A Pediatric Handling Manual

Improving Movement *and* Postural Control *in Children with* Neuromotor Dysfunction

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clinician's view®

Improving Sensorimotor Learning and Postural Control in Children with Neuromotor Dysfunction: A Pediatric Handling Manual

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TENETS OF A THERAPY SESSION

ANALYZE: What can we accomplish in today's session?

Break down **MOVEMENT COMPONENTS** to give the balance of stability and mobility experience needed.

PREPARE the child's body to make a response possible.

IMPROVE the child's function through a sensorimotor change.

CONSIDER developmental level, sensory thresholds, physical and emotional needs, and interests of the child.

PROVIDE a successful new sensorimotor learning experience.

LEARN something new about the child's difficulties to guide future therapy sessions.

Functional Objectives for Children with Cerebral Palsy

Most parents are concerned about their child's future abilities to walk and to talk. These abilities represent the possibilities to move freely about one's environment and to communicate with their fellow humans. Parents want to be assured that their child has the possibility of being a person in his or her own right, and has the potential for an independent life.

Functional therapy objectives for the child take into account the parents' present concerns while considering past experience and opportunities that the child has had for new learning. Learning occurs in every living being at some level. The learning of abnormal movement patterns is an active process in the child with cerebral palsy when he or she does not receive effective therapy intervention. Limited or restricted postures severely reduce movement initiation and variability. The therapist takes into account the child's sensory intactness and the ability to integrate the sensorimotor input that is essential for posture and movement control. Analysis is made of the movement components that are controlled by the child. The establishment of a dynamic correspondence between visual, vestibular and kinetic subsystems is a primary goal. It then becomes possible to help the parents understand the preparation that is being made to reach their goals for their child.

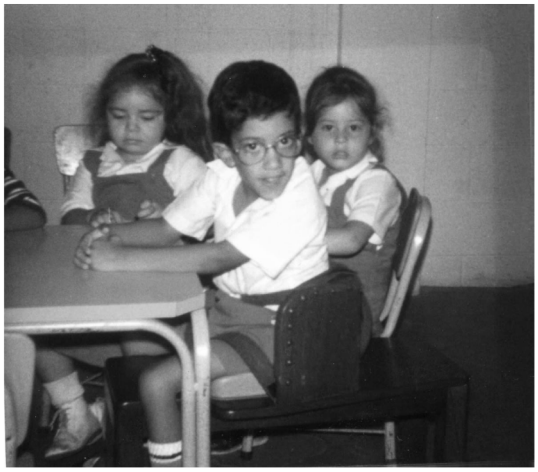
The school age child is evaluated clinically for the skills that are needed to function within a school environment. Typical seating and spaces for the child to move are taken into account by the therapist in relation to a task analysis of the function needed. Communication abilities may be supplemented or modified

Therapy experiences move the child to higher levels of function to integrate earlier movement components.

The standing position incorporates a balance of sensory inputs, with the need to align the body over the base of support.

The child without trunk extension tends to tense the limbs as movement is attempted. Effective intervention starts with the trunk.

"We treat the reactions of the patient and we are constantly guided by his response to our intervention." – K and B Bobath



School settings permit the child to know himself in relation to his peers and to develop strengths in cognitive and emotional development.

A walker may offer more safety in school while canes or poles are used in therapy and/or home settings.

Self-feeding assists shoulder development and personal independence.

to permit interaction with the teacher and other students. When there is an inability for the child to function intellectually with his or her age peers, consideration of an optimal learning environment for the particular child will give the therapist the functional objectives that prepare the child to be a participant in that particular setting.

For the preschool child every effort is made to prepare motor skills for more spontaneous movement in the environment and control of postural changes. By establishing better physical function in the preschool years there is less interruption of the more formal cognitive learning process, and the child has the postural base for hand skills and communication. This permits access to a more challenging learning experience for the child. Special movement aids, electronic communicators and adaptations should be provided only as a clear need is established and after a wide variety of learning opportunities have been offered the child.

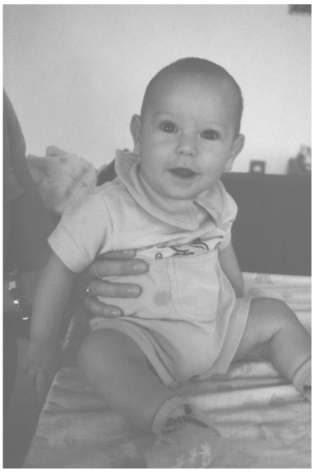
An adaptive device will assist compensatory efforts and, as such, needs to be analyzed thoroughly to avoid increasing future structural complications. For example, daily use of a head control switch that gradually destroys previously achieved sitting balance is contraindicated. For the child with severe neurological impairments, the therapist may design improved positioning with supportive seating for use in the school setting. Children who can be identified early as needing some type of protective environment in the future will need functional communication and some participation in daily care when learning responses permit. For example, the ability to feed oneself can make an important improvement in the quality of life for a person who is later dependent on custodial care.

The "airplane" response of the normal infant establishes the strong scapular adduction that is essential for shoulder stability.

"Observation of human movement reveals a seemingly infinite variety of positional change which involves or is controlled by a wide variety of internal and external forces."

– M. Trew and T. Everett

Lateral control develops with small shifts off midline.



Assisted sitting balances the trunk against gravity and establishes head and trunk coordination in the vertical alignment.

ment of postural responses. For example, the lifting of the head in prone actually lifts the shoulders with scapular adduction and activates extension in the spine with balanced activation of the pectoral musculature. With this lifting of the shoulder girdle the arms are in a position to push against the surface.

The higher position of the shoulders and the increasing head movement with vestibular activation leads to lateral shifts of weight that give the infant experience in bearing weight on one arm at a time. This asymmetrical weight bearing also frees one hand to reach and touch nearby toys. To use this type of preparation in therapy for the older child, the therapist can work in a sitting position at the table. The sitting posture of the trunk increases in extension as the body moves forward. In some cases the therapist needs to give special control to the head position during the transition.

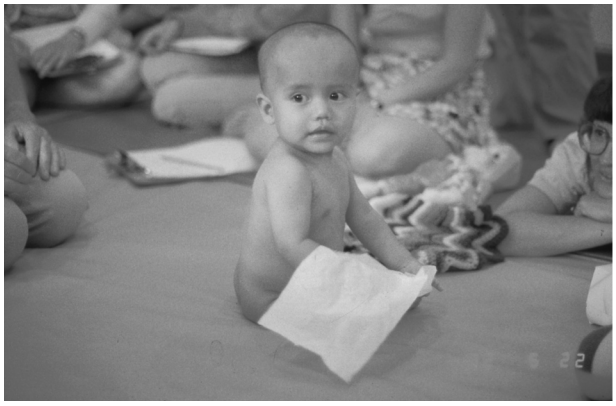
The infant best illustrates the strength needed in scapular adduction at approximately five months of age in the "airplane" posture. The arms are in horizontal alignment and maintained simultaneously off the surface while the legs are also in the air. This accomplishment helps us understand the participation of the horizontal influence of scapular adduction that combines with and strengthens the spinal extension. It is important to note that the head maintains freedom to change. The therapist can elicit this type of response with the client in a seated position, or by controlling the alignment of the lower extremities on a mat or a ball. Younger children are encouraged to reach for small toys, pegs, etc. with the child's body alignment controlled by the therapist.

Sitting most often begins with arm support forward of the pelvis, which indicates that the

strong scapular adduction described above is able to release to permit the arms to come forward. These postural contrasts support the establishment of dissociated movement patterns. This posture also compresses the soft tissues over the sternum and changes the activity of the anterior neck. Head control must be well established to maintain independent motion of the head and of the shoulders while sitting. Minimal head turning characterizes the infant's initial control of the sitting position, and head turning is noted to increase in frequency and range before both hands are free to move. A common compensatory pattern is the raising of the shoulders to stabilize the head position. While a vertical alignment of the trunk is important in sitting, excessive stiffness of the trunk alignment will prevent the infant from reaching forward with the hands and rotating to the sides.

As sitting ability matures the pelvis is more adaptable and the movements that were practiced in supine, prone and lateral alignments are gradually incorporated in the sitting position. This mobility of the pelvis permits more subtle weight shifts, which are used to relax the trunk during long periods of sitting. This ability to move the pelvis will also help to normalize the postural tone in the legs, which is particularly important for children with increased tone there.

Control of leg movement begins with generalized kicking in alternate patterns. Symmetrical straightening of both legs together off the support occurs in the four-month-old infant and serves to prepare for later standing. It is important to note that the five-month infant will place both feet to stand when lowered to a surface in vertical alignment. This means that the response of standing occurs in the developmen-



As sitting matures, coordinated use of the hands matures and trunk rotation is established.

Active pivoting in prone is permitted by lateral flexion and elongation of the trunk.

"When the circumstances are right during the therapy session, the infant will spontaneously make a righting response with the part of his body that is the most free to respond."

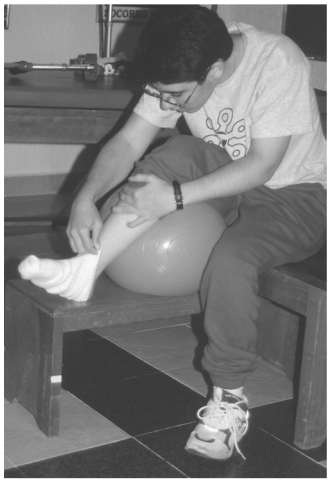
– M Quinton

Pushing with the legs at 8 months is important to prepare for later standing with good hip control

Pelvic Mobility

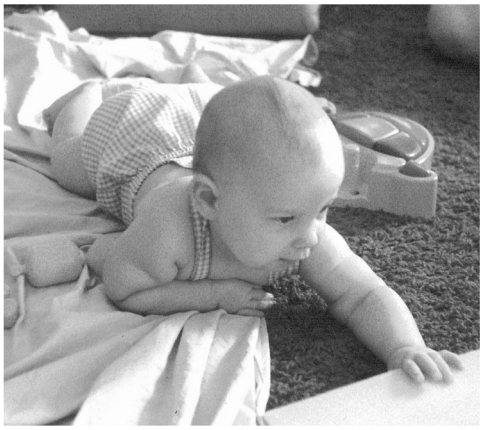
Therapists often begin with an evaluation of pelvic mobility when confronted with a child with neuromotor challenges. Pelvic mobility is essential for changing the center of gravity during postural transitions. Tilting of the pelvis results in tone changes throughout the trunk for balance and postural stability. A prominent Texas therapist, Cindy Thomas, refers to the ischial tuberosities as the "eyes of the pelvis." The child with severe or moderate spasticity has most often never achieved any pelvic lift in supine, and the lumbar curve could not form due to the infant's lack of head lift and general movement in the prone alignment. Forward inclination of the pelvis in sitting may be resisted due to inadequate or confusing visual impressions, inability to elongate the neck or poor flexibility of the lumbar spine and related soft tissues. The therapist is usually more successful introducing lateral shifts and diagonal forward movement before initiating direct forward movement that requires lengthening of the hip extensors and a dynamic response of the upper body.

For a smooth and normal gait the pelvis must be able to move over a stable weight-bearing leg. This begins early in supine and in prone, and is refined in the side-lying position. In the seated position the pelvis tilts anteriorly, posteriorly, laterally, and diagonally to adjust the trunk posture. This ability to adapt posture prevents us from suffering fatigue that comes from one unchangeable position. The child with spasticity or low tone may not have such options unless therapeutic intervention is available. Lateral tilting in the seated position is important for weight shift that will be needed in standing. Diagonal changes in the pelvis relate



Supporting the leg with a vinyl ball gives security for reaching forward to pull up the sock.

When working for separation of the legs of the child the therapist must take care to include the pelvic action that accompanies active leg movement.



The following of reaching by the shoulder girdle adapts the trunk alignment for the maintenance of a dynamic central stability.

nerve roots at two to four levels of the lumbar spine. This surgery seems to be optimally successful when done between five and eight years of age, depending on the severity of the child's spasticity. The procedure has relieved stress and fatigue for adolescents and young adults as well. Parents should be encouraged to obtain two or three consultations before agreeing to any surgical intervention.

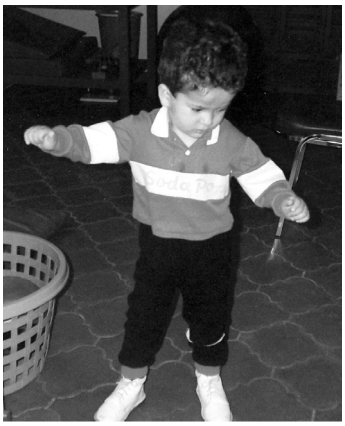
Botox injections may be used to temporarily deactivate overactive muscle synergies. It is critical that a physician who is familiar with functional movement patterns do the injections. Intensive therapy handling while the Botox is in effect helps to establish new control of functional movement patterns. New forms of the botulism toxin permit re-injection, with more opportunity for new motor learning in therapy. Direct tissue mobilization is also more effective in some children while the muscle is relatively inactive. Baclofen is used to reduce the general level of central spasticity, but may be difficult to regulate in the individual child. It is used with success to reduce pain in adolescents with severe limitations in movement. All these processes and procedures are optimally successful when combined with therapy preparation as well as follow-up for the child's active learning of new movement patterns.

Alternating movements are difficult for the child with spasticity due to poor reciprocal innervation and gradually increasing fascial restrictions. This is reflected in the child's inability to change the balance of stability with mobility in different parts of the body. Limb movement away from midline is limited in quantity and quality. Spontaneous trunk rotation is of poor quality or absent due to the limited development of the righting reactions as well as the inadequacy of the fascial memory

By using her leg as a supportive roll, the therapist can converse with the child while facilitating more active trunk extension through better respiration.

This boy with a history of two strokes is able to briefly lift one leg off the support after therapy intervention to improve trunk alignment.

Supporting the child on the surface of a large ball permits the therapist to assist lateral flexion of the trunk while the body weight is forward.



Initial independent steps are taken cautiously by this two-year-old after a near-drowning accident and therapy for some months.

Support over the hands can be facilitated over the large ball, with the possibility of lateral displacement to activate lateral balance in the upper body.

Full extension of a low tone child reveals tension through the rectus muscles and soft tissue tension over the rib cage.

for movement. There are often developmental inadequacies in functional vision that distort the child's perception of the space into which he or she is moving, creating a mismatch between the sensory systems and producing faulty feedback. For these reasons, as well as the influence of gravity and fascial restrictions on respiratory efforts, spasticity appears to increase when the child is standing or walking.

Prism lenses have been used very successfully to alter the individual visual perception of space and to make a related change in balance and gait. The consequent response to the feedforward mechanism changes the postural set that directly affects alignment and weight distribution over the base of support. The gait pattern changes with the influence of the new perception and there is a consequent reduction of the previously mismatched information. Postural tone over the ventral trunk and the sternum is immediately reduced. The body feels lighter to the child and movements thus become easier to execute. The ideal situation is one in which the therapist and the functional optometrist collaborate to make the most effective changes for the benefit of the child.

Early treatment of infants who are beginning to develop signs of spasticity shows us that movement patterns are best influenced by changes in the fluidity of righting reactions and the gaining of better mobility in the neck and the central body. It happens that this also results in improved patterns of respiration, which is often impaired in a difficult birth or other early systemic illnesses. Improved control in respiratory function reduces excessive tone in the legs as postural tone in the trunk normalizes and pelvic mobility improves.

What appears to be spasticity that originates at a cortical or subcortical level is often an

tral body and results in compensatory adaptations of the proximal joints. Remember that trunk tone is directly related to respiratory adequacy, which is stressed with the holding of a difficult posture for an extended period of time. Increased stress results in use of postural compensations. A small soft ball or roll may be used to partially support the child's body under the lateral trunk when lengthening the trunk to prepare for better respiratory function in sitting.

Side sitting is useful as a starting point to facilitate reaching and gradual postural transitions that use upper extremity support. The therapist can give support at the upper trunk or the shoulder of the elongated side. This partial support permits improved stability of the posture with the possibility of shifting weight from one limb to another without fear of collapse. Intermittent support and changes in the hand contact of the therapist will stimulate the child's body to take over the necessary control.

Functional Movement Control

Regardless of the level of the child's function it is useful to remember that we are most successful in making change when we analyze the daily developmental needs of the child. Is the child sitting well, but can't move out of this position? Is the child able to support over the hands, but unable to move a small object with control? Functional movement control is that movement that makes it possible for the child to have more influence over his or her personal environment.

When preparing for upper extremity function it is most often necessary to increase the postural support of the trunk so that the child's focus of attention is on eye-hand coordination. Children with athetoid movement have had

Passive soft tissues between the scapulae when the scapulae are adducted suggest a lack of active response even though compression of the local tissues meets with no resistance.

Tasks that require visual-motor coordination combined with active lengthening of the lateral trunk prepares for better balance in gait.

By giving clear sensorimotor information for stabile weight-bearing, the therapist gives the child freedom to adapt the body actively. Diagonal control encourages control of rotation.

Adequate respiration is fundamental for the child to initiate spoken communication. Sound production is paired with active trunk movement in typical development.

Righting and balance reactions are monitored closely as the therapist changes control to keep the postural challenge at an appropriate level.

Lack of mobility in the rib cage is perceived through a very light contact of the open hands of the therapist.

By using an asymmetrical alignment in the limb support the therapist is able to assist the trunk in better central adaptation.

minimal consistency in visual focus and following of hand movement. Visual following requires adaptation of the head position and touching of an object requires shoulder stability to move the arm. This is a very high level demand for the child with fluctuating tone, so it is important to prepare the needed components one step at a time.

All children are in process of learning new movement, and they need successful experiences in order to learn in a positive way. If the response is not guided by the therapist or by a carefully structured environment to be successful in its execution, the child with athetoid movement will use compensatory movements to achieve the desired outcome. If head stability has not been established, the visual system becomes accustomed to rapid scanning as its source of information.

Random trial and error does not result in effective learning of efficient movement adaptations. The therapist is an important element in the child's achievement of specific combinations of functional posture and movement adaptations. Limiting the abnormal responses at the point of initiation is effective in the more active child. The younger or less organized child may need to have the therapist give strong central control to maintain a functional base of support. For example the pelvis may be maintained specifically in a side-sit alignment while the child is lightly assisted to correct trunk alignment during a play activity.

Guiding the child's arm through a complete sequence of functional movement to complete part of a specific task allows the child to experience the postural control necessary to initiate and continue the functional movement. While the therapist moves the limb slowly, the child actively adapts the posture of the proximal