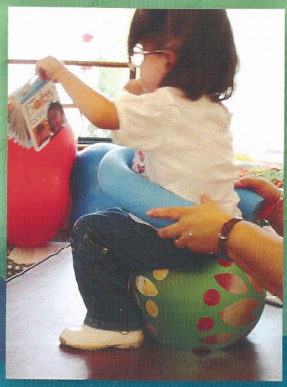

Developing Postural Control & Movement Learning in Children with Neuromotor Challenges:

A Handbook for Parents and Therapists

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IS THE "DIAGNOSIS" IMPORTANT?

A formal diagnosis by a physician may be important to be certain that necessary medical treatment has been provided. There are syndromes that alter metabolic function, for example, and that require a special diet. Early identification and nutritional treatment intervention can alter the developmental prognosis for such a child. There are conditions that need to be identified early in order to provide special medications, or even to plan essential surgical interventions. For these reasons we refer to the need for a child to be "medically stable" before concerning ourselves with the organization of movement skills and postural control. Not all children who need help have a specific diagnosis, but are simply observed to have less than optimal development for their age.

Children with a neuromotor impairment of some kind comprise the largest group of children who need special help to learn control of their bodies. They may have suffered some type of birth injury, or even an excessively rapid birth, with accompanying pressure changes. In some cases, medical efforts were focused on saving the life of the infant and the mother so that movement of the infant during the birth process was rapid with inadequate time to adjust to position changes. This type of movement learning assistance is also of help to children born with myelomeningocele, hydrocephalus, and a wide variety of syndromes that affect early developmental movement experiences. Meningitis and other systemic infections also interfere with the development of coordinated movement responses.

It is most helpful to observe the child's movement patterns, and to consider his or her history of development and early opportunity to move. For example, a child who has had three cataract surgeries in the first year of life will not have had opportunity to move around the house and to explore the movement potential of his or her developing body, even though the basic abilities may be present. Repeated hospitalizations for any reason may affect, in a negative way, the child's interest in moving as well as the confidence typically observed in the infant without these interferences. Infants born with respiratory complications, which occur particularly in the eighth month of gestation, may need oxygen support during the first one or two years of life when motor development proceeds rapidly. Memories of early experiences of restricted movement are held in the fascia, where tissue

restrictions often affect the quality and complete range of movement experience.

Hip dysplasia is generally identified early and treated with 24 hour positioning of the infant. This reduces the infant's opportunity to move spontaneously and limits the variety of movements that can be expressed by the child. Some extra assistance with new movement opportunities often improves the quality of movement control seen as the child matures. Sitting and other movement may need to be modified to keep the correct alignment of the hips (the head of the femur centered in the acetabulum) during activity sessions.

OBSERVING THE MOVEMENT PROBLEM

Accurate observation is the first step toward effective intervention. There are many possible reasons for movement problems, and they may relate to quantity, quality or initiation. Vision leads movement in young children so a distorted visual impression of space causes movement initiation to be blocked or distorted. Movement in space is a visual-motor action.

Postural control is essential to express movement of good quality. This is related to the need for part of the body to be secure or stable while another part is moving. The inability to hold a position or maintain contact with the supporting surface may indicate that the child needs assistance in positioning a part of the body so that movement can be initiated. Some children show excessive movement that is disorganized and difficult to predict.

Movements may appear to be out of control when an excessive range of movement is used for what should be a more subtle change in position. Subtle postural adaptations are very difficult to control. For example, rolling to one side requires an initiation that shifts the vertical midline of the body. Assistance with the initiation may result in the person continuing the motion actively. An error in "over-reaching" may relate to an inability to make a visual judgment as to the space available, or the distance to the target or to the edge of the support surface.

The righting reactions that coordinate body movement that changes the contact with the surface begin with head movement that leads body movement, and continue with body changes that stimulate an adaptation of the head position. Initiation with the upper body or the shoulders results in

following of the lower body or the pelvis. Initiation with the pelvis stimulates the shoulders to follow. This interaction within the body and between head and body results in rotation, or in the turning patterns of movement that are so important to smooth postural change as well as to respiratory adaptation.

Observation of attempted movement may lead us to the conclusion that part of the body does not follow as it should. In this instance the adult may be able to assist the part of the body that has difficulty. It is common for the body to increase the force used in the part that is able to move, seemingly in an effort to stimulate motion in the more passive body part. This is a type of compensatory effort, which is not always successful in achieving the functional goal that is intended. Effective movement responses are those that need minimal effort unless a resistive task is initiated.

In conclusion, we want to see movement initiated in various directions, with the head, shoulders and pelvis participating in changing direction. The central body should follow the limbs and the limbs should learn to support the central body. When there is a need to balance or hold a position when the base of support is moved, the equilibrium reactions aid the head in maintaining its verticality. For example, displacement of the shoulders in a posterior direction results in the head moving forward to maintain an upright alignment. These reactions rely on an integrated coordination between extension and flexion in the trunk, as well as visual-vestibular interaction for body balance.

HOW DOES THE TYPICAL INFANT BEGIN TO MOVE?

The unimpaired infant does not have to “learn” to move at any conscious level. The basic movement patterns used in the first months of life are a reflection of the movement patterns used in utero, which are now adapted to the gravity environment. During the first three months of life, the body becomes increasingly organized through the use of predictable movement patterns until there is some control of body symmetry, which is expressed with the hands coming together at midline over the chest and the midline of the face aligning with the sternum. The infant has also practiced maintaining the head up in prone (face down) position, motivated strongly by the changing visual characteristics of the environment.

Righting reactions begin with the lifting of the infant's head off the surface. By three months of age the body lifts off the supporting surface when the head is lifted laterally. These are known as "chain reactions" because the movement of one part of the body causes an immediate and coordinated reaction in other parts of the body. The interaction between the head position and the body alignment is especially important, as these closely integrated responses permit the infant to turn quickly to locate a visual or auditory signal. As the body shifts its position, the head follows and increasingly keeps a more vertical, or perpendicular alignment with respect to the surface on which the body rests. The more complex righting reaction is the ability of the upper or lower body to initiate a turning movement and the opposite half of the body will follow. This alternation of leading and following is related to the ability to keep one part of the body stable or steady while another part is moving. The 7-month infant in the photo keeps a secure body posture with the left foot pushing against the surface, while reaching for the toy with both eyes and the hand that is closer to the object seen.

While the righting reactions are being established and the head is more secure in the more vertical or upright alignment, the equilibrium or balance reactions begin to have their effect. These are coordinated reactions of the

development as a visual-motor experience. Correction of inadequate acuity makes all the difference in how the child sees and reacts to his world.

WHAT DOES VISION HAVE TO DO WITH MOVEMENT AND POSTURAL CONTROL?

Ambient visual processing actively leads changes of position in the young infant, and this occurs much earlier than the conscious intention to move. During this early stage of visual-motor integration, the infant relies principally on the ambient visual process that draws his attention to movements or objects in the environment and guides movement in space. As the body becomes capable of maintaining a position against gravity, the infant develops confidence in his or her body so that exploration of the environment is expanded. Visual "knowing" of a new object is confirmed by the infant through touching, mouthing and/or handling of the object seen, so that generalization of that information can later act as a reference. This type of activity depends on the focal process, by which visual detail is captured and stored in memory.

It is a lesser-known fact about the visual system that there are two separate forms of processing information within the same system. The second form of processing is known as the ambient visual process. It helps us to anticipate surface changes that require different movement responses or changes of speed. It calls our attention to something that is moving in the periphery of our visual field. The blind individual must learn to move through the environment by utilizing different sensory avenues. The person with partial vision or functional inadequacies receives distorted information through this sensory avenue, which may make it difficult or impossible to anticipate the movement response required.

Learning occurs at many different levels. One child may be learning to accept the sensations that accompany a new body alignment while another child is pairing word descriptions with the movement control. Each new challenge motivates new responses and serves to consolidate prior experience. The child who begins to make active responses at a new level progresses to new levels of function. The improvement of functional performance is concisely explained by W. Michael Magrun, M.S., OTR, in his book, Neural Systems Integration: Improving Performance in Children with Learning Disabilities. This work addresses the needs of adults with head trauma as well as children with various levels of dysfunction. It provides the reader with many examples in persons of all ages.

Respiration patterns must change and adapt to support those positions that keep the body in an anti-gravity alignment. This is sometimes a problem for children who have low tone or poor muscle development in the limbs. Adults can assist by changing the weight bearing on the trunk. Any time that the body weight is taken in a different part of the rib cage, or placement of support changes, the respiratory pattern alters to activate a different part of the thorax. When the child adapts to a new position or a new surface that respiratory change needs time to occur. Getting the child to laugh, talk or make sounds helps the adaptive process.

IS THE OLDER CHILD STILL ABLE TO LEARN NEW MOVEMENT CONTROL?

Learning continues throughout the life span. The child who has been presented with some limitations in the automatic control of his or her body resorts to compensatory movement patterns that serve to complete the task that needs to be accomplished. The older child, like the adult, has had more time to develop his or her own way of doing what is expected or requested. Their success in accomplishing daily tasks with compensatory movement patterns may make them reluctant to try a new way of moving or performing. It may take a little more patience on the part of the adult to change the established habits, but the new response often opens the door to further learning. A more efficient fluid movement gives more normal feedback, which is recognized as preferable by the central nervous system.

Remember that the enjoyment of new experiences will lead to new feelings of success and competence. Leading the older child to enjoy an increased range of movement or a new alignment of the body may be done with music accompaniment, or may lead to new play or sport experiences. This makes the movement response functional and more automatic while the child's attention is focused on participation in the activity. At the same time the adult is communicating to the child that new activities are possible, and the internalized self-image of the child is changing as a result of the positive experience. New confidence in his own abilities causes the child to seek out new challenges on his own.

Children with disorganized movement quality may lack some of the smooth activation of various parts of the body that contributes to efficient position change. They are helped by assistance in the timing of a movement response

To achieve improved control of posture does NOT require practicing all the steps through which an unimpaired infant passes. There is no time to work through all the steps, and the larger disproportioned body of the older child is unable to control postures mastered readily by the infant. The child who requires help needs to experience the sensation or feeling of the position we want him to control. Getting started may mean that the adult is doing 90% of the work initially. This does not mean that the child is not in a process of active learning. Active adaptation to the sensation of the new posture is the first step in controlling the body in that posture. Remember that those sensory systems are registering the information that is related to the new alignment of the body in space. Balance and enhanced sensory information reinforce new postural adaptation.

WHAT IS THE PURPOSE OF GUIDED HANDLING?

Special handling that has some objective in communicating the sensation of postural change and movement to a child with motor impairments acts as externally imposed feedback for the child's system. In some instances the physiological system of the child has difficulty accepting the sensations that are awakened with shifts of body weight, and this is one reason why movement was not initiated. In some cases the adult will need to closely observe subtle changes in respiration. It happens with some children that they learn to hold their breath when the alignment of the central body changes. This may cause a child to struggle against any change but adaptation may be assisted with patience and guided handling. The adult may need to maintain the child's new alignment on a softly inflated ball so that gentle movement of the controlled body will ease adaptation. In some children with neuromotor impairments the response to a slight displacement is an exaggerated reaction, as seen in this boy.

It is important that pushing with two feet at the same time is also assisted. In a child with less preparation this position may be difficult to control initially. The knee may be bent to place the forefoot on the surface. The adult maintains placement of the child's foot, while the knee is gradually extended or straightened by the child. This position, with the accompanying small movements of the legs, actually reduces tension in the Achilles tendon. It is best to place one foot first and then add the second foot to ease into the experience of simultaneous weight support over two feet. When necessary it is possible to work with one leg moving and then the other, combining the two feet to support only after practice.

HOW CAN FUNCTIONAL HAND USE BE SUPPORTED?

The child with neuromotor impairment is often physically moved from one place to another and has not learned to use hand contact for support during postural change. Mastery of anti-gravity positions may come slowly and habits are established so that the child does not associate moving with his own initiative. By positioning the child early to have experience with weight taken on the heel of the hand, the sensorimotor process is established.

Firm pressure helps to organize the sensory information so that later, light touch may be perceived without a feeling of being threatened. It is <u>not</u> important that the fingers are semi-closed as the sensation of weight bearing on the heel of the hand passes through the wrist and up the arm. The little girl in the photo to the left benefits from a small ball under her chest to give stability to her upper body while her hands and arms take partial weight. On the right the adult grades the weight moved over the hands. Active joint receptors are providing feedback to relate the positioning of the body to the sensation of weight support. The sensorimotor experience is a total, with

active matching of proprioceptive, visual-vestibular and kinesthetic information.

Functional hand use is paired with appropriate postural adaptation. The child who has developed an ability to use the hands in only one position of the body is severely limited in a practical situation. Reaching and touching may be initiated in prone, supine or sitting. Supporting with one hand to free the second hand for reaching or swatting at a light object is a functional goal.

In the presence of a neuromotor dysfunction, the child may demonstrate closed hands or sudden tightening of the hand when reaching for an object. These visual-motor reactions interfere with the child's attempt to explore the physical characteristics of the immediate environment. With increased frustration and failure the child loses interest and may become passive. He or she often permits other family members to bring the world closer and to carry out the exploration that is part of learning. By gently assisting the position of the hand that tends to become tense and incorporating the hand into postural changes, the child's body accepts the different sensation and begins to incorporate that more relaxed alignment into her normal posture. Functional vision intervention is often important to coordinate this ability to reach and touch an object accurately. Touching of the child's own body is a good way to start the process.

The adult may place two or three fingers into the child's hand to provide contact, and then to use this as a simulated support surface against the child's palm. Maintaining this firm contact while moving the hand in space provides the child with the sensorimotor experience of "holding while moving". This experience may be elaborated by holding of a washcloth or other lightweight colorful object while the arms are moving with the body.

The arms need to learn to push against surfaces to support the body and to push objects. It is not practical for the older child to push the body weight off the surface and then sustain the position. It is much more interesting and fun for the child to push the bench as seen in the photo below. The displacement of the bench can be both seen and felt, and the child's body adds force to the activity of the extended arms. This balance of activity between the central body and the peripheral limbs fosters true coordination between stability and mobility. The adult may also use a roll to hold the child's body, which allows hand placement to occur initially with minimal weight over the limbs and good alignment.

The first step in gaining specific hand function is to prepare the ability to place the hand. This ability is gained at the shoulder, where the joint structure permits movement in a variety of directions. This movement of the arm is controlled by large muscles that are capable of sustaining the weight of the limb in space. The joint receptors that have been activated by weight bearing over the upper limbs tend to be more precise in directing arm movement. Supporting the arm on a roll, ball or other support to place the hand within the visual field of the child and near the target to be touched obtains the better initial responses.

It is not necessary to use only the hand for weight bearing as the forearm or elbow may more readily control shoulder alignment. The four-month-old unimpaired infant begins to shift the shoulders in a lateral direction to free one hand for reaching. The shoulder is shifted past the point of the elbow, which provides greater security for balance of the upper body. This displacement serves to lengthen the tissues superior to the shoulder joint, while giving a wider variety of experience to the elbow and forearm. The