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ABSTRACT

Discussed are theoretical and treatment aspects of perceptual motor dysfunction and rehabilitation in 4- to 12-year-old academically failing children involved in a 3-year investigation at the University of Kansas. The program is said to stress increasing the amount of stimulation received by sensory receptors of the vestibular, reflex, and haptic systems. It is explained that balance is developed through activities such as vigorous spinning and rolling to stimulate the vestibular system; that reflexes are developed through tugging and jerking movements to stimulate the muscle spindles; and that tactile and kinesthetic sense of hyperactive children are developed through rubbing the skin and applying weights to children's ankles. It is reported that perceptual motor dysfunction is highest in children with a history of restricted movement during their early years, but that 6 months to 2 years of training with the half hour, 4-day-per-week program usually results in the disappearance of signs of specific receptor malfunction. (DB)

Perceptual-Motor Dysfunction*

by

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Perceptual motor dysfunction in children has been under extensive investigation the past three years in the Department of Health, Physical Education and Recreation at the University of Kansas. After realizing minimal success when applying large comprehensive perceptual motor models with children four to twelve years of age identified as having serious problems in academic setting, we began to research possible alternative methods to resolving the difficulties.

Recognizing that most contemporary P-M programs concentrate on integration and output levels of perception and performance, we began to focus on the input level of sensation. Reasoning that deficiencies or dysfunctions of specific receptors could prevent environmental stimulation from even reaching the central nervous system, we began to sort and categorize receptor groups that might contribute to perceptual-motor performance. Relying heavily on Ayres (1,2,3,4) theoretical postulates and related disciplines' knowledges, each receptor system was divided into basic components and possible evaluation techniques explored. After agreeing on methods of evaluating performance efficiency, we sought ideas for therapeutic procedures through outlining causative factors which might contribute to receptor dysfunction or inefficiency. Individual programs to alleviate specific dysfunctions were then designed and are being tried.

* Topic of discussion at a "More Than One Way" Session, in Wichita, Kansas, April 22-27, 1973.

It was decided that three possible causes of failure for environmental stimuli to reach the CNS might be 1) absence of sensory receptors, 2) nerve injury, or absence, or 3) insufficient sensitivity of specific receptor groups. Altering the first two factors was beyond our capabilities; however, the third, insufficient reaction to stimulation, represented a possible realm of investigation. It was decided to attempt, within reasonable limits, to increase amounts of stimulation to receptor groups in hopes of "activating" them.

We selected the vestibular, reflex, and haptic systems to begin our work. Visual and auditory discrimination difficulties are dealt with by specialists in those respective disciplines.

It is well known that balance performance is dependent upon the integrity of the vestibular system and postural reflexes throughout the body. The vestibular apparatus, as we all are aware, is located in the inner ear. Displacement of the head causes endolymph to move tiny hair cells and initiate sensory impulses. The crista relays the impulses over the 8th cranial nerve to other areas of the central nervous system. A wide discrepency between ability to balance on one foot with the eyes open and the eyes closed could be an indication that sluggish performance in the inner ear is preventing a high enough threshold to be reached to discharge a nerve impulse. To increase the probability of endolymph and haircells moving sufficiently to fire the crista, vigorous spinning, turning, and rolling activities are used. Scooters, barrels, tires tied on ropes, and incline boards have proven satisfactory for this purpose. Nystagmus is used as indication that impulses are being received into the central nervous system. Once a child demonstrates this phenomenon consistently within about 30 seconds of stimulation, we are satisfied the vestibular system is "activating" reasonably efficiently. Given that the system seems to be discharging within reasonable limits, we teach the child how to prevent dizziness by fixating on a point at 180° and 360° during each complete rotation.

Reflexes under investigation are those originally categorized by the Bobaths (5) and described in Fiorentino's Reflex Testing Methods for Evaluating C.N.S. Development (6). Fourteen reflexes mediated at the spinal, brain stem or midbrain C.N.S. levels appear sometime within a child's first two years of life and then should become inhibited out of the movement repertoire permanently. Another twenty-two reflexes primarily involved with maintaining equilibrium begin to appear at about six months of age and should persist throughout life. The impulses for these reflexes are believed to be initiated from activated muscle spindles in almost all skeletal muscles and are transported over the Gamma system. Our experience with approximately 300 children in the last three years demonstrates that it is not uncommon for reflexes to persist abnormally in children older than age two years, and for some equilibrium reflexes not to appear by age 12. We have seen children with abnormally persisting reflexes exhibit difficulty learning controlled movement patterns. A persistent flexor withdrawal or extensor thrust reflex can interfer with learning to skip or riding a bicycle. Youngsters whose equilibrium refloxes are delayed are often described as clumsy. If they are caught off balance and begin to fall, they do not demonstrate any postural correcting moves and often do not extend their arms ahead with a protective extensor thrust reflex to catch themselves once the fall is inevitable. As a result, the head often is the first to strike the surface. Evaluation of reflexes is described by Fiorentino. To inhibit out or facilitate abnormally delayed reflexes each reflex is dealt with individually. Efforts are made to stimulate the muscle spindles through tugging, jerking and jarring movements of the involved limbs. In the cases of persisting flexor withdrawal or extensor thrust reflexes, stimulating the soles of the feet through trampoline and other bouncing activities is most effective in eliminating these undesirable automatic actions.

The haptic system was subdivided into two areas for research - tactile and kinesthetic. Tactile discrimination is generally thought of as the ability to identify shape and texture of an object which comes in contact with the body. However, Ayres has also theorized a "protective" system of receptors that responds to only the most subtle stimuli which come in contact with body hair or surfaces of the body. These "protective" receptors are believed to remain receptive to stimuli until tactile discrimination receptors are activated at which time the threshhold of the "protective" receptors is believed to raise and the receptors "turn off" while the discriminators function. It has been postulated that hyperactive children may demonstrate unusual sensitivity to tactile stimulation because both the "protective" and "discriminative" receptors fire continuously instead of the "protective" system shutting off. Such a position could explain why hyperactive children over-react in a withdrawing manner to even the slightest touch or being required to stay seated for any length of time. The feel appears to be noxious to them. The child with the suspected tactile defensive withdrawal reaction can be identified through his reaction to single and double points of stimulation. Such children, when blindfolded, will quite accurately identify the location of a single stimulus to the hand, arm or neck; however, when two stimuli are applied simultaneously to two parts of the body, they will identify only one stimulus or respond by pointing to several places they believe were touched. Their discrimination powers are always inaccurate. In keeping with our decision to "overstimulate" receptors that did not seem to be activating properly, we borrowed from Rood's (7,8) sensory stimulation techniques. Rubbing and brushing all exposed parts of the body with textures such as carpet, net, brushes with various bristle stiffness, feathers and sponge combined with instruction in conscious relaxation have been very effective in reducing the activity level of "hyper" children. To begin with we allow each child to experiment with a variety of textures and to

select those that seem most acceptable to him. We find that initially the most active children select the more abrasive textures; a child will brush vigorously with a Chore Boy, and smile throughout the session.

Children who have difficulty moving limbs into demonstrated or requested positions could be exhibiting inadequate reception of kinesthetic information. If the kinesthetic receptors, probably the Pacincian corpuscles, are not firing efficiently, a child would not receive adequate feedback as to the position of his limbs in space. Without additional clues from the visual or tactile systems, he would be unable to assume desired limb positions. Working from this premise, we attempt to increase tension (and thus Pacincian corpuscle firing) in the joints by having the child carry two or three pound weights or wear weighted cuffs on his ankles or wrists while completing movement tasks. As the child begins to perform more efficiently, the weights are gradually reduced and finally eliminated.

An area of disability we do not deal directly with, but are extremely cognizant of, is visual discrimination. The visual receptive process can be subdivided into the categories of refractive and nonrefractive vision. Most of us are familiar with refractive visual anomalies such as nearsightedness, farsightedness and astigmatism. There are, however, nonrefractive errors which receive far less attention, but can be as handicapping, if not more so, than the refractive problems. Nonrefractive vision to the manner in which the two eyes work as a unit. For clear, singular, binocular vision to occur the extraocular muscles around the eye must be evenly balanced so that the stimuli entering the eyes strike each retina at precisely the same point. If, for example, the medial extraocular muscles of one eye contract slightly more than the medial muslces of the other eye, entering stimuli contact the two retinas at different

points. We often unconsciously correct for this problem when using our vision, however, after extended periods of reading, muscles tire, our eyes become itchy and tend to water and a headache often develops. Persistent inaccuracies between the muscle balance of the two eyes can lead to blurring, to double vision, and finally to total supression of one eye. Supression occurs because the optical center in the cerebrum will not tolerate two inconsistent simultaneous images for any length of time. This is a reflexive type of protection - the cerebrum literally shuts out one image. When this results, an individual's depth perception is destroyed. Adult individuals with such problems often-time learn to compensate by using other visual cues to make decisions about depth; children so handicapped do not have the visual and motor experience to make such compensations. Until the problem is corrected through visual training under the direction of specialists in that area or through the use of prism lens, the child must attempt to make decisions based on distorted visual impulses. Under no circumstances do we proceed with visual tracking or fixating tasks unless an optomotrist or optholomologist trained in nonrefractive visual examination techniques assures us a child is free of such anomalies. To insist a child use his vision under such circumstances will only increase his visual and resulting motor difficulties.

Approximately 60 percent of the children referred to us by physicians, school psychologists and psychiatrists demonstrate some or all of the problems discussed above. The highest incidence of occurance seems to appear in children with a history of restricted movement experience during their early years. The lowest incidence occurs in children exposed to a wide range of movement experience and/or movement exploration elementary school physical education program.

The remediation techniques described herein have proven effective with children with normal intelligence and also with mentally retarded youngsters. Signs of specific receptor malfunction usually disappear after 6 months to 2 years

of a ½ hour daily, four-day week program. After that time if integration or output level performance problems such as directionality, spatial awareness, figure ground or hand-eye coordination difficulties persist, standard perceptual-motor approaches are applied. We are satisfied with a child's performance when he demonstrates no signs of dysfunction and achieves to perceptual-motor norms for his age.

Rigorous statistical analyses of all data collected over the last three years are now in process and, when completed, should offer additional insight into the identification and treatment of perceptual-motor dysfunction in children.

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