Assessment and Treatment of the Child with Mental Retardation: Guidelines for the Public School Therapist
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Physical therapists employed in public schools may be responsible for the evaluation and treatment of not only physically handicapped children, but also children who have moderate to severe motor disabilities secondary to mental retardation. The purpose of this article is to suggest appropriate assessment and treatment techniques for these children. General principles of intervention based on neurophysiologic treatment approaches, particularly sensory integration, are described. Examples of specific assessment and treatment strategies are given for visual, auditory, tactile, olfactory-gustatory, proprioceptive-kinesiologic, and vestibular functions. In addition, self-stimulatory behaviors, tests of motor and reflex development, problems in muscle tone and strength, and variations in gait patterns are discussed.

Key Words: Mental retardation, Motor skills, Evaluation procedures, Physical therapy.

A trend in public education in the United States has been toward passage of "right to education" and, in some instances, "right to treatment" laws guaranteeing a public school education for every child regardless of physical or intellectual impairment. These children often have a variety of developmental and neurologic deficits, including problems in sensory processing, reflex maturation, and attainment of gross and fine motor skills.

Most physical therapists are not adequately prepared to assess or treat the child with strictly developmental problems. For this reason, the purpose of this article is to outline general principles of intervention for the mentally retarded child who does not have an accompanying physical handicap such as cerebral palsy or myelomeningocele. Examples of assessment and treatment techniques are included to aid the therapist in developing therapy programs for these children in a public school. The suggestions for assessment and treatment are based on a review of the literature and on my clinical experience with developmentally delayed children in elementary and secondary public school programs.

PRINCIPLES OF ASSESSMENT AND INTERVENTION

Attention to Sensory Processes

Neurophysiologic treatment approaches used by physical therapists attempt to follow the normal sequential process of human development that has been researched and documented by experts in various professions. Knowledge is still superficial because...
Clinicians are limited to observing motor or behavioral aspects of development and understand less of the sensory and integrative components. The amount of literature documenting the detrimental effects of sensory deprivation on man and other animals, however, is enormous. An organism that is deprived of normal sensory input may suffer permanent, partial, or temporary nervous system damage. In an introduction at a symposium on cerebral palsy, Kenney suggested that, ever since this condition was systematically described by Little in 1861, the emphasis in evaluation and treatment of children with brain damage has been on locomotor defects and disabilities. Rather, Kenney believes, the normal child must first experience his environment through afferent (sensory) pathways, then evaluate the information before he acts or moves. For this reason, Kenney suggested that cerebral palsy should be regarded from the sensory side first, with evaluation of the locomotor defect occurring later. A similar premise applies to the retarded child, whose sensory abilities must be functioning normally for proper motor development to occur; physical therapists should consider evaluation of sensory processes to be a major component of the assessment process with the retarded child.

Kinnealey delineated two groups of mentally retarded children by their reactions to a variety of sensory stimuli. She described one group as having difficulty perceiving incoming stimuli and modulating the response, whereas the other group had difficulty perceiving incoming stimuli and required more intense input for arousal or response elicitation. Obviously, the therapist must determine the basic responsiveness of each child to sensory input before deciding on appropriate therapeutic techniques.

Analysis of Process

In assessment and treatment planning, the therapist determines what the child is able to do, how the child performs various tasks, and, most importantly, why the child is able or unable to accomplish certain goals. Before the therapist can determine treatment objectives and goals, the process underlying the end product, not the task itself, must be analyzed. For example, if ambulation is the therapeutic goal or task, therapy procedures should not stress ambulation itself, but the "process" of ambulation, such as head control, trunk rotation, equilibrium reactions, and reciprocation. If improvement of fine motor skills, such as handwriting, is the goal, the therapist may initially gear activities toward the development of adequate postural and balance mechanisms, shoulder girdle and neck stability, and eye-tracking abilities. Repetition of specific motor tasks may result in the acquisition of splinter skills. Splinter skills—motor acts that are accomplished after much repetition (usually on a cognitive basis)—do not generalize to other motor tasks and are not usually the goal of therapeutic programs.

Purposeful Activities

Therapeutic activities should be purposeful and intrinsically rewarding for the child. Rote physical exercises, range-of-motion routines, or pulley regimens are not usually purposeful and seldom hold the child's interest. Devising activities that will provide and maintain interest during therapy requires ingenuity. Maturation and integration at each stage of development is dependent upon repetition; therefore, having a repertory of activities in which the child will cooperate is essential.

Automatic Mechanisms

Moore outlined three methods of learning: 1) subcortical, or unconscious, 2) reflexive trial and error—also subcortical, and 3) cortical, or conscious. The easiest type of learning is subcortical, and the most difficult level of learning is cortical. "Subcortical" describes behavior that is automatic rather than directed by "thought." Although emphasis in neurophysiologic treatment approaches is on automatic mechanisms, this does not imply that cognitive functions are unimportant or should be ignored. But because higher levels of the nervous system cannot function optimally without adequate functioning of lower levels, normalization of basic brain mechanisms is crucial.

In physical therapy, many techniques seem to be more effective when directed to a subcortical level, not requiring the patient's conscious effort. Neurodevelopmental, sensorimotor, and sensory integrative techniques of the Bobaths, Rood (Stockmeyer), and Ayres seem particularly appropriate for the retarded individual because neither cognition nor intellectual cooperation is necessary.

For the purpose of description, sensory and motor aspects of behavior are discussed separately. Sensory and motor functions should not be considered separate entities, however, because they are integrated in all aspects of behavior.

Assessment and Treatment Strategies

Visual

In assessing visual problems, the child's ability to orient to, focus on, and then track a visual stimulus should be noted. Eye movement patterns may be classified as "saccadic" (changing fixation from one
point to another) and “pursuit” (following a moving target). Getman and co-workers suggested that horizontal eye movements are the easiest, vertical more difficult, and diagonal the most difficult. Note during testing of both patterns in all three directions if the child demonstrates difficulty in visually crossing the midline of the body. Check sustained upward and downward gaze because these responses may be absent or difficult for the child to perform. Flashlight activities can be used both to test the child’s automatic visual scanning response and to give the child practice in focusing and tracking during treatment.

Interaction of the vestibular system and body proprioceptive mechanisms (particularly in the neck) is crucial for proper functioning of extraocular muscles. Therefore, children who have abnormal muscle tone and poor trunk and head control may have an inadequate base of support for eye movements, and treatment aimed at improving postural mechanisms may improve visual skills.

Vestibular input may also improve visual processing because vestibular reflexes, together with optic and neck reflexes, maintain a stable retinal image while the head and body are in motion. Also, the vestibular-oculomotor pathways contribute to skilled movement of the eyes, which is needed for educational skills such as reading and writing.

Auditory

Response to auditory stimulation may range from no response, to simple orientation to and movement toward the stimulus, to a startle response. Hearing deficits are difficult to assess in the nonverbal, profoundly retarded child. Observation of an eye-blink to auditory stimulation (which the child cannot see) may be the only indication that the child hears. Audiologic testing is indicated whenever deficits are suspected.

Children may overreact to auditory stimuli and startle at every noise. Some are “auditorily defensive” and are often observed in noisy classrooms or hallways with their hands cupped over their ears. An auditorily defensive child may attempt to protect himself from environmental noise over which he has little control by making noises to himself, talking excessively, crying, or, in the lower functioning child, screaming or shrieking. This hypersensitivity to sound is often associated with tactile and olfactory defensiveness.

A component of treatment aimed at enhancing auditory integration may be vestibular stimulation. Although the vestibulocochlear nerve (cranial nerve VIII) has classically been described as two separate entities (vestibular and auditory), it developed as a unit phylogenetically and also appears to be related functionally. There is clinical evidence that some hearing problems interfere with equilibrium responses and that incoordination caused by deficits in inner ear mechanisms can be improved or adversely affected when certain types of hearing aids are used. Vestibular input may not only improve equilibrium but, in some instances, may also enhance hearing.

Tactile

Dual cutaneous systems, the “protopathic” and “epicritic,” were originally described by Head. The primitive protopathic system is protective in nature and causes the individual to react to tactile stimuli with alertness and increased affect. This system may be synonymous with the spinothalamic system described by Poggio and Mountcastle. The epicritic system is higher, serves a discriminative function, and may be synonymous with the lemniscal system. This system allows the individual to respond to light touch with a well-localized sensation. Nature has arranged a balance of the two so that the protopathic predominates when the individual is threatened and the epicritic predominates when the individual is free to explore and manipulate the environment.

Tactile defensiveness is an aversive response to certain types of tactile stimulation. Often, mentally retarded children will seek out tactile experiences and do not appear defensive to touch when they are controlling the stimulus. However, when someone reaches out to touch them, they may withdraw or respond verbally with “ouch,” “that hurts,” or “don’t touch me.” This aversiveness is often associated with hyperactivity and distractability. The protopathic system may be out of balance with the discriminative (epicritic) system and tactile stimuli may be interpreted as noxious. Ayres suggested that graded application of cutaneous stimuli will alter the balance of the two systems in favor of the discriminative one. Treatment may include activities such as rubbing or having the child rub himself with a terry washcloth or rolling on a carpeted surface. Light touch or stimuli that “tickle” the child should be avoided in favor of activities that cause pressure.

Children who are tactually defensive may also exhibit an avoiding reaction in the hands and have a hypotonic grip. Activities that exert pressure on the palms, such as those in a hands and knees position, are excellent for decreasing tactile hypersensitivity and also promote proximal joint stability.

Tactile defensiveness (or hypersensitivity) in the facial and oral area may cause the child to reject textured or flavored food in preference to bland foods with a smooth consistency. Tactile stimulation to the face and specific desensitizing procedures within the mouth, such as gum rubbing, coupled with the gradual introduction of coarser foods as improvement occurs is one example of treatment.
Tactile discriminative abilities in higher-functioning children can be evaluated by blocking the child’s vision and asking him to name or touch the place where the therapist touches him. In contrast, the response of profoundly retarded children to tactile stimulation must be determined through observation. The therapist should note whether the child responds to the stimulus and, if so, how he responds. If the sensory input is noxious, is there simply a facial grimace or does the child move actively to remove the stimulus? It can be surmised that the child who actually removes the stimulus is not only aware of the stimulus but also has some proprioceptive awareness of body schema in order to locate and remove it.

**Olfactory-Gustatory**

Olfactory input is a valuable adjunct to therapeutic programs. In one study, olfactory stimulation was found to enhance tactile discrimination in blind children. Odors can be used to excite or inhibit an individual, but one cannot generalize that harsh odors will be excitatory and pleasant odors inhibitory. The response to olfactory stimulation will depend upon the person’s age, sex, and previous experience.

Olfactory stimuli should be administered cautiously and may be contraindicated in individuals with certain cardiac, respiratory, or seizure disorders. Trigeminal nerve irritants, such as ammonia or vinegar, should be avoided. Because habituation occurs rapidly, periods of stimulation should be brief.

The sense of taste may be overly acute in some children with oral hypersensitivity, causing them to reject flavored or textured foods. Other children appear to have less than normal acuity in the mouth and react less strongly to harsh tastes. Decreased oral sensitivity may be one reason some children seek more intense oral stimulation and constantly mouth hands and objects.

The olfactory and gustatory systems are closely related neuroanatomically. In a study of mentally retarded children, Kinnealey found a high positive correlation between their responses to these types of stimuli.

**Proprioceptive-Kinesthetic**

Various sensory receptors provide information about body movement, weight, and position in space. *Kinesthesia* refers to conscious information relayed by receptors within joint surfaces, and *proprioception* refers to information (primarily subconscious) relayed by receptors in muscles, joints, and ligaments. The vestibular mechanism, also considered proprioceptive, will be discussed separately.

Proprioceptors in the neck musculature are extremely important for overall function. In experiments on monkeys, paralysis of neck muscles resulted in widespread deficits in balance, orientation, and motor coordination. It is as important for the person to know where his head is in relation to his body as it is to know where his head is in space (a vestibular function). Poorly integrated tonic neck reflexes and poor head control are frequently observed in the mentally retarded child and obviously interfere with normal proprioceptive-kinesthetic feedback from the cervical area.

Many mentally retarded children rely on visual input for information about the environment and their position in space. This can be demonstrated by blocking a child’s vision and noting his postural reactions or having him identify in which direction various limbs are being moved by the evaluator. Children who have abnormal muscle tone, poor joint stability, tremors, and associated reactions receive poor or incorrect proprioceptive feedback from their own movement. One approach to correcting or improving proprioceptive-kinesthetic feedback is to facilitate normal movement patterns and to normalize muscle tone. Techniques include various methods for positioning and handling children and specific activities.

**Vestibular**

The vestibular system, along with the tactile, is among the earliest sensory systems to develop in the human. The vestibular system includes a dynamic component designed to provide information regarding angular acceleration around the body axis and a static component that provides knowledge about body position relative to gravity. Ornitz stated that if an individual is to receive and interpret auditory, visual, and tactile input correctly and consistently, these perceptions must occur in relation to simultaneous information about the individual's own position in space from which these sensory stimuli originate. Therefore, other sensory systems have a functional dependence on and interaction with the vestibular system.

The functioning of the vestibular mechanism can be observed clinically by noting the presence and duration of nystagmus following vestibular stimulation such as spinning. Nystagmus is a slow movement of the eyes in one direction, followed by a rapid movement of the eyes in the opposite direction. Ayres has developed a procedure for testing postrotatory nystagmus that has been standardized on children between five and nine years of age. If a child is unable to maintain sitting balance on a small turntable that is then rotated 10 times in 20 seconds, the test may be done by placing the child in a hammock. However, in analyzing test scores obtained when spinning the child in a hammock, it should be remem-
Vestibular stimulation can be provided through a variety of activities, and the amount of therapist supervision will depend on the type of activity and the intellectual ability of the child.

Higher functioning children, such as the learning disabled, who actively engage in activities such as rolling, swinging, and spinning on a merry-go-round, may limit themselves and stop an activity when they feel they have had enough or are beginning to be nauseated. Mentally retarded children may not be able to make this judgment adequately; they may overstimulate themselves to the point of losing all affect and approach unconsciousness or they may become nauseated and vomit. In addition, there is some concern that vestibular stimulation may precipitate seizures in seizure-prone children. Because of the lack of judgment by mentally retarded children in determining when vestibular stimulation is excessive and the precautions necessary for using this type of sensory input, the therapist must limit the amount of vestibular stimulation these children provide themselves.

Self-Stimulation

Self-stimulatory behavior is a concern with some mentally retarded individuals, and intervention is essential whether or not this self-stimulation becomes abusive in nature. Examples of self-stimulation are constant mouthing of objects or the hands, head banging, hand flapping, scratching, teeth grinding, or rocking. Evaluation of the sensory status of the child may reveal whether the child is stimulating himself to fulfill a basic sensory need or whether he is being overstimulated and resorting to self-stimulation out of frustration or inability to cope with sensory overload.

The tendency in educational programs is to restrict a child’s ability to self-stimulate, particularly if the stimulation is abusive. However, if the child needs more sensory input, this may result in further sensory deprivation and the child may substitute another form of self-stimulatory behavior. For example, a child whose elbows are restricted in extension so he cannot get his hands to his mouth may begin to bang his head on the floor. A child who cannot cope with the sensory stimuli in his environment and is being overstimulated needs to have sensory input graded to his tolerance. Although restrictions may be necessary in extreme cases to protect the child from injury, appropriate sensory input should be provided to ameliorate any existing sensory abnormalities or deficiencies. This sensory approach to treatment may decrease the frequency of self-abusive behavior and negate the need for restraints.

The type of behavior should be considered in light of the child’s developmental age. Constant mouthing of objects, hands, and clothing is considered socially unacceptable for the child of school age; however, if he is functioning at a primitive developmental level, oral exploration is a primary component of the learning process. Rather than restricting oral stimulation, providing the child with oral toys and oral stimulation, such as gum rubbing, may be more therapeutic.

The manner in which the child provides self-stimulation should also be observed. The slow, rhythmical rocking of the hyperactive, distractable child may be an attempt to calm himself, whereas the violent, irregular rocking of the hypotonic child may be an attempt to provide sensory input that will increase alertness and muscle tone. I have observed clinically that rocking behavior decreases or stops after the individual is provided with appropriate sensory input, particularly tactile, vestibular, and proprioceptive.

Some retarded children are fascinated by spinning or twirling objects, and Ornitz suggested that watching the movement of such objects may trigger an optokinetic nystagmus—alternating slow and rapid movements of the eyes in opposite directions induced by visual rather than vestibular input. Studies in lower animals indicate that similar visual stimulation results in neuronal firing in the vestibular nuclei. It may be that this type of visual input provides vestibular stimulation and may be a form of self-stimulation.

Motor and Reflex Development

Tests of motor development should be selected carefully to meet the needs of each child. Lewko studied current practices in evaluating children’s motor behavior in a large number of facilities in the United States and Canada and concluded that many tests were misused, considering the various disabilities and age ranges for which they were developed.

Assessing motor abilities in the child who shows developmental lags in some areas and not in others, or who has already developed isolated skills that give a false clinical impression regarding his level of development, is difficult. A functional analysis of simple motor skills may yield more information regarding a child’s level of neuromotor development, particularly as it relates to treatment planning.

Reflexes are the substrata of human movement, the raw material upon which the CNS builds volitional movement. An evaluation of reflex integration is essential for determining the basic level of neuromotor development. Motor tests that include an assess-
ment of the effect of reflexes on motor skills are of value to the physical therapist in terms of treatment planning.

Classic reflex testing, which is often geared toward evaluation of the cerebral palsied child, may not indicate dysfunction in the mentally retarded child. However, reflex or movement abnormalities often become evident during functional activities because reflexes do not work in isolation, but may be more or less evident depending on the position of the head in space or on the relative positions of the head and trunk. An analysis of postural responses can be done during activities such as rolling, crawling, and creeping. For example, several areas of inadequate reflex integration can be identified by observing the child while he is rolling on the floor. An overly flexed position in prone or extended position in supine may indicate poor integration of tonic labyrinthine responses. "Log rolling," or rolling without rotational movement within the body axis, may indicate that the body righting response is not used during functional activities. If the child rolls with his head touching the underlying surface, head-righting responses are poor.

One of the primary goals in treatment is to normalize postural reflex mechanisms. In addition to providing appropriate sensory input, the therapist must devise activities that allow the child actively to inhibit primitive responses, such as the tonic neck and tonic labyrinthine, and facilitate higher responses such as equilibrium and protective reactions.

Special attention should be paid to any primitive and abnormal oral reflex mechanisms. For example, a tongue thrust may be evident during eating and result in loss of food. The child may adapt this forward-backward movement of the tongue to mash food, and this may retard the development of tongue lateralization and rotatory chewing. A hypoactive gag response may contribute to the intake of large amounts of food, which may lead to choking and coughing. Treatment principles and techniques include normalization of muscle tone and inhibition of abnormal reflexes through sensory input, proper positioning, and jaw control.

Muscle Tone and Strength

Muscle tone may range from extreme hypotonia to hypertonia and, in many children with cerebral palsy, to spasticity. These problems are due to integrative deficits of the CNS rather than to muscular dysfunction.

Hypotonia, or abnormally low muscle tone, contributes to poor joint stability and immature postural mechanisms. Children with hypotonia appear to have flabby muscles and have distinctive postures such as "pot bellies," "coat hanger shoulders," and hyperextended knees. One reason for low muscle tone may be lack of gamma-system "biasing" of the muscle spindle. Activity of the gamma efferent system has been related to general levels of activity in the CNS and sensory stimuli, which are effective in treatment in increasing alertness, may also elicit an increase in muscle tone.

Extreme flexibility of joints is usually associated with hypotonia, and children should be encouraged to participate in activities that facilitate cocontraction of muscles, particularly of the proximal joints. For example, activities performed on hands and knees require cocontraction of hip and shoulder musculature. Resistive activities such as pushing a weighted pushcart, pushing open heavy swinging doors, or riding a weighted tricycle accomplish similar treatment objectives but are more difficult than floor activities because the child is in a less stable position.

Subtle deficiencies in muscle tone may interfere with the academic performance of children who are in a traditional classroom setting. Sitting for long periods of time at tables or desks is extremely fatiguing for the hypotonic child, who often reacts with increased distractability or by slumping over his desk for periods of time. Teachers should be encouraged to allow children to perform academic tasks in a variety of positions. For example, prone on elbows on the floor is an excellent position to increase extensor tone in the upper trunk and neck musculature, to improve stability in the neck and shoulder girdle, and to inhibit the tonic labyrinthine prone response. Children can assume this position during many academic activities.

Poor muscle tone in the facial and oral areas is usually part of the clinical picture of hypotonia and often results in mask-like features and inadequate lip closure.

Breathing rate, depth, and regularity are important for providing adequate respiration for sound production. In cases in which abnormal muscle tone is normalized, breathing becomes more normal. Periods of hyperventilation can be observed in some individuals and have been known to precipitate seizures. Hyperventilation may be a form of self-stimulation or serve some undetermined physiologic function.

Hypertonia should be distinguished from the more pathologic increase in muscle tone, spasticity. Spasticity is identified clinically as an exaggerated response to muscle stretch, exaggerated deep tendon reflexes, or the presence of clonus.

Increased muscle tone may be observed in some mentally retarded children who do not demonstrate signs of spasticity. These children are extremely tense and are often tactually defensive, hyperactive, and distractable. Sensory input with hypertonia or spasticity should be geared toward decreasing or normalizing tone. However, hypertonia is seen less frequently than hypotonia, particularly in profoundly retarded persons.
Some children appear to fluctuate between hypotonia and hypertonia. “Posturing,” involuntary or voluntary movements that are not necessary to the motor activity, may be self-stimulatory and an attempt to normalize muscle tone.

Many intellectually impaired children do not understand the principle of “resistance.” This renders standard muscle testing techniques useless. It is usually necessary to structure a play situation in which general observations can be made regarding strength. For example, can the child lift or move toys or objects of various weights? Can he move his extremities if Velcro weight cuffs are attached to distal points? Does he perform functional resistive activities such as pushing open swinging doors? The variety of activities devised must be appropriate for the functional and intellectual level of the child.

Gait

In observing gait, or in determining why a child has not yet begun walking, the therapist must first consider if the child has adequately mastered the developmental prerequisites of normal gait. As described by Peiper, these include 1) head control, 2) gradual increase of extensor tone, 3) development of righting reactions, 4) rotation within the body axis, and 5) setting the hands free from support. In addition, the influence of primitive or abnormal postural patterns and muscle tone should be determined.

A primitive gait observed in a mentally retarded, school-age child is the gait pattern of a normal 10- to 12-month-old child. The legs are abducted in a wide base and the arms are straightened and spread out in extension, ready to catch himself should he fall.

A high-guard posture is often seen in the hypotonic child who has begun walking at a late age. As in a primitive gait, the legs are abducted in a wide base but the arms are flexed at the elbows and the shoulders retracted. It may be that the child is using the basic pivot-prone posture in an upright position to facilitate extensor tone, which is critical for maintenance of the erect posture.

Some children walk on tiptoes, although they are not cerebral palsied and do not demonstrate clinical signs of spasticity. They are generally hypotonic, hyperflexible, and demonstrate a variety of tactile and vestibular deficits. Bracing and surgical intervention do not seem to normalize this type of gait. Inasmuch as the cause may be related to integrative deficits, treatment stressing tactile, vestibular, and proprioceptive input may be appropriate.

Head posture is often a cue to the use of primitive postural patterns during walking. The head thrown back in extension may signify use of the tonic labyrinthine response to facilitate extensor tone. If the head is tilted to one side and the child consistently flexes and leads with the leg on the skull side, he may be using an asymmetrical tonic neck response.

Unfortunately, the ability to walk is viewed by many parents and educators as the primary motor skill to be mastered and a major index of individual success. Appropriate or not, walking is a common goal for mentally retarded children in school programs. Placing the child upright and assisting him during ambulation manually or with walkers, parallel bars, or other devices should be considered only a part of the treatment routine and, in some instances, may not even be indicated. Instead, physical therapy procedures should be geared toward developing the necessary components of gait.

SUMMARY

Physical therapy assessment and treatment planning for the mentally retarded child should be based on the normal developmental sequence and include an analysis of sensory functions. The attainment of motor skills should not be the immediate goal of therapeutic programming. Instead, the goal of treatment is to enhance basic developmental processes.

Although clinical studies are difficult to accomplish and there are few studies with this specific population of children, there are indications that a neurophysiologic treatment approach to mentally retarded children can be successful. Conclusive evidence to support the effectiveness of treatment based on neurophysiologic theory is still in the future and is a fertile research area not only for the neurobiologist, but also for the inquisitive clinician.

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