in feeding and in playing with peers. During treatment, the mother may set out several types of textured toys (e.g., a large bin of styrofoam chips with many interesting toy figures buried inside the bin) during the time designated for child-centered activity. She waits and watches the child as he approaches the materials, facilitating exploration by taking turns. In this way, the child learns to explore the materials on his own terms, taking in only as much tactile information as his nervous system can handle. Aggressive behaviors may be channeled appropriately by providing the child with toys such as heavy push carts that he can lift and move or large Nerf balls and bats that he can throw and hit. These types of activities also serve to desensitize the child's overly sensitive tactile system.

The child-centered activity approach, or floor time, has been applied by individuals in several disciplines to accomplish different goals. Speech and language therapists have used this approach to achieve balanced interactions between an adult and child through turn-taking. For example, a child initiates an action, and the adult imitates the action or vocalization or responds by continuing the child's topic. This turn-taking exchange may continue for a number of turns with variations in responses with each turn. It not only serves

to facilitate communication, but also increases a child's attention to tasks.

Because the focus of the approach is on mastery for both parent and child, it is a highly positive and reinforcing experience for both parent and child. Preconceived notions that a child must be taught in order to learn are challenged, particularly for the parents who perceives that their child is less competent than her peers. The parents' difficulties are not considered detrimental to the treatment process; however, they must be addressed. Some parents may not be able to embrace this approach. Parents with obsessive or rigid parenting styles may find the more reflective and responsive style of child-centered activity difficult. If these parents can master floor time techniques, it may help them develop less rigid patterns of interaction and allow them to expand their repertoire of parent behaviors that will later enhance mental health. The child-centered activity is a natural foundation for developing listening skills.

Goals of Floor Time

Floor time has different goals for the parent and the child.

The ultimate goals of floor time for a child are to:

- Provide the child with focused, nonjudgmental attention from the parent.
- Facilitate self-initiation and problem-solving by the child.
- Develop intentionality, motivation, curiosity, and exploration.
- Promote sustained and focused attention.
- Refine the child's signal giving.
- Enhance mastery of sensorimotor developmental challenges through the context of play.
- Broaden the repertoire of parent-infant interactions.
- Develop a secure and joyful attachment between parent and child.
- Enhance flexibility and range in interactive capacities.

The goals of floor time for a parent are to:

- Develop better signal reading of their child's cues and needs.
- Become more responsive or attuned to their child, allowing the child to take the lead in the interaction.
- Develop a sense of parental competence as a facilitator rather than as a director of their child's activity.
- Take pleasure in their child in a totally nonprohibitive setting.
- Appreciate their child's intrinsic drive for mastery and the various ways in which it is manifested.
- Change their internal image of each other to that of a competent parent and a competent child.

Through the child-centered therapy process, parents who have felt overwhelmed by their child's difficulties may begin to acquire new ways of interacting and enjoying their child at home. By working through the parent-child relationship, the child's emotional and developmental competence is enhanced.

Instructions On How to Teach Floor Time

Instructions that a therapist may use in guiding a parent to learn floor time follow.

Instructions for Floor Time

1. *Set aside 20 minutes/day when there are no interruptions.* Be sure to do the play during a time when you and your child are well rested and you don't have other things to worry about, such as something cooking on the stove or the doorbell ring-

ing. Take the telephone off the hook or put the answering machine on. Be sure that your child's physical needs such as toileting, and feeding are met so that you won't need to stop the play to take care of these needs. Put things out of reach that you don't want your child to play with (e.g., business papers or fragile objects). Use an area that is childproof and where there are no prohibitions or limits that you might have to set.

2. *If you can, put out two sets of toys so that you can join in play with your child* (i.e., two toy telephones, several trucks and blocks). Select toys that allow your child to explore and try new things, and that are more open-ended in nature. Avoid toys that require teaching or that are highly structured, such as board games, puzzles, or coloring. Your therapist will help you in picking out the best toys for playtime.
3. *Let your child know that he or she is getting "special time" with you.* Get on the floor with your child unless you are uncomfortable getting down to, or up from, the floor. Try to stay close to your child so that she can see your face and you can see what she is doing.
4. *Let your child take the lead and initiate what happens.* Anything that your child does is acceptable, except for hurting himself or you or destroying toys and materials. If your child wants to throw toys, put out soft things that are okay to throw, like foam balls or bean bags. Play with your child however he wants to play. Discover what he wants from you during this time. Does he want you to admire him? To imitate him? Try out what you think he wants from you and watch his reaction. See if your child starts to notice you and begin to interact more. Respond to what your child is doing, but don't take over the play.
5. *Watch, wait, and wonder about what your child is doing*. Think about what your child is getting out of doing a particular activity. Enter her world and reflect on what her experience of it and you might be. Observing your child is the first step to providing a foundation of good listening.
6. *Watch what your child seeks in play with you and try to pick materials each play time that allow for those kinds of interactions.* For example, if your child likes to bang and push toys, pick things that may be banged and pushed.
7. *Avoid cleaning up toys that your child seems to be finished with until special time is over.* Your child may return to those toys to play some more. Only clean up if your therapist suggests that your child is becoming overstimulated by a variety of materials and needs less stimulation.
8. *Interact with, and/or talk with your child about what she's doing without leading the play or guiding what should happen next.* For example, you may copy or describe what she did ("What a big bounce you made with that ball!" "Look how you like to run!"). With older, verbal children, you may ask questions about what is happening (i.e., "Why is the baby doll crying?" "What is the monster thinking of doing now?"). It's useful to help your child bridge play ideas, particularly if your child begins an activity, then moves onto the next play topic, leaving a play idea hanging (i.e., "What happened to the dinosaur? I thought he wanted some food to eat.").
9. *Have fun! This is very important!* Try to enjoy playing with your child during special time. If you find it boring, find the

balance that will make the play fun and interesting for both of you.

10. *Remember that special time is not a teaching time.* Try to avoid praising your child or setting limits while you play. You want the motivation and pleasure of doing things together and exploring the world to come from within the child rather than because you are encouraging these through praise or reinforcement. There is no right or wrong way to play with toys.
11. *Sometimes, special time elicits uncomfortable feelings or strong reactions in parents: reflect on what the play is eliciting in yourself.* These reactions are useful to talk about with your therapist, so that you may understand what they mean for you and your relationship with your child. Should you feel overwhelmed by feelings, try to be less involved and play the role of the interested observer. You may even want to take notes on what you notice about your child and shorten the play time to 5 to 10 minutes if that is all you feel you can do. The important thing is that you are giving your child focused, nonjudgmental attention and the joy of interacting with you.
12. *When special time is over, make it clear to your child that it is time to end*. If your child shows frustration because it is difficult to end special time, empathize with him and help him express his frustration (e.g., a gentle hand on his back or a statement, "Wouldn't it be wonderful if we could do this all day long! I wish we could, but now it's time to stop and do something else."). If your child should become tired during the playtime, end it earlier. Clean up the toys and transition to some other activity, such as having a snack or reading a book.
13. *Try to do special time every day.* This is particularly important during times when there are other stressors in the child's or family's life.
14. *If there are other siblings, try to set aside time for focused interaction with them as well.*
15. *Take at least 20 minutes a day for yourself to rest, relax, and do something just for you.* Taking time to catch up on household chores, food shopping, or other work activities doesn't count as time for you. This is your time to restore yourself.

Role of Therapist in Floor Time

The role of the therapist is to be a facilitator of the parent-child relationship. Although the therapist's role varies depending upon what each dyad or family brings to the process, the therapist should try to avoid too much direct teaching or directing of the process. More direction may be necessary for children with more significant developmental challenges (e.g., autism or pervasive developmental disorder). There are instances when the therapist needs to coach or reassure the parent, or modify the approach to be most effective. For example, when parents have difficulty allowing their child to take the lead or they are overstimulating the child (e.g., too verbal, too active, or anticontingent to infant's response), the therapist may need to help the parents tune into the child's cues. In such cases, the therapist may cue the parent by making comments such as, "Let's see what she's doing here" or "It looks like she's changed the play topic to something else. Let's watch and see what she wants to do now." The therapist may also offer more direction when the child's developmental needs are especially challenging.

Therapeutic Challenges in the Application of Floor Time

There are a number of challenges that arise in doing floor time. Lieberman and Pawl

(1993) describe some common therapeutic mistakes in working through the parent-child relationship. Some of the challenges they describe include the therapist who may become so involved in the parents' experience that the baby's contribution is overlooked, or the therapist who colludes with the parent in maltreating the child, or the therapist who over-identifies with the child's experience and finds it difficult to become empathically attuned to the parents' experience.

Another challenges to the therapeutic process is that some parents cannot see the value of doing this type of therapy, particularly when their child is demanding and won't respond to limits. They may make comments such as, "Won't this make him even more demanding of me if we give him more time?" It is useful to explain that during floor time, the child learns how to exert control in a healthy, adaptive way while getting her emotional needs for attention met, thus making it easier for the child to accept limits at other times of the day. When accepting limits is an issue, it is useful to practice limit setting after doing floor time by cleaning up the toys and then embarking on an activity that may evoke conflict, such as having the child sit at the table for a meal or walk to the car without running into the street. All the while, the therapist should work with the parent and child on how to balance limits and share control.

Debriefing Parents About the Process

In the first few sessions, it is often useful to question parents about the experience of playing with their child. Some questions that may be useful are: "What have you noticed this week about your child?" "What do you think was happening when your child did x (or wanted you to do x)?" "How did you feel when you and your child were doing x together?" or "How easy or difficult was it for you to do this play with your child?" As the caregivers become more comfortable with the process and in talking with the therapist about their reactions, the therapist can further explore their feelings and projections from the past. The therapist may ask things such as, "How did you play as a child with your parents?" "Does playing with your child remind you in any way of your experiences with your own parents?" It is not necessary that the parents make connections with their own past or feelings and reactions to their child in order for floor time to be successful, although insights are useful to the process. As the therapy process unfolds, the parents may talk more about the observations they made about their child while they were engaged in playtime at home. They may also discuss how they might have been surprised when their child responded quite differently than they had expected.

It is important for the therapist to avoid intellectualizing the play experience by focusing too much on questions about why the child did something or asking the parent too many questions about what happened. Some parents may express emotions such as feeling rejected by their child if the child turns his back to them. The therapist may normalize those feelings by expressing that many parents feel the same way when similar things happen to them. Empathizing with their position in a nonjudgmental way is very important. Some parents become preoccupied with their reactions to their child, or need to talk at length about themselves and their own past. When this occurs, the therapist may wish to refocus the attention on what happened that day between the parent and the child. It is often useful for a parent to receive individual counseling concerning his or her personal needs, rather than drawing attention away from the parent-child relationship during these sessions.

Sometimes the parents expresses feelings of being resentful or angry towards their child, or feeling depleted when they give their child full attention during play. It is important for the therapist to acknowledge these feelings, nurturing the parents so that they feel less depleted. It is often useful to spend the first few sessions attending to the parents' needs, listening to them, and acknowledging how they feel in a nonjudgmental way. As the parents feel more "filled up" by the therapist's focused attention, it may then be possible to try floor time in small doses. In some cases, a parent may need to play with the toys himself because he did not get to play as a child. The therapist should set out two sets of toys, one for the parent and one for the child. In addition to allowing a parent time to play, the therapist may nurture him further by providing a snack to "feed" both parent and child.

As the therapist and the parents process the experience of what happened in the session, it is useful for them to focus on positive interchanges. Parents with regulatory disordered children often need help in seeing the positive aspects of their relationship with their child. For example, the therapist might comment, "You looked like you were really enjoying each other when you were playing together in the pup tent." The therapist should be careful when sharing observations, so as not to interject her own interpretations or projections about the process. Such interjections create a dynamic between the therapist and a parent whereby the therapist is the "wise therapist" who expresses opinions about the parent and child. It is better for the therapist to validate the parents' own discoveries and learning process by eliciting the parents own interpretations and by helping to bridge the parents' feelings and reactions with what is actually happening in the relationship. Comments made by the therapist may be, "I wonder what you were experiencing when x wanted you to hide?" or "Did you notice that x seemed to watch you more when you did x?"

The next section describes research investigating the effectiveness of child-centered activity, followed by a case example.

RESEARCH EXAMINING THE EFFECTIVENESS OF TREATMENT APPROACHES

There is a paucity of research investigating the outcome of therapy approaches for infants and toddlers with regulatory disorders. Because valid diagnostic criteria for young children are lacking, few systematic studies have been conducted. When infants are used as subjects, normal maturation often confounds the effects of therapy over time. In addition, outcome measures are often based on therapist ratings rather than on objective and valid observations. These methodological problems have confounded or negatively affected the results of many studies (Weisz & Weiss, 1993).

There also are few studies examining the benefits of interventions suitable for children with regulatory disorders, or the effectiveness of floor time and other child-centered therapies. This section describes research that analyzed variations of child-centered therapy. They include mother-infant psychotherapy, infant-led intervention, and the "Watch, Wait, and Wonder (WWW)" technique. These approaches emphasize the importance of the parent-infant relationship and its organizing effects in fostering the child's emotional development. The differences in these approaches are described earlier in this chapter.

Cramer and his collages (1990) compared the Fraiberg (1980) method of mother-infant psychotherapy with noninterpretive interactional guidance (MacDonough, 1989) with

infants under 30 months of age showing behavioral disturbances. They found no differences in the two approaches; however, short-term gains were reported in symptom relief or removal and there were more harmonious mother-child interactions and better projective identification in as few as 10 treatment sessions provided once weekly.

Using a methodology that focused on the quality of attachment, Lieberman, Weston, and Pawl (1991) found that anxiously attached dyads receiving infant-parent psychotherapy improved in maternal empathy, the security of the infant's attachment, and the mother-child partnership. They found that the mother's emotional connection with the therapist significantly correlated with the mother's empathy towards her infant. Mothers who were more able to use the parent-infant psychotherapy to explore their own feelings towards themselves and their children were more empathic and more engaged with their toddlers at outcome than those who did not develop insights. In addition, their children showed more secure attachment, more reciprocity, and less anger and avoidance towards their mothers.

The infant-led psychotherapy (e.g., WWW) and traditional psychotherapy were compared in a study with 67 clinically referred infants and their mothers (Cohen et al., 1999). Treatment was provided once a week for 5 months. Dyads receiving the WWW approach showed more organized or secure attachment relationships and greater gains in cognitive development and emotion regulation than did infants in the psychotherapy group. Mothers in the WWW group also reported greater parent satisfaction and competence and a decrease in depression compared to mothers in the psychotherapy group. Both methods of treatment helped in reducing the infant's presenting problems, decreasing parent stress, and reducing maternal intrusiveness.

DeGangi and Greenspan (1997) conducted a study that compared the relative benefits of a child-centered (i.e., floor time) infant psychotherapy approach and a structured, developmental parent-guidance approach in the treatment of irritability and inattention. The intent of contrasting these two interventions was to examine the contributions and roles of the parent and the child in addressing the child's self-regulatory needs. In particular, the study examined how the child's locus of control (internally initiated versus externally directed) would impact regulatory capacities and function. Subjects consisted of 24 infants between the ages of 14 and 30 months who had disorders of regulation, including high irritability, sensory hypersensitivities, and a short attention span. There were three groups of eight subjects, matched for age and symptoms. Twenty-four subjects had irritability and 21 had attentional problems. Subjects receiving treatment were given a pretest, six one-hour per week sessions of either intervention A or B, and a retest 4 months after intervention. Subjects in the no-treatment group were retested between 4 and 6 months after initial testing. Formalized assessment procedures of development, attention, and self-regulation were used to systemize the change that might occur over time.

The results showed that child-centered therapy was more effective than structured therapy or no treatment in treating inattention and irritability. Seventy-five percent of subjects receiving child-centered therapy resolved in their attentional problems, in contrast to 37.5% of subjects receiving structured therapy and 0% of subjects receiving no treatment. For irritability, 57% of subjects resolved in their irritability after child-centered therapy, 28% after structured therapy, and 0% after no treatment. An important finding of this study was that

children with regulatory problems could make progress in resolving problems related to inattention and irritability in 6 weeks of intervention using a child-centered therapy approach. Since these basic skills of self-regulation (e.g., organizing attention and regulating mood) were responsive to short-term intervention using child-centered therapy, it suggests that therapies focusing on the relationship between parent and child are more useful than interventions that stress concrete developmental skills.

A second prospective study involved 39 infants with regulatory disorders (e.g., high irritability and sensory processing problems during infancy), who were retested at 3 years of age. Subjects were not randomly selected for the treatment or no-treatment group nor were they matched for type of problem or developmental capacities. Subjects who had received parent-child psychotherapy showed less behavioral and emotional problems than did the untreated group. This finding is especially interesting in light of the fact that the treated group evidenced more severe and continuing motor and sensory problems and, therefore, may have been more challenging than untreated subjects at 3 years of age (DeGangi, Sickel, Wiener, & Kaplan, 1996). Parents of infants with motor and sensory problems are more likely to seek treatment than will parents whose children only evidence emotional challenges at an early age. In a study examining the effects of infant temperamental traits and early home-based intervention on psychiatric symptoms in adolescence, it was found that early intervention focusing on the parent-child relationship helped to protect subjects from developing psychiatric symptoms in adolescence (Teerikangas, Aronen, Martin, & Huttunen, 1998). These studies point to the importance of improving the parent-child relationship in preventing long-term emotional and behavioral problems in children at risk.

CASE EXAMPLE: Julie, a Toddler With Chronic Irritability

This last section presents a case example that exemplifies the treatment approach described in this chapter; that is, an approach that works with a child's motor and sensory challenges in the context of an integrated model of intervention.

Julie was a 26-month-old child who was referred by her early intervention program because of her constant irritability. Although she had attended the program three mornings a week for a year, her inability to separate from her mother was interfering with her ability to partake in various educational and therapeutic activities. Her mother—Mrs. T.—was interviewed at her school program because she was reluctant to go to a professional whom she did not know and because she felt more comfortable in the school setting. Her husband did not participate in this interview because of his heavy work schedule.

Presenting Concern

Mrs. T. described Julie as being an unhappy child since birth. She wanted to be held most of the time and demanded adult company constantly, seldom playing by herself. Once upset, Julie was difficult to console. She had no favorite toy and seemed to need consoling from an adult. Being held and rocked, riding in the car, and being offered the pacifier were the only things that calmed Julie. When not inconsolable, Julie would constantly tug at her mother's hand or whine for attention. It was very difficult for her mother to know what Julie wanted

because her daughter had no spoken words and very limited gestures. Julie could point, but only in a general direction rather than to a specific object or person. Mrs. T. expressed concerns about spoiling her and not knowing when or when not to give in to Julie's demands.

Mrs. T. found Julie's whining and crying very difficult to handle, especially as she has two other children, a 7-year-old and a 7-month-old, who both need her attention as well. She felt frustrated that nothing she did seemed to work for very long. She described a typical scenario when she would first talk nicely to Julie, then sternly, and then scream and shout at her, followed by spanking. The mother stated that she never physically abused Julie beyond the spanking. The early intervention program staff had not observed any bruises or injuries; however, they had observed Mrs. T. yell and spank Julie at school and were concerned.

Pregnancy History

Julie was born full-term and there were no problems during the pregnancy or any neonatal complications. The parents had been trying to have a baby for many years. After the first child, the mother had a miscarriage and was then treated with fertility drugs to help her conceive again. After delivering Julie, the mother experienced a postpartum depression that lasted for about 3 months. She described it as feeling like the "third world war." She did not see a doctor or take medication for it because seeking medical help for depression was incompatible with her family's background. Both parents had looked forward to this child but, instead, felt very disappointed.

Developmental History

Julie was developmentally delayed in all areas of development, functioning approximately one year behind in all areas. She walked at 16 months and had motor difficulties. Her greatest problem was communication, with her expressive language skills falling at the 9-month-old level. She spoke no words, and used only gestures to indicate needs. Initially, there were feeding difficulties with choking and vomiting, but these had resolved. A complete neurological work-up revealed no cause for the developmental delay. There was no history of learning, behavioral, or other developmental problems in the family.

Family History

In addition to the parents and three children, Mrs. T.'s mother lived in their house. Mrs. T. felt that she had a great deal of stress in her life. Both she and her husband worked very hard and had little time alone together or for themselves. She was worried about Julie's future, and was eager to obtain some guidance on ways to help Julie become a happier child.

Diagnostic Impressions

On the Test of Attention in Infants, Julie showed poor attention for visual, auditory, and tactile events. She had little understanding of cause and effect, and tended to watch the toys for long periods of time without understanding how to play with them. On the Test of Sensory Functions in Infants, Julie was hypersensitive to touch. She was able to explore textured toys, but she had difficulty planning and organizing motor actions such as removing a furry mitt placed on her foot. In addition, Julie was sensitive to movement when rough-housed gently.

Observations of mother-child interactions revealed that Julie had difficulty initiating reciprocal interactions with her mother. She would fill and dump toys, but not stay with any one toy long enough to show a preference. There was no symbolic play.

Overall, Julie was a child with multiple developmental delays and chronic irritability. Her predominant problems included poor communication, hypersensitivities to movement and touch, poor sustained attention, delayed play skills, and an inability to separate from her mother, on whom she relied for any soothing. At the time of the assessment, it was difficult to determine what was underlying the irritability. Was she overstimulated because of her sensory hypersensitivities? Was she frustrated because she could not communicate what she wanted? Was it an inability to self-soothe? Or, was it a problem in organizing herself for purposeful activity?

Regardless of the cause of Julie's irritability, a negative dynamic was occurring between mother and child. Mrs. T. reacted in a very negative way to Julie's constant need for her attention and the child's whining. This mother was overworked and felt unduly burdened by Julie's overwhelming needs. Although Mrs. T. stated that she suffered postpartum depression only temporarily after Julie was born, she appeared to be depressed when interviewed and during the assessment process. Although Mrs. T.'s mother was helpful in cooking for the household, Mrs. T. bore all of the responsibilities for child-rearing. Mr. T. worked long hours and was not involved in Julie's early intervention program. There was a lack of support from Mrs. T.'s family in terms of understanding her feelings and worries about Julie. Therefore, it was important that the intervention program provide support to Mrs. T. so that she would be able to help Julie. She needed to feel that she had an important role in helping Julie, while not feeling as if she was having more demands and pressures placed upon her.

The Treatment Plan for Selected Concerns

The treatment plan developed for Julie follows.

1. **Irritability and self-regulation**
   a. Develop strategies that Julie could use to help herself self-soothe when distressed, other than demanding attention from her mother.
   b. Help mother to redirect Julie when the child is distressed or irritable, supporting Julie's capacity to self-organize in a positive way.
   c. Help Julie develop the capacity to read and give signals when attempting to communicate her desires and needs.

2. **Sensory processing and attention**
   a. Desensitize Julie's responses to touch and movement.
   b. Find sensory activities that Julie could use to help her focus attention and self-soothe.
   c. Develop strategies for managing the environment that help Julie to focus attention.

3. **Parent-child interactions**
   a. Facilitate Julie's ability to self-initiate play schemes.
   b. Foster Julie's motivation to explore the environment.
   c. Help Julie to engage in reciprocal interactions with her mother, using simple sensorimotor activities.
   d. Encourage the mother to provide focused, nonjudgmental attention on Julie for short periods of time.

e. Through play experiences, provide the mother with opportunities to observe Julie's skills and abilities rather than only having an experience of Julie as a demanding and irritable child with many needs.

4. **Parent support**
   a. Provide support to mother in a non-judgmental way, allowing her to express feelings about herself, her relationship with Julie, and Julie's demanding behavior and developmental problems.
   b. Help the mother find ways to restore her energy by doing things for herself as well as for her children and other family members so that she may feel more available to meet their many demands.

The Treatment Program

Julie and her mother were part of the research project (described earlier in this chapter) that provided only a limited intervention program: 12 weeks of intervention on a once-a-week basis. Nonetheless, her response to the intervention was instructive. (See chapter 3 for a description of a comprehensive intervention program.) Julie's treatment began with six weeks of structured intervention, followed by child-centered activity for another six weeks. The therapists in this case were two clinical developmental psychologists, one with a background in special education and the other with expertise as an occupational therapist. Mrs. T. attended all sessions. The father was not involved in the therapeutic program due to his long work hours.

As treatment began, the therapists had to confront several challenges that affected the treatment process. Mother had an unrealistic view of Julie's problems, thinking that her daughter would be fully normal if only she would talk and get better balance. Mother was also very intrusive with Julie, constantly trying to teach her new skills because she felt that Julie "had a lot of catching up to do." Her style was often frantic, so that Julie could not respond or self-initiate any responses. Mother was also feeling overwhelmed and depressed. It was very important that the therapists address the mother's needs in a way that she would find supportive and nurturing.

Session One

During the first session, Julie had difficulty transitioning from the waiting room to the play room. She was extremely fussy, and would not explore the room on her own. She spent the session in her mother's lap or by her mother's side. Mrs. T. talked about how stressed she felt that Julie needed her constant attention. Mother began talking about her many concerns for Julie: her poor attention to tasks and people, feeding problems, night wakings, immature play skills with mouthing and banging toys, no verbal and little gestural communication, and no ability to self-soothe.

The therapists tried several activities during this session to help Julie and mother engage in reciprocal interactions. The goals were to help Julie focus her attention on the task or her mother, to initiate exploration with the activity, and then to respond to her mother's cues in a reciprocal manner. Linear vestibular movement (e.g., rocking in a rocking chair) while providing firm deep pressure (holding Julie securely in mother's lap) were used to help soothe and calm both mother and child. The following list describes the activities tried during the initial clinical session, which the therapists wrote down and encouraged the mother to repeat at home.

Recommended Home Activities

1. Find a quiet time to sit with Julie. Put out only a few toys. You may want to put on quiet, rhythmic music in the background. Start out soothed and calm. Slowly rock Julie on your lap.
2. Have Julie sitt on your lap while you rock. Have a blanket, dried beans, corn, or uncooked macaroni in a bowl. Play with the materials first to capture Julie's attention.
3. Next, try letting Julie take the first step. Imitate her, then let her take another turn. It should be like a circle—Julie does, you do, Julie plays more—all in the same activity.
4. Make up a game with your body, such as stamping your feet to the music or playing peek-a-boo. Have some fun.

During these activities, the therapists noted that there was little pleasure in the interaction between the mother and child. Mrs. T. was highly intrusive. She would not allow Julie to take a turn or wait for Julie's responses to occur. Mrs. T. seemed adverse to having Julie sit on her lap, but this became more palatable if there was a pillow between her and Julie. The therapists were very soothing and calm, praising Mrs. T. for trying the suggested activities. They focused the session on discussing Mrs. T.'s concerns, and on working with the dyad to establish attention and engagement through gentle rocking, tactile stimulation with textured objects, and soft rhythmic music. The therapists tried to think of activities that calmed both mother and child because they both seemed to need this. Suggestions were made to the mother to modify her verbal input to Julie, relying less on words and more on gesture and intonation. Finally, the therapists worked with the mother on following Julie's lead, and opening and closing circles of communication. They found the mother to be a very likeable, highly motivated, and energetic woman who easily engaged with them. She appeared enthusiastic about the treatment.

Session Two

Mrs. T.'s concerns were similar to those she expressed the first week, although she felt Julie was using more gestures. During the second session, the therapists continued to help Julie acclimate and focus as she sat next to her mother or was rocked and held as they listened to music on the tape player. The therapists encouraged Mrs. T. to be more passive in her interactions while Julie took more initiative during sensory play with tactile materials (i.e., Koosh balls, corn, furry rug). They talked with Mrs. T. about allowing herself to be a secure home base while Julie explored a little on her own. The therapists discussed how this approach was different than teaching Julie specific skills. The take-home suggestions from this session follow.

Recommended Home Activities

1. Put a pillow on your lap, then encourage Julie to sit with you, giving her "pillow-hugs" while you watch a video together.
2. Play with water, using brushes. Paint her feet and hands with the water and brush. You might put a doll in the bathtub so that Julie might paint the doll with the brush too.
3. Continue playing with the corn and the dried beans.
4. Always let Julie take the lead. Make a circle of communication: Julie starts, Mom joins in, Julie takes another turn, then Mom joins again. Always let Julie end the turn so that she can close off the circle of communication.
5. Try music and rocking for soothing.

During these activities, the therapists noticed that the mother's need to play with the toys was as strong as the child's. The therapists speculated to themselves that Mrs. T.

might have had a deprived childhood and needed to revisit the experience of play for herself. They were very aware that they were re-parenting Mrs. T., providing her with aspects of nurturance that she may not have had early in life.

At the end of the session, Mrs. T. confided that she felt burnt-out, and that she had difficulty getting any time for herself to refuel physically and emotionally. The therapists encouraged her to spend some time alone each day, just for herself. Mrs. T. was able to say that she felt anxious about taking time for herself. Because there was so much to do at home, she felt guilty whenever she tried to take time to relax. The therapists again emphasized the importance of her needing to refuel so that she would be more available for her family.

Session Three

Mrs. T. reported some positive changes. She was faithfully doing "quiet play" with Julie, 20 minutes a day. She talked of her concerns about Julie's stubbornness, short attention span, and inability to play independently. She wondered how Julie would adjust to a Kindergarten routine in a few years. In this session, Julie was more organized and focused. The mediums used included water play and vestibular stimulation on a large bolster (e.g., rocking and bouncing). Julie also engaged in very nice reciprocal play with her mother using a tunnel to play peek-a-boo.

Session Four

During this week, the therapists noticed that Julie was able to organize several sequences of behavior with one toy, thus showing the beginnings of more elaborated play. She tolerated the swing nicely and engaged with her mother around music and movement. The therapists worked with the mother on reading Julie's nonverbal cues and on reducing her own verbal barrage, being very careful to be nurturing towards the mother as they gave her feedback.

Mrs. T. opened up about her own exhaustion and depression. She felt that she must maintain a facade, a "happy face" on the outside in order to get through the day. Additionally, she felt conflicted by the competing demands of her three children, taking little time for herself. The therapists strongly encouraged her to take time out for herself, as they had before.

Session Five

Julie's mother entered this session feeling very positive about her daughter's progress. She felt that Julie was more organized, was communicating more purposefully, and was better able to sustain some independent play. During "quiet play" at home, Julie was focusing on some fine-motor tasks, using keys which her mother had encouraged her to use. The therapists strongly reinforced the good work both were doing, and stressed how important mother was to Julie's growth. The work in this session focused on oral-motor and feeding skills—using yogurt and crunchy granola, and on vestibular activity on the swing and inner tube. Julie initiated play and Mrs. T. was able to engage her in a reciprocal game around bouncing on the inner tube. Julie seemed to focus her attention better when deep proprioceptive input was provided (e.g., pressing on her hips while bouncing on the ball). The therapists counseled Mrs. T. to try this and other movement activities at home. She appeared very motivated to follow their recommendations. The activities that she was to try included the following:

Recommended Home Activities

1. Try rocking and singing with Julie on your lap. Use a little pillow to put on Julie's stomach or back if she likes this.

2. Put out dried beans and macaroni in a box for Julie to explore. Let her take her shoes off to put her feet in the box. Also try playdoh.
3. Pull Julie in a wagon. At the playground, encourage her to swing.
4. After movement activities such as swinging, encourage Julie to sit down and do fine-motor activities.
5. After her bath, pat Julie with the towel. Use lotion on her body, applying with firm pressure. Watch how she acts. If she pulls away, it means that she is not processing the touch in a positive way.

Session Six

Mrs. T. brought the maternal grandmother and the 12-month-old brother to the session. Julie was very unfocused with the overload of stimulation and was unable to play in the bath of plastic balls. Her play was very fleeting. Eventually, she organized herself to sit in a nest of pillows and listen to rhythmic, rocking music.

Despite feeling more positive about Julie's progress following the earlier sessions, Mrs. T came into this session expressing a good deal of frustration with Julie's slow progress. She continued to have an unrealistic picture of Julie's abilities, expressing relief in her belief that Julie was not mentally retarded or emotionally disturbed. Again, Mrs. T. felt depleted and the therapists encouraged her to take refueling breaks for herself.

Child-Centered Play Intervention

The child-centered play therapy was introduced after the first six sessions of the structured program. When the child-centered therapy began, Mrs. T. was suspicious about whether this type of intervention would work. She felt that Julie must be taught different skills, and she did not think that giving Julie the initiative in the play would work, although the therapists had been teaching the mother this strategy all along. However, because Mrs. T. had developed a strong therapeutic alliance with her therapists, she was willing to try this therapy.

Session Seven

During the first session of child-centered therapy, Julie initiated a lot of proprioceptive stimulation, stamping her feet, butting mother with her head, and bouncing while sitting on the inner tube in a fairly well-organized sequence. Her play was immature, but focused. Julie appeared to need to be grounded by the tactile play with her mother to help her focus her attention. Despite mother's worries that were expressed prior to the play, there was positive affect between mother and daughter. Mrs. T. seemed fairly relaxed with the child-centered play, although she needed to restrain herself from structuring turns and making verbal demands. Written notes provided to the mother about child-centered therapy included the following:

Child-Centered Therapy Activities

1. Find toys that make noise or music, such as a tape recorder or the pop-up tunes toy.
2. Use toys that Julie can pound, hit, or bang, such as a pounding bench with hammer or a chair to push.
3. Give her places where she can sit inside, such as a nest of pillows.
4. Let Julie take the lead, but stay next to her.
5. Give her all your attention for a concentrated time—up to 15 minutes if you can.
6. Julie likes seeing what she can make you do—sit down, now run with her, now jump. Go with it.
7. Let Julie do most of the work to show you what she wants.

Mrs. T. appeared to be dealing more with the reality of Julie's delays. The early intervention program staff had been discussing a Fall placement for Julie at a school for children with significant communication disorders and cognitive delays. Mrs. T. was concerned about Julie's diagnosis and what the future would hold for her. At a personal level, Mrs. T. discussed how isolated she felt from her peers, how different her experience of mothering was from that of her friends, and how her friends were unable to empathize with her. In addition, Julie had been ill with a skin irritation and a fever. Mrs. T. had been feeling very tired. The therapists suggested that she set a schedule that included special time for herself, free of distractions. The therapists delayed the child-centered therapy with mother and child until after Mrs. T. had time to discuss her many concerns.

Later during processing, and after mother practiced the child-centered therapy, Mrs. T. discussed tensions in her role and relationship with own mother, who was very critical of her. There was a very strong work ethic in the family that placed very high demands on the mother to meet all the needs of her children and husband. Mrs. T. stated that even if she had time for herself, she would feel guilty about it. In addition, she felt that her mother was critical of the way in which she parented her children.

Session Eight

During the eighth session, Julie appeared regressed in her play, unable to engage with objects or sequenced activities. The therapists mainly focused on trying to engage the mother in the therapeutic process and on helping her understand that Julie needed to be the initiator of the play. With this guidance, Mrs. T. was able to respond appropriately to Julie without being overly intrusive, and the affective engagement in the dyad was very positive.

Mrs. T. expressed doubts about the child-centered therapy. Julie seemed to be going "backwards" in her view since she was not teaching her daughter specific skills during therapy. Mrs. T. reported that special time at home consisted of her putting out toys that were good for Julie's cognitive level, but that Julie showed little interest in them. At the same time, Mrs. T. was feeling exhausted. She did take one hour for herself, but admitted that she felt guilty asking for relief from her husband since this was frowned upon by her mother. The therapists reinforced the need for her to get respite and to have some pleasure in her own life.

Session Nine

The play was consistent with the play of previous weeks in that Julie craved tactile grounding in order to focus. Julie spent time flitting from the inner tube to the big box enclosure to rocking activities. Julie was especially interested in pulling her mother's hand and tugging her mother along as she moved about her environment. Her mother responded by trying to fend off Julie's demands, stating, "What do you want?" The therapists' presence in the room at this point was somewhat counterproductive in that Mrs. T. wanted to talk about her concerns, which took her away from Julie. The therapists suggested the possibility that Mrs. T. finding someone to talk with privately as a future option. During the actual treatment session, the therapists found that it was better to allow Mrs. T. to practice the child-centered therapy while they went into the observation booth for about 15 minutes.

Mrs. T. was able to respond to the therapists' suggestions that she learn to separate her needs from Julie's. She acknowledged that she was loosening up on her usual involvement with the oldest child's schoolwork and in doing things constantly for Julie. There was a birthday party for the young

baby, in whom mother took great pleasure. She talked about how she and her husband were enjoying the time they had begun take for themselves after their long work day. All of these changes were occurring under the critical eye of her mother, who referred to Mrs. T. as being selfish. At the same time, Mrs. T. was worrying about not setting enough limits on Julie, particularly her high need for constant attention.

Session Ten

Mrs. T. came in looking very attractive and upbeat. She reported that Julie seemed better able to play by herself and able to separate more easily from her. The therapists continued to reinforce the idea that a big dose of child-centered play with mother could go a long way towards Julie's independence in other contexts. The therapists again contrasted the difference between structured teaching and child-initiated activity. In Julie's case, she had an essential need for both types of interventions due to the seriousness of her delays. Julie continued with her sensory play while attempting to control her mother's involvement with her activities, pulling and tugging her mother to come along with her. The dyadic play was positive and well modulated; mother was responsive and nonintrusive.

Interestingly, the early intervention staff from Julie's center had called during the week to discuss Julie's wonderful progress. They no longer found Julie to be irritable and demanding, and found that she could join into circle time, snack, and other activities without any difficulty. She was showing increased gestures, intentional communication, fewer problems with hypersensitivities to touch and movement activities, and better focused attention. They asked what techniques the therapists were using that were working so well.

Session Eleven

By session eleven, the therapists noticed that Julie's mood regulation was better, with less whining and more autonomy. After some reminders about letting Julie take the lead, the dyadic play went well. Mother needed repeated reminders to allow the play to be child-initiated: this was not something that came naturally to her. Julie engaged in the same tactile-proprioceptive activities of previous weeks, but had better organized sequences of play. There was very positive affect between mother and child.

Mrs. T. reported major changes in the family's sleeping arrangements. Julie was now sleeping in the older sister's bedroom and the baby was in a separate room. Although this had not been shared with the therapists before, Julie had been sleeping in the parent's bed. Mrs. T. stated that she and her husband now slept alone together ("I'm back with my husband and now we're having special time!"). At home, Julie was apparently observing and imitating her 1-year-old brother and experimenting more on her own. Mother described herself as standing by while Julie did things for herself.

Session Twelve

During the last session, Julie engaged in considerable tactile-proprioceptive play, laughing and smiling as her mother followed along with her. During this play, Julie gestured with signs while vocalizing with a few new words that she had just attained (i.e., "up" and "more"). Her sequences of play were intentional and organized. It was clear what Julie was wanting to do in her play. In addition, she was able to use the sensory play to help organize her attention for a focused fine-motor task. Julie indicated that she wanted to sit in a chair with a table in front of her. She pointed to the puzzle, signed "more," and clapped as her mother placed the puzzle

on the table for her. She then proceeded to work at this task for at least 10 minutes.

The therapists reinforced Mrs. T.'s observation that Julie was happier when mother could give her a dose of full attention, even if only briefly. Julie was now able to play independently for 10 minutes at a time. Mother was in the throes of planning for Julie's Fall school placement, getting financial support, negotiating with her husband on the best plans for Julie, and accepting the fact that Julie was a "special needs" child. The therapists discussed termination of their work together. They also emphasized again that Mrs. T. needed to find support for herself when Julie moved into another setting. The therapists reviewed with Mrs. T. the activities that Julie liked and needed. In addition, they stressed the important role that she played in facilitating the changes that could be observed in Julie's behavior. Her playing with Julie, giving focused attention while Julie took the lead, and letting Julie show the mother what she wanted were important to the progress that Julie had made.

Conclusion of Treatment

By the conclusion of the therapy program, many of Julie's problems had resolved. Sleep and feeding problems were no longer a concern. Chronic irritability had diminished significantly. This second improvement appeared related to Julie's capacity to refine her gestures and vocalizations to communicate her needs, her ability to play by herself for short periods of time, and her mother's changed perception of Julie as a child who *could* master new skills. Julie's difficulties with separating from mother had improved when Mrs. T. had set aside playtime with Julie to fulfill her needs for focused, one-to-one attention. Julie was more animated and happier and was more able to play by herself at home. Her mother found her to be far less clingy and needy, although Julie remained fairly demanding, requiring help to play with objects for any sustained period of time. Julie showed more organization and range in her variety of play skills. She was beginning to develop autonomy and had her own opinions about toy and activity preferences. Attentional skills had improved dramatically, particularly when tactile-proprioceptive or movement activities had been used prior to tasks that required focused cognitive, language, or perceptual thinking.

The success of the therapy program appeared strongly related to the mother's strong therapeutic alliance with the therapists. She became very comfortable with them, sharing her thoughts and feelings. The therapists emphasized the importance of mother's role in facilitating Julie's development through her interactions with Julie. Mrs. T. put a great deal of effort into practicing the various activities at home with Julie. Even when she was suspicious that the child-centered therapy was not going to help her with Julie, she gave it a try with the therapists' encouragement. After a few weeks, she began to see many changes in Julie and in her family life. The mother's depression improved and she was more able to meet her own personal needs, as well as those of her family.

It was fortuitous that structured therapy was first in the sequence in the research project for this child because, in hindsight, this mother needed explicit directions about how to interact with Julie. Once the dyad was on course and "cooking together," it became possible to help guide the mother in finding ways to help Julie through the interactions using a child-centered therapy approach. Mrs. T. began to understand the process of reading Julie's cues and responding in ways that Julie needed. It was important for the parent to learn how to internalize this process

of reading the child's cues and finding what would help both of them.

Although Julie was a child with ongoing developmental needs who would probably require long-term educational and therapeutic services, this short-term therapy program helped to get this mother and child on a positive developmental trajectory. It was important for Julie and her mother to connect as a dyad so that they could engage with one another in a pleasurable exchange. As the mother gave Julie more focused attention, Julie could switch her efforts from demanding her mother's attention to expanding her gestures to communicate her intents. Through the interactions with her mother, Julie was able to develop the core processes of sensory processing, basic communication, attention, and emotional regulation that underlie many skills that she needed to develop.

CONCLUSION

This chapter presented an integrated therapeutic model designed for infants and children with constitutional and related relational problems and their parents. Within this child- and family-centered intervention approach, a combination of parent guidance, child-centered activity, and sensory integration therapy techniques address the complex needs of the child with sensory and motor problems. Parent guidance techniques provide parents with specific management techniques to handle their child's sleep and feeding problems and irritability. Child-centered activity (i.e., floor time—a form of infant psychotherapy) is applied to enhance parent-child interactions and facilitate self-initiation, sustained attention, purposeful behavior, and communication in the child. Sensory integration therapy techniques are integrated within the context of parent guidance and child-centered activity to normalize the child's responses to sensory stimulation, modulate arousal and state control, and promote organized, adaptive responses during play and everyday activities. Preliminary research suggests that these approaches are useful in addressing the problems of infants with regulatory disorders. Further research is needed to examine the effectiveness of the specific treatment approaches and the value of an integrated treatment model for children with developmental needs. ■

REFERENCES

Ayres, A. J. (1972). *Sensory integration and learning disorders.* Los Angeles: Western Psychological Services.

Ayres, A. J. (1979). *Sensory integration and the child*. Los Angeles: Western Psychological Services.

Carey, W. B. & McDevitt, S. C. (1995). *Coping with children's difficult temperament*. New York: Basic Books.

Clark, F. A., Mailloux, S., & Parham, D. (1985). Sensory integration and learning disabilities. In P. N. Pratt & A. S. Allen (Eds.), *Occupational therapy for children.* New York: C.V. Mosby.

Cohen, N. J., Muir, E., Lojkasek, M., Muir, R., Parker, C. J., Barwick, M., & Brown, M. (1997). Watch, Wait, and Wonder: Testing the effectiveness of a new approach to mother-infant psychotherapy. *Infant Mental Health Journal, 20*(4)*,* 429-451.

Cramer, B., Robert-Tissot, C., Stern, D. N., Serpa-Rusconi, S., DeMuralt, M., Besson, G., Palacio-Espasa, F., Bachmann, J., Knauer, D., Berney, C., & D'Arcis, U. (1990). Outcome evaluation in brief mother-infant psychotherapy: A preliminary report. *Infant Mental Health Journal, 11*(3), 278-300.

Daws, D. (1989). *Through the night: Helping parents and sleepless infants*. London, England: Free Association Books.

DeGangi, G.A. (2000). *Pediatric disorders of regulation in affect and behavior: A therapist's guide to assessment and treatment.* New York: Academic Press.

DeGangi, G. A., Craft, P., & Castellan, J. (1991). Treatment of sensory, emotional, and attentional problems in regulatory disordered infants. *Infants and Young Children, 3*(3), 9-19.

DeGangi, G. A., & Greenspan, S. I. (1997). The effectiveness of short-term interventions in treatment of inattention and irritability in toddlers. *Journal of Developmental and Learning Disorders, 1*(2), 277-298.

DeGangi, G. A., Sickel, R. Z., Wiener, A. S. & Kaplan, E. P. (1996). Fussy babies: to treat or not to treat? *British Journal of Occupational Therapy, 59*(10)*,* 457-464.

Dunst, C. J, Trivette, C. M., Davis, M., & Cornwell, J. (1988). Enabling and empowering families of children with health impairments*. Children's Health Care: Journal of the Association for the Care of Children's Health, 17,* 71-81.

Ferber, R. (1984). Diagnosis and treatment of sleep disorders in children. *Pediatric Basics, 39,* 7-14.

Fisher, A. G., Murray, E. A., & Bundy, A. C. (1991). *Sensory integration: Theory and practice.* Philadelphia: F. A. Davis.

Fraiberg, S. (1980). *Clinical studies in infant mental health: The first year of life.* New York: Basic Books.

Friedrich, W. N., Cohen, D. S., & Wilturner, L. T. (1988). Specific beliefs as moderator variables in maternal coping with mental retardation*. Children's Health Care: Journal of the Association for the Care of Children's Health, 17,* 40-44.

Greenspan, S. (1979). Intelligence and adaptation: An integration of psychoanalytic and Piagetian developmental psychology. *Psychological Issues*. Monogr. 47/48. New York: International Universities Press.

Greenspan, S. I. (1981). *Psychopathology and adaptation in infancy and early childhood: Principles of clinical diagnosis and preventive intervention*. New York: International Universities Press.

Greenspan, S. I. (1989). *The development of the ego.* Madison, CT: International Universities Press.

Greenspan, S. I. (1992). *Infancy and early childhood: The practice of clinical assessment and intervention with emotional and developmental challenges.* Madison, CT: International Universities Press.

Greenspan, S. I. (1997*). Developmentally based psychotherapy*. Madison, CT: International Universities Press.

Greenspan, S. I. (with Lewis, N.). (1999). *Building healthy minds: The six experiences that create intelligence and emotional growth in babies and young children.* Reading, MA: Perseus Books.

Greenspan, S. I. & Greenspan, N. T. (1989). *The essential partnership.* New York: Viking Press.

Greenspan, S. I., & Salmon, J. (1995). *The challenging child: Understanding, raising, and enjoying the five "difficult" types of children.* Reading, MA: Addison Wesley Longman.

Greenspan, S. I., & Wieder, S. (1998). *The child with special needs: Intellectual and emotional growth.* Reading, MA: Addison Wesley Longman.

Greenspan, S. I., & Lourie, R. S. (1981). Developmental structuralist approach to the classification of adaptive and pathologic personality organizations: Application to infancy and early childhood. *American Journal of Psychiatry, 138*(6).

Kahn, A., Mozin, M. J., Rebuffat, E., Sottiaux, M., & Muller, M. F. (1989). Milk intolerance in children with persistent sleeplessness. *Pediatrics, 84*, 595-603.

Kandel, E. R., & Schwartz, J. H. (1985). *Principles of neural science* (2nd ed.). New York: Elsevier.

Lieberman, A. F., & Pawl, J. H. (1993). Infant-parent psychotherapy. In C. H. Zeanah (Ed.), *Handbook of infant mental health* (pp. 427-442). New York: Guilford Press.

Lieberman, A. F., Weston, D. R., & Pawl, J. H. (1991). Preventive intervention and outcome with anxiously attached dyads. *Child Development, 62(1)*: 199-209.

Mahoney, G. (1988). Enhancing the developmental competency of handicapped infants. In K. Marfo (Ed.), *Parent-child interaction and developmental disabilities: Theory, research, and intervention.* Westport, CT: Praeger.

Mahoney, G., & Powell, A. (1988). Modifying parent-child interaction: Enhancing the development of handicapped children. *Journal of Special Education, 22,* 82-96.

Mahrer, A. R., Levinson, J. R., & Fine, S. (1976). Infant psychotherapy: Theory, research, and practice. *Psychotherapy Theory, Research and Practice, 13*, 131-140.

MacDonough, S. (1989). *Interaction guidance: A technique for treating early relationships.* Paper presented at the Fourth World Congress of Infant Psychiatry and Allied Disciplines, Lugano, Switzerland.

Muir, E. (1992). Watching, waiting, and wondering: Applying psychoanalytic principals to mother-infant intervention. *Infant Mental Health Journal, 13(4)*, 319-328.

Ostrov, K., Dowling, J., Wesner, D. O., & Johnson, F. K. (1982). Maternal styles in infant psychotherapy: Treatment and research implications. *Infant Mental Health Journal, 3*, 162-173.

Rapp, D. (1986). *The impossible child.* Tacoma, WA: Sciences Press.

Schaaf, R. C., & Mulrooney, L. L. (1989). Occupational therapy in early intervention: A family-centered approach. *American Journal of Occupational Therapy, 43*, 745-754.

Sears, W. (1985). *The fussy baby.* Franklin Park, IL: LeLeche League International.

Teerikangas, O. M., Aronen, E. T., Martin, R. P., & Huttunen, M. O. (1998). Effects of infant temperament and early intervention on the psychiatric symptoms of adolescents.

Journal of the American Academy of Child and Adolescent Psychiatry, 37(10), 1070-1076.

Turecki, S., & Tonner, L. (1985). *The difficult child.* New York: Bantam Books.

Weisz, J. R., & Weiss, B. (1993). Effects of psychotherapy with children and adolescents. *Developmental Clinical Psychology and Psychiatry* (Vol. 27). Newbury Park, CA: Sage.

Wesner, D., Dowling, J., & Johnson, F. K. (1982). What is maternal-infant intervention? The role of infant psychotherapy. *Psychiatry, 45*, 307-315.

Winnicott, D. W. (1960). The theory of the parent-infant relationship. In D. W. Winnicott (Ed.), *The maturational processes and the facilitating environment* (pp. 37-55). London: Hogarth.

11

An Ophthalmologist's Approach to Visual Processing/Learning Differences

Harold Paul Koller, M.D., F.A.A.P., F.A.A.O.

In the past, most ophthalmologists read or were told that treatment of the disorders affecting children with dyslexia and other learning disabilities fell outside the field of ophthalmology because the brain, and not the eyes, is the main organ active in the process of thinking and learning (Hartstein, 1971; Hartstein & Gable, 1984; Miller, 1988). Because dyslexia, for example, implied an inability to understand the written word, the definitive diagnosis and therapy was in the hands of the educators and clinical psychologists, not the ophthalmologist. The role of an ophthalmologist, thus, was to rule out disease as the first step in determining the reason for a learning difference before referring the child back to the pediatrician or family doctor for further evaluation and referral.

This limited role for ophthalmologists in treating children with learning disorders is now being displaced by a move toward an interdisciplinary approach. The ophthalmologist is often the first expert to whom the pediatrician refers a child suspected of having a learning disorder. Educating ophthalmologists in the medical and nonmedical conditions and situations that could affect learning in a child or older individual will help ensure that a patient receives appropriate, effective, and timely remedial treatment.

The first step in educating ophthalmologists is to introduce psychiatry, educational and neuropsychology, physical and occupational therapy, and educational science in all its forms relating to learning differences in children and adults to the ophthalmology community (Koller & Goldberg, 1999). (An appendix to this chapter outlines briefly what an ophthalmologist in general practice should know about learning disorders.) The second is to make the diagnosis and treatment of children more efficient by developing a system for classifying disorders that is oriented toward ophthalmologists. This chapter describes such a classification system for learning disorders. It then goes on to describe causes and treatment of medically based ophthalmic problems affecting learning, as well as other conditions affecting learning that are not purely ophthalmic but which ophthalmologists can help diagnose (Koller, 1999a).

AN OPHTHALMOLOGIST'S CLASSIFICATION APPROACH TO LEARNING DISORDERS

Children with learning disabilities can be classified into two main groups: (1) those with purely medically and surgically treated ophthalmic disorders that temporarily or

chronically affect learning efficiency in school (DSM-IV: Axis III – general medical conditions), and (2) those with conditions not purely ophthalmic that traditionally have fallen into the243 fields of the cognitive sciences and education (DSM-IV: Axis I). The second group of conditions can be subdivided into the four traditional types of learning differences: (1) developmental speech and language disorders, (2) nonverbal learning disorders, (3) attention disorders, and (4) pervasive developmental disorders (PDD). Many of these have observable ophthalmologic findings. The social reasons for deficient learning in school, such as dysfunctional family environment, poor instruction, foreign first language, and severe psychiatric disease are not directly associated with eye abnormalities (DSM-II and IV). The next section discusses the causes and treatment of disorders within the first main group; that is, medical conditions that temporarily or chronically affect learning.

Ophthalmic Causes of Learning Difficulties

There are several purely ophthalmic causes of temporary or chronic learning difficulties. Many times these conditions cause intermittent blurry vision in school and at home, itchy eyes, redness, foreign body sensation, various visual phenomena, double vision, tearing, light sensitivity (photophobia), and ocular pain and headache. All of these symptoms can affect children's concentration in the classroom and at home and their ability to learn efficiently (Koller, 1997). The main categories of ophthalmic causes affecting learning are refractive errors, strabismus and amblyopia, nystagmus, systemic diseases affecting the eyes, local ocular diseases, and neuro-ophthalmic disorders.

Refractive errors are optical refractive imperfections due to the size and shape of the focusing structures of the eyeball (globe) itself. Refractive status is inherited, with the eyeballs of children shaped like the eyeballs of their parents. A nearsighted eye (myopia) is longer, and the light is focused in front of the retina. A farsighted (hyperopia) eye is shorter, and the light is abnormally focused in back of the retina, not on it. An astigmatic eye is one in which the cornea in front or the lens in the middle of the eye is misshapen microscopically like a lemon or football, more curved in one direction than the other, 90 degrees away. A blurry image results from all three refractive abnormalities (Reinecke, 1965). A corrective spectacle lens is necessary to refocus the light rays coming from the objects observed to create a sharp focused image on the retina, which is then transmitted to the brain so a person can interpret what is seen clearly.

Strabismus is the condition of misaligned eyes in which the eyes are not aimed in the same visual direction. The eyes may be divergent (exotropia or walleyes), convergent (esotropia or crossed eyes), or vertically apart (hypertropia). They also can be cyclotropic, or misaligned around an anterior-posterior axis through the pupil, which can cause significant visual confusion and image "tilt" or torsion. Most acquired strabismus can cause double vision (diplopia), which is most annoying to school-aged children. Less frequently, the sudden onset of strabismus with diplopia in a school-aged child or younger may be of paralytic etiology as a result of a virus infection, or even a brain tumor. The paralysis in the latter case is due to one of the three cranial nerves innervating the six extra-ocular muscles in each eye being affected. A thorough medical evaluation is mandatory (Parks, 1975).

Treatment for exotropia is usually surgical, although for small deviations and those less severe cases in which the eyes go out more at near (convergence insufficiency) than

in the distance (divergence excess), eye exercises in the form of classic orthoptics or optometric vision training is quite acceptable. The idea is to train diplopia awareness to improve fusional convergence amplitudes. This enables the individual to see and focus singly over a broader area of viewing and for a longer duration (Bedrossian, 1969). Treatment for nonparalytic esotropia (the eyes are crossed in but move normally in all directions and to the extreme gaze positions) is usually surgical or optical (eyeglasses) if there is excessive farsightedness. In such a case, the eyes over-focus and turn in too much. The hyperopic power of the glasses assumes the focusing function and, when the lenses are worn, the eyes do not have to focus to see clearly and the eyes remain straight. If the eyes turn in more at near than in the distance, bifocal eyeglasses are required to cause more focusing relaxation close up. There are cases, however, involving both esotropia mechanisms that require both glasses and, for the portion of deviation not controlled by the eyeglasses alone, surgery. If left untreated, the weaker eye may develop suppression in order to avoid double vision and become amblyopic. Paralytic as well as restrictive esotropia patients often present with face turns to preserve use of their eyes together away from the side of the paralyzed eye muscle. This can sometimes interfere with efficient reading. Treatment is often surgical.

Hypertropia or vertical strabismus comes in a variety of forms but often it presents to the pediatrician or ophthalmologist as a head tilt, chin depression, elevation or face turn, or combinations of these abnormal head postures. These can all interfere with normal navigation as well as with reading and learning. The treatment is usually surgical. One common such condition is congenital fourth nerve palsy; head tilt is the presenting sign. One should also be aware of the so-called "A" and "V" syndromes in which the eyes go "in" or "out" more in one gaze than in another. For example, a "V"-pattern esotropia is one in which the eyes go in more when looking down than when looking up, which could cause double vision when reading. Treatment is either with bifocal eyeglasses or surgery if spectacles are ineffective.

Amblyopia is the term applied to diminished vision without an obvious physical or structural abnormality present to account for the vision loss (Simon & Calhoun, 1998). It is called "organic amblyopia" when the vision loss is due to a structural defect such as an abnormal optic nerve. The lay term for amblyopia is "lazy eye," which people often confuse with strabismus or "a weak eye muscle." A more appropriate term for amblyopia would be "lazy vision." There are three types of amblyopia: (1) refractive, due to the eyes having different refractive errors and focusing ability; (2) strabismic, in which the eyes are not aimed at the same object, causing diplopia to occur; and (3) occlusion amblyopia, in which one eye has unclear or opaque media inhibiting light from being clearly transmitted from the environment to the retina, such as a cataract.

For vision to develop normally, both eyes must be in focus, see clearly, be aligned straight ahead, and maintain coordinated eye movements in all fields of gaze. If this does not take place, the lateral geniculate body in the brain develops ganglion cell degeneration and a subsequent decrease in visual acuity. The cause of this in the refractive type is one blurred retinal image in the affected eye and one clear image in the more normal eye. The brain automatically shuts off the blurry image and the cells in the lateral geniculate body atrophy. Giving these patients the correct eyeglasses and covering the better eye with a patch to cause the cells to regenerate is the best therapy. The earlier this is done, the

easier it is for the cells to regenerate and the better the results. The brain becomes less plastic after age six and often does not respond to occlusion therapy after puberty. In the strabismic type, eyeglasses or surgery to eliminate the malalignment of the eyes, preceded and followed by occlusion therapy over the better eye, is the best treatment. In occlusion amblyopia, surgical therapy to remove the cause of the obstruction is performed first, followed by appropriate optical correction. A contact lens, or intraocular lens in the case of a unilateral cataract in a child, is currently the best therapy. Amblyopia is reversible if diagnosed early. However, treating school-aged children is frequently a challenge due to peer ridicule and the child's lack of compliance with eye patching. Schoolwork and learning can be affected because the patch covers the better eye. Alternatives to patching include cycloplegic eyedrops, such as atropine and cyclopentolate, to blur the vision in the better seeing eye as well as oral levodopa. L-dopamine seems to improve amblyopic vision in some individuals, even after adolescence, although this drug is not yet in widespread use in the United States (Leguire, Rogers et al., 1998).

Nystagmus is repetitive movements of the eyes, usually horizontally to-and-fro with a fast jerk in one direction (Reinecke, 1997). The movement may be only horizontal or vertical and rarely torsional, but more often it is a mixture. Nystagmus is typically stable in any specific field of gaze, which is termed the "null point." There are many types of nystagmus based on description of the pattern and on the etiology. Examples include vestibular nystagmus, latent and manifest latent nystagmus, amaurotic or "blind" nystagmus (which is more a searching, than jerking movement), and idiopathic infantile nystagmus. The latter is seen in patients with albinism and various retinal disorders. Occlusion amblyopia can cause deprivation nystagmus, which decreases or is entirely eliminated when the obstacle to normal focusing is removed. Many types of nystagmus are associated with less than normal vision and often a null point exists in one field of gaze, causing a head tilt or face turn in order to achieve optimal visual acuity that exists in the field of least nystagmus activity. Treatment in some cases is surgical in order to move both eyes and the null point away from the extreme gaze position of the null zone and to the primary straight-ahead position. Reading can be labored for children and adults with nystagmus, and learning is therefore sometimes compromised.

Systemic disease affecting the eye and disrupting normal visual learning processes most commonly include (1) juvenile rheumatoid arthritis; (2) metabolic and endocrine disorders, such as juvenile diabetes or pituitary disorders; (3) blood dyscrasias affecting the eye and brain, such as leukemia; and (4) metastatic neoplastic disease to the eye and/or brain, such as neuroblastoma. All of these diseases are treated medically and surgically, as required. Disruption of schooling often occurs for significant periods of time in the more serious cases. Learning is thus secondarily compromised even if no basic learning disorder was present before the child became ill. If the brain becomes structurally involved in the disease process, the various learning centers can be directly affected, causing a possible permanent learning disorder.

Local ocular causes of decreased vision include:

- Ocular media opacities, such as opaque corneal lesions and cataracts.
- Congenital and infantile glaucoma (high intraocular pressure frequently causing legal or complete blindness).

- Significant unilateral and bilateral ocular trauma causing moderate to severe vision loss, such as rupture of the globe after falling on a sharp object.
- Ocular and adnexal neoplasms with secondary disfigurement and/or vision loss, such as retinoblastoma and rhabdomyosarcoma of the muscles of the globe or eyelids.
- Severe chronic ocular infections, such as Herpes Simplex Virus–I, with vision loss affecting the cornea.
- Congenital and degenerative retinal or optic nerve diseases affecting the macula or optic nerve, such as toxoplasmosis and optic nerve hypoplasia (small, poorly functioning optic nerve).

These are frequently seriously urgent conditions, often requiring surgery, chemotherapy, or other medical treatments to cure or control. Schooling and learning invariably suffer (Miller, 1988).

Neuro-ophthalmic causes of temporary or intermittent learning impairment and inefficiency include two broad categories frequently seen in the pediatric ophthalmologist's office: (1) primary brain diseases and tumors causing personality and behavior changes and (2) the vast variety of vascularly mediated pediatric migraine syndromes.

Classic migraine involves a vascular-mediated headache, often preceded by various visual auras, photophobia, and nausea. It is usually followed by the desire to sleep, after which the headache often is gone. Children frequently present with a variation termed "acephalgic migraine." Headaches are not usually a part of the presenting symptom complex. This fact often confuses the parents and many professional caregivers who expect migraine to always be a headache. Children who complain of blurry vision in school but who are found to have a normal eye evaluation may merely be experiencing the pediatric equivalent of adult, constricting visual fields and the typical "scintillating scotoma." These aura are often termed "ophthalmic migraine" when headache symptoms are minimal or absent in adults. Children have a number of associated signs and symptoms of pediatric migraine. These para-migraine entities include infantile colic, lactose intolerance, sleep disturbances (including night terrors and nightmares), and motion sickness. They also include frequent febrile seizures; unexplained abdominal discomfort; allergic predisposition; unusual sensitivity to light (photophobia), noise, and smell; and a type-A personality resistant to change with occasional obsessive/compulsive behavior. Para-migraine entities may also be characterized by various other visual phenomena, such as micropsia (things looking smaller or farther away), macropsia (things looking larger or closer), and metamorphopsia (things looking distorted, as in a fun house mirror). The classic description of the latter is the so-called "Alice in Wonderland" syndrome.

Children complaining of any of these symptoms, either as a single symptom or in combination, sometimes are not believed or are misunderstood, leading to a misdiagnosis or no diagnosis at all. A pediatric examiner must ask the parents of children with learning differences and difficulty with schoolwork if these symptoms occur to ascertain whether or not para-migraine complaints exist. A pediatric neurologist is best for advising these families about acephalgic pediatric migraine therapy. More severe pediatric vascular migraine can result in the syndrome of ophthalmoplegic migraine, which is manifested by paralysis of one or more extraocular muscles with resultant strabismus and diplopia. In these cases, a pediatric ophthalmologist should be consulted. More serious conditions such as a brain tumor must be ruled out. A

migraine predisposition must be considered in any child with a learning problem. Migraine is definitely familial and inherited in a multi-factorial mode with various family members having different combinations of symptoms (O'Hara & Koller, 1998).

The following section discusses conditions that are not purely ophthalmic, but some of which may have ophthalmologic findings. These include receptive language disorders, a nonverbal learning disorder, and some pervasive developmental disorders.

COGNITIVE AND EDUCATIONAL CLASSIFICATIONS IN LEARNING DISORDERS

Speech and Language Disorders

Articulation and expressive language disorders (Koller, 1999b) can be grossly diagnosed by taking a history of the child from the parents and observing the child speaking or not speaking while seated in the exam chair. If the parents have not yet sought professional help, the child can be referred back to the pediatrician, an ear, nose, and throat specialist, or a speech and language pathologist for further evaluation and therapy with the primary care physician's knowledge and consent. The ophthalmologist is not directly involved in the specific diagnosis or treatment of children with these disorders.

Receptive language disorders, in contrast, involve visual processing and perception and should be more thoroughly analyzed by the pediatric ophthalmologist. Realizing that developmental dyslexia is now thought to be a result of a genetically inherited deficiency (Shaywitz, 1998) in cerebral phonetic analysis, the ophthalmologist can deduce the likely presence of dyslexia from the family history and by asking the child a few questions about simple words, such as "cat" and "bat," in an attempt to bring out the inability of such children to identify the components of "bat" as "bu," "aah," and "teh." A history of letter reversals in school and difficulty reading may not really point to a receptive language disorder alone because nonverbal learning disorders and attention disorders can also cause these symptoms in certain instances. Early preschool identifying characteristics include unusual difficulty learning numbers, letters, and colors without evidence of eye disease. The ophthalmologist should refer these children to a knowledgeable neuropsychologist or speech and language pathologist for further testing to identify all the specific language disorders existing in each individual case and then to recommend diagnosis-specific therapy. A licensed reading teacher and a homework tutor may both be required, with additional therapy and monitoring by the speech and language pathologist and the neuropsychologist as necessary.

Auditory processing disorders are in the realm of ear, nose, and throat specialists, as well as speech and language pathologists, and should be referred to those professionals for appropriate, specific diagnoses and therapy (Welsch, 1980; Welsch & Healey, 1982). A tutor is often helpful to teach auditory interpretation and attention in the classroom environment. Auditory processing disorders are receptive language dysfunctions and the "hearing" equivalent of "visual" developmental dyslexia. One remedial method in reading disorders is to have the child simultaneously listen to a recording of the written text while following the printed material in the book in the presence of a reading instructor. This therapy is effective if only visual or auditory processing is abnormal, not if the child suffers from both disorders.

Nonverbal Learning Disorders

Appropriate diagnostic studies establish this all-too-often missed learning disorder.

The ophthalmologist can suspect a nonverbal learning disorder (NVLD) by giving the young patient a simple visual memory test in the office. It takes only 1 to 2 minutes to perform. (See Figure 1.) NVLD is thought to be associated with right hemisphere white matter dysfunction (Bannatyne, 1974; Foss, 1991; Johnson & Myklebust, 1967). The frontal lobe may also be involved. The main deficits of this disorder include visual-spatial perception, visual memory, psychomotor coordination, complex tactile-perceptual skills, reasoning, concept formation, mathematical abilities, and psychological/behavioral difficulties.

Well-developed verbal and reading skills, however, are frequently observed in these children and adults. Occupational therapy is the treatment path that is most efficient for individuals with NVLD. At times, therapy must be coordinated with a homework tutor, reading specialist, and/or a physical therapist if other, more complex aspects of NVLD are identified. Numerous treatment strategies have been tried over the years but utilizing current repetitive, standard rehabilitation science techniques seem, at present, to be best.

It is in this category of learning differences that some optometric vision training techniques appear to be effective. These techniques are partially based on occupational and physical therapy principles as well as standard rehabilitation science. Adults, after

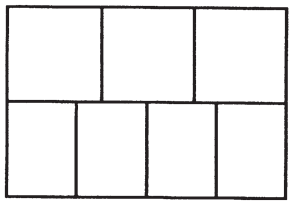


Figure 1a

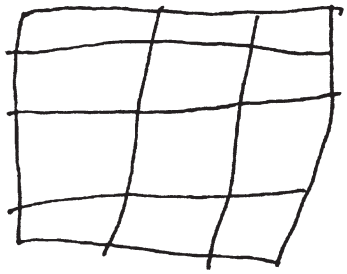


Figure 1b

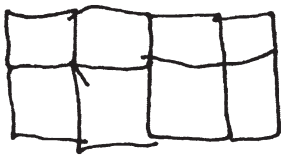


Figure 1c

Figure 1a-1e. – A Diagnostic Tool for Categorizing Nonverbal Learning Disabilities in School-aged Children 6 to 12 Years Old

(A simple pattern [1a] is presented to a child for 15 seconds. The child is then asked to draw the pattern from memory. Figures 1b and 1c are examples of acceptable normal variations in children's drawings. Figures 1d and 1e represent variations that indicate a possible nonverbal learning disorder.)

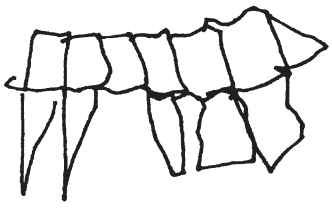


Figure 1d

Figure 1e

strokes, as well as all-aged individuals after accidental closed head trauma, are taught to utilize the uninjured functioning parts of their brain to compensate for loss of normal use of an injured or damaged brain area, despite the fact that the area of the brain assuming the new function was never intended to do so. Stroke patients thus learn to read, write, talk, and navigate once again despite permanent brain damage to the area previously programmed to maintain those particular functions. A similar model exists for children with naturally occurring brain dysfunction, such as the one for nonverbal learning disabled individuals. These children are born with inefficient or inadequate brain programming and processing. Laterality training, eye movement coordination strategies to help create smooth pursuits (saccades), and hand-eye coordination exercises all help improve, to some extent at least, performance of those functions. To what direct extent learning itself, in a classroom or at home, is enhanced in all cases has yet to be shown via evidence-based science using a masked or double masked controlled study. Published studies reviewed by the author to date are anecdotal or retrospective/prospective reviews of measurement parameters or performance, often while other remedial methods are carried out simultaneously (Atzmon et al., 1993).

Piaget's theory stating that "intelligence is the most important instrument of learning" and that environmental interaction is equally important has been used as the basis for utilizing games and play as a medium to enhance the process of thinking and learning. This was tried in a West Virginia school setting by Furth and Wachs more than 25 years ago (Furth & Wachs, 1974). Developmental optometry has adopted some of Piaget's theory for vision training. The idea is to think before you can actually learn a fact or concept.

Some optometric exercises (Scheiman, 1994) are designed to improve developmental visual information processing. The first goal of therapy is to develop the patient's motor-awareness ability by performing isolated, simultaneous, and sequential movements involving both sides of the body. The treating optometrist wishes to develop motor memory of the differences between the right and left sides of the body. This is typically accomplished using balance activities, ball bouncing, chalkboard squares, and other gross eye-hand coordination activities such as beanbag tossing or ball playing. The second goal of therapy is to develop the patient's motor-planning ability. This is accomplished using numerous other techniques, including jumping jacks, the Randolf shuffle, and slap-tap, among others. These strategies seem to work by repetitive, positive psychological reinforcement and one-on-one patient-therapist interaction as much as by direct influence on the cerebral academic learning process itself. Since NVLD involve higher cognitive learning centers in which abstract thinking, visual memory, and spatial recognition are the main deficits, repetitive training makes it possible for a child to learn to perform certain tasks more efficiently. "Practice make perfect" is a commonly accepted theme. If a child with NVLD is taught by optometric techniques to enhance motor memory, motor awareness, and motor integration—and this improvement can be transferred to the academic arena—then the claimed benefits of optometric vision training can be realized. Those who profess benefits from vision training in cases of speech and language disorders, attention disorders, and pervasive developmental disorders (including classic autism) are simply not reporting the other therapies for these individuals being carried out simultaneously by other professionals, including pediatric neurologists, psychiatrists, psychologists, language therapists, occupational therapists, physical therapists, educators, and pediatricians. NVLD account for less than 15% of all learning disabled individuals (Koller, 1999b). Vision

therapy is but one of many interdisciplinary interventions necessary for these individuals.

Attention Deficit/ Hyperactivity Disorders

The diagnosis of attention deficit/hyperactivity disorders (ADD/ADHD) is established by the criteria listed in the DSM-IV, with behavior repeated over time. Some controversy still exists concerning the real existence and definition of these two diagnoses as a separate category of learning disorders (Carey, 1999). The pediatric neurologist, pediatric developmental specialist, family pediatrician or physician, or psychiatrist usually provides treatment. It is necessary for the ophthalmologist to identify the behavior by listening and observing while the child is in the examination chair and referring appropriately. Pharmacological therapy is the treatment of choice, with ancillary remediation from homework tutors, certified reading specialists, and, occasionally, occupational therapists. Teaching a child to concentrate quite often appears to be easier when the patient is on stimulant therapy such as Ritalin or Adderal. Nonetheless, many pediatric neurologists and pediatric developmental specialists now prefer to reserve drug therapy for more persistent cases.

The Committee on Quality Improvement (Subcommittee on Attention Deficit/Hyperactivity Disorder) of the American Academy of Pediatrics (2000) recently published its clinical practice guidelines, *Diagnosis and Evaluation of the Child with Attention Deficit/Hyperactivity Disorder,* which emphasizes to pediatricians the DSM-IV criteria for diagnosing ADHD and observing the typical behaviors in more than one setting, location, and situation over time. Research involving the study of academically efficient individuals with ADHD compared to those afflicted who are scholastically inefficient was suggested.

Pervasive Developmental Disorders

The ophthalmologist can frequently identify an individual with Asperger's syndrome or Rett syndrome by history and observation of the patient's behavior in the examination chair. Lack of eye contact is often the initial complaint and reason for referral to the ophthalmologist (Koller & Goldberg, 1999). Lack of social relatedness and peer interaction is obtained by the ophthalmologist from the family and patient history. The history can also provide information concerning an intense area of interest or other behavior peculiar to individuals with autistic spectrum disorders. Definitive diagnosis and treatment should be in the hands of a qualified psychiatrist and knowledgeable pediatricians, as well as occupational and physical therapists, who are well schooled in diagnosing and treating children with pervasive developmental or autistic spectrum disorders (PDD/AS) (Greenspan & Wieder, 1998). The role of the ophthalmologist is to suspect the diagnosis and refer appropriately, noting the high index of suspicion.

"Vision training" techniques have yet to be shown to directly influence the main deficits of autistic individuals. However, some vision training techniques and occupational therapy are appropriate for nonverbal learning disorders that are part of an autistic individual's component disabilities. Since the autistic spectrum involves people with difficulties in social relatedness and social skills, use of language for communicative purposes, and a limited but intense range of interest, many different professionals must become involved in ongoing therapy. Any eye abnormality present should be corrected by the ophthalmologist, just as an appropriate specialist should treat any medical condition. If the patient is sufficiently functioning and can concentrate on occupational and/or vision therapy tasks,

these tasks should be provided for those component disorders the PDD/AS patient manifests. There is much to be learned in the future from studying these remedial methods with evidence-based science. Optometrists, ophthalmologists, occupational therapists, and speech and language pathologists should work together to bring about this research.

OTHER DISORDERS AFFECTING LEARNING

Other disorders affecting learning that an ophthalmologist frequently sees include Tourette syndrome and some purely mental disorders such as anxiety disorder, oppositional defiant disorders, and personality disorders (Axis-I). Idiopathic sleep disorders can also affect learning, as can social and family dysfunction or poor school instruction (Axis-IV). All these conditions can be suspected from a social and family history taken by an ophthalmologist in the office. Tourette syndrome is often treated by a pediatric neurologist or psychiatrist, whereas a pediatric psychiatrist most effectively handles the other conditions mentioned.

Several serious genetic disorders are frequently associated with learning differences, including familial dysautonomia (Reilly-Day syndrome) (Groom, Kay, & Corrent, 1997) and mitochondrial cytopathy (Phillips & Newman, 1997). Both these conditions involve multiple systems within the body. The brain is a high oxygen/energy uptake organ and the mitochondria are the oxygen generators of our cells. Any disease of the mitochondria affects most organ systems. The autonomic nervous system is almost nonfunctional in familial dysautonomia, and brain processing is also affected. Much more research in the area of mitochondrial (not nuclear) inheritance must be done to correlate learning disabilities with these conditions. Familial dysautonomia may also be a partial mitochondrial disorder, as might many other types of learning differences and disabilities.

CONCLUSION

As noted previously, having the ophthalmologist aware of all of the medical and nonmedical conditions and situations that could affect learning in a child or older individual increases the potential for a child with learning disabilities to receive appropriate, effective, and timely remedial treatment. It is important for one professional to take the responsibility of coordinating all the specialists actually involved in the care of any patient with a learning difference. It doesn't matter what that person's specialty is, so long as he or she is knowledgeable in the general field and has the motivation, passion, and resources necessary to coordinate the efforts of numerous physicians, psychologists, educators, and allied health professionals, such as occupational therapists, physical therapists, optometrists, and speech and language therapists. Social workers and attorneys often are involved, too. Given the desire, an ophthalmologist can assume this task easily. The ophthalmologist is often the first expert to whom the pediatrician or family physician refers the child suspected of having a learning difference. However, the pediatric psychiatrist, neurologist, or developmental specialist could be equally effective. True multidisciplinary science and coordination of effort is mandatory if optimal benefit is to be achieved for all individuals with learning disorders. ■

REFERENCES

American Academy of Pediatrics (2000). Clinical practice guideline: Diagnosis and evaluation of the child with attention deficit/hyperactivity disorder. *Pediatrics, 105*(5), 1158-1170.

Atzmon, C. O. et al. (1993). A randomized prospective masked and matched comparative study of orthoptic treatment versus conventional reading and tutoring treatment for reading disabilities in 62 children (including pro and con editorial comments by Drs. Hardenbergh and Cibis Tongue). *Binocular Vision & Eye Muscle Surgery Quarterly, 8*(2), 91-106.

Bannatyne, A. (1974). Diagnosis: A note on recategorization of the WISC scaled scores. *Journal of Learning Disabilities. 7,* 272-274.

Bedrossian, E. H. (1969). *The surgical and nonsurgical management of strabismus.* Springfield, IL: Charles C. Thomas.

Carey, W. B. (1999). (in commentaries). Problems in diagnosing attention and activity. *Pediatrics, 103*(3), 664-667

Foss, J. M. (1991). Nonverbal learning disabilities and remedial interventions. *Annals of Dyslexia, 41,* 129-131.

Furth, H. G., & Wachs, H. (1974). *Thinking goes to school, (Piaget's theory in practice)*. Toronto: Oxford University Press.

Gable, J. L. (1984). *Visual disorders in the handicapped child.* San Mateo, CA: Macel Dekker.

Greenspan, S. I., & Weider, S. (1998). *The child with special needs.* Reading, MA: Perseus Books.

Groom, M., Kay, M. D., & Corrent, G. F. (1997). Optic neuropathy in familial dysautonomia, *Journal of Ophthalmology, 17*(2), 101-102.

Hartstein, J. (1971). *Current concepts in dyslexia.* St. Louis, MO: Mosby.

Johnson, D., & Myklebust, H. R. (1967). Nonverbal disorders of learning. In *Learning Disabilities Educational Principles and Practices.* New York: Grune and Stratton.

Koller, H. P. (1997). How does vision affect learning? *Journal of Ophthalmic Nursing & Technology, 16* (Vol. I), 7-11.

Koller, H. P. (1999a). Visual perception and learning differences: An ophthalmologist's view. *American Orthoptic Journal, 49.*

Koller, H. P. (1999b). How does vision affect learning? *Journal of Ophthalmic Nursing & Technology, 18*(1), 12-18.

Koller, H. P., & Goldberg, K. B. (1999). A Guide to visual and perceptual learning disabilities, *Current concepts in ophthalmology,* 24-28. Pennsylvania Academy of Ophthalmology.

Leguire, L. E., Rogers, G. L., et al. (1998) Occlusion & Levodopa-Carbidopa Treatment for Childhood Amblyopia. *Journal of AAPOS, 2*(5), 257-264.

Miller, N. R. (1998). Neuro-Ophthalmologic Topographic Diagnosis of Tumors and Related Conditions. In Walsh & Hoyt (Eds.), *Clinical Neuro-Ophthalmology* (pp. 1137-1242).

O'Hara, M. A., & Koller, H. P. (1998). Migraine in a pediatric ophthalmology practice. *Journal of Pediatric Ophthalmology & Strabismus, 35,* 203-208.

Parks, M. M. (1975). *Ocular motility and strabismus.* Hagerstown, MD: Harper & Row.

Phillips, P. H., & Newman, N. J. (1997). Mitochondrial diseases in pediatric ophthalmology. *Journal of AAPOS, 1*(2), 115-122.

Reinecke, R. D. (1965). *Refraction: A programmed text.* New York: Appleton Century-Crofts.

Reinecke, R. D. (1997). Idiopathic infantile nystagmus: Diagnosis & treatment. *Journal of AAPOS, 1,* 67-82.

Scheiman, M. M., & Rouse, M. W. (1994). *Optometric management learning-related vision problems.* St. Louis, MO: Mosby.

Shaywitz, S. E. (1998). Dyslexia: Current concepts. *New England Journal of Medicine, 338*(1), 307-312.

Simon, J. W., & Calhoun J. H. (1998). *Amblyopia: A child's eyes.* Gainesville, FL: Triad.

Welsh, L. W., Welsh, J. J., & Healey, M. P. (1980). Central auditory testing and dyslexia. *Laryngoscope, XC*(6), 972-984.

Welsh, L. W. et al. (1982). Cortical, subcortical, and brainstem dysfunction: A correlation in dyslexic children. *American Journal of Otolaryngology, Rhinolaryngology and Laryngology, 9*(3), 310-315.

Appendix

VISUAL PERCEPTION AND LEARNING DIFFERENCES IN PEDIATRIC OPHTHALMOLOGY: What the Ophthalmologist Needs to Know about Learning Disabilities in Clinical Practice

I. Ophthalmic Causes of Temporary Learning Impairment and Inefficiency

A. Strabismus, amblyopia, and refractive errors
   1. Decompensated accommodative esotropia with secondary diplopia
   2. Secondary ocular cranial nerve palsies (n. III, IV, VI)
   3. Uncorrected congenital vertical strabismus with abnormal face and head positions
   4. Bilateral very high ametropias, such as bilateral amblyopia of high hyperopia
   5. Bilateral occlusion amblyopia, such as after congenital cataract surgery
   6. Associated untreated "A" and "V" syndromes
   7. Convergence insufficiency exotropia/phoria in certain individuals

B. Nystragmus of moderate to severe degree causing significant vision loss

C. Pediatric ocular diseases that can affect learning via visual and emotional effects
   1. Severe juvenile rheumatoid arthritis and related ocular inflammations
   2. Congenital glaucoma with vision loss
   3. Congenital cataracts and major corneal opacities with vision loss and nystragmus
   4. Significant unilateral and/or bilateral ocular trauma with vision loss
   5. Ocular and adnexal neoplasms with secondary disfigurement and vision loss
   6. Severe chronic ocular infections such as HSV-I with vision loss
   7. Congenital and degenerative retinal diseases affecting the macula

II. Neuro-ophthalmic Causes of Temporary or Intermittent Learning Impairment and Inefficiency

A. Brain tumors causing a change in personality and behavior in a pediatric patient

B. Migraine syndromes
   1. Acephalgic pediatric migraine with visual disturbances and variable vision in school
   2. Ophthalmic migraine in childhood
   3. Ophthalmoplegic migraine
   4. Classic migraine in the older student

C. Optic nerve disease with significant visual impairment

III. Systemic Diseases Associated with Vision and Neurologic Dysfunctions Potentially Affecting Learning

A. Metabolic and endocrinic disorders

B. Blood dyscrasias affecting the eye and brain

C. Metastatic neoplastic disease to the eye and/or brain

IV. The Ophthalmologist's Role in Examining a Child and Advising the Family of a Defect in visual processing and/or learning is to rule out the presence of eye disease or related systemic disorder and to refer the pediatric patient to the proper professionals for more definitive diagnoses and subsequent treatment(s). In order to effectively do this, a classification of non-ophthalmic learning disorders will now be outlined.

A. Learning disabilities (differences)
   1. Developmental speech and language based disorders (epidemiology)
      a. Articulation disorders
      b. Expressive language disorders
      c. Receptive
         (1) Dyslexia—phonologic processing disorder
            (a) genetics
            (b) pathophysiology
            (b) remediation
            (d) early preschool identifying characteristics
         (2) Other receptive language disorders
   2. Nonverbal learning disabilities (epidemiology)
      a. Definition
      b. Characteristics and affected areas of learning
         (1) visual-spatial perception
         (2) visual memory
         (3) psychomotor coordination
         (4) complex tactile-perceptual skills
         (5) reasoning
         (6) concept formation
         (7) mathematical abilities
         (8) psychological behavioral difficulties
         (9) good verbal and reading skills
      c. Early identification traits
      d. Differential diagnosis
      e. Methods of treatment. What exactly is optometric vision training?
      f. Rationale of therapy based on the traditional closed head trauma/stroke rehabilitation model
   3. Attention deficit hyperactivity disorder (epidemiology)
      a. Definition
      b. Characteristics (DSM-IV) and diagnostic criteria observable during an eye exam
         (1) squirms in seat, fidgets with hand and/or feet
         (2) unable to remain seated when required to do so
         (3) easily distracted
         (4) blurts out answers before a question is finished
         (5) difficulty following instructions
         (6) unable to sustain attention in work activities
         (7) interrupts or intrudes on others

(8) does not appear to listen
(9) loses items for tasks such as toys, pencils, and books
(10) often engages in dangerous activities without considering the consequences

c. Subclassification
(1) inattention
(2) impulsivity
(3) hyperactivity

d. Differential diagnosis
(1) Tourette's syndrome
(2) conduct disorder
(3) oppositional defiant disorder
(4) other tic disorders

e. Treatment and community support
(1) pediatric neurologist
(2) pediatric developmental specialist
(3) pediatric psychiatrist
(4) special education teacher or tutor
(5) various support groups

4. Pervasive developmental disorders/autistic spectrum disorders (PDD/ASD)
a. Definition
b. Characteristics: defects in social relatedness and language/communication skills
c. Subclassifications
(1) Asperger's syndrome (chief eye symptom is "lack of eye contact")
(2) Rett syndrome
(3) classic autism
(4) unclassified PDD/ASD
d. Referral and treatment options
e. Micro and primary dyskinetic strabismus as a presenting sign of PDD
f. Hyperlexia

V. Patient Support Groups for Learning Disabled (LD) Individuals

A. CHADD (Children and Adults with ADD)
B. CEC (Children's Educational Counsel)
C. ASLHA (American Speech, Language and Hearing Association)
D. LDAA (Learning Disabilities Association of America)
E. PERC (Parents Educational Resource Center)
F. The Orten Dyslexia Society
G. AHA (American Hyperlexia Association)
H. HALO (Health Achievement Learning Opportunities Centers)

VI. Role of the Pediatric and Comprehensive Ophthalmologist Concerning Individuals with Learning Disabilities

A. Identify and treat any eye or eye-related systemic disease or abnormality.

B. By observation and careful history, identify which broad category of learning differences the patient likely has and convey that impression to the pediatrician, the family, and any other interested parties. These children have often been through many psychological tests, tutoring, and other attempts at remediation without a definitive diagnosis or combination of diagnoses. Suggest a comprehensive neuropsychologic/educational evaluation from a qualified, credentialed neuropsychologist when all interested parties agree.

C. Help the family by giving them a direction in which to proceed so that the child with non-ocular learning differences can start to achieve his full potential. Not every individual with learning disabilities requires every possible specialist. These professionals include:

1. Pediatric neurologist
2. Pediatric psychiatrist
3. Pediatric developmental specialist
4. Pediatric endocrinologist
5. Pediatric geneticist
6. Pediatric otolaryngologist
7. Pediatric ophthalmologist
8. Speech and language pathologist (audiologist)
9. Neuropsychologist
10. Educational psychologist
11. Educator with special education credentials
12. Reading tutor
13. Physical therapist
14. Occupational therapist
15. Pediatric social worker
16. School placement expert (educator)
17. Disabilities attorney
18. Family physician or general pediatrician

D. A specialized attorney is often beneficial for helping families receive federal LD benefits to which they are entitled under the terms of the Individuals with Disabilities Education Act (IDEA) and Americans with Disabilities Act (ADA).

E. When the answer the question, “Is the child’s reading and/or learning problem in school due to his eyes?” is “No,” the ophthalmologist must explain why it is not and offer a positive and constructive method to direct those families toward obtaining the proper and appropriate care. The public still believes that eye specialists are knowledgeable in the field of visual perception as well as visual function.