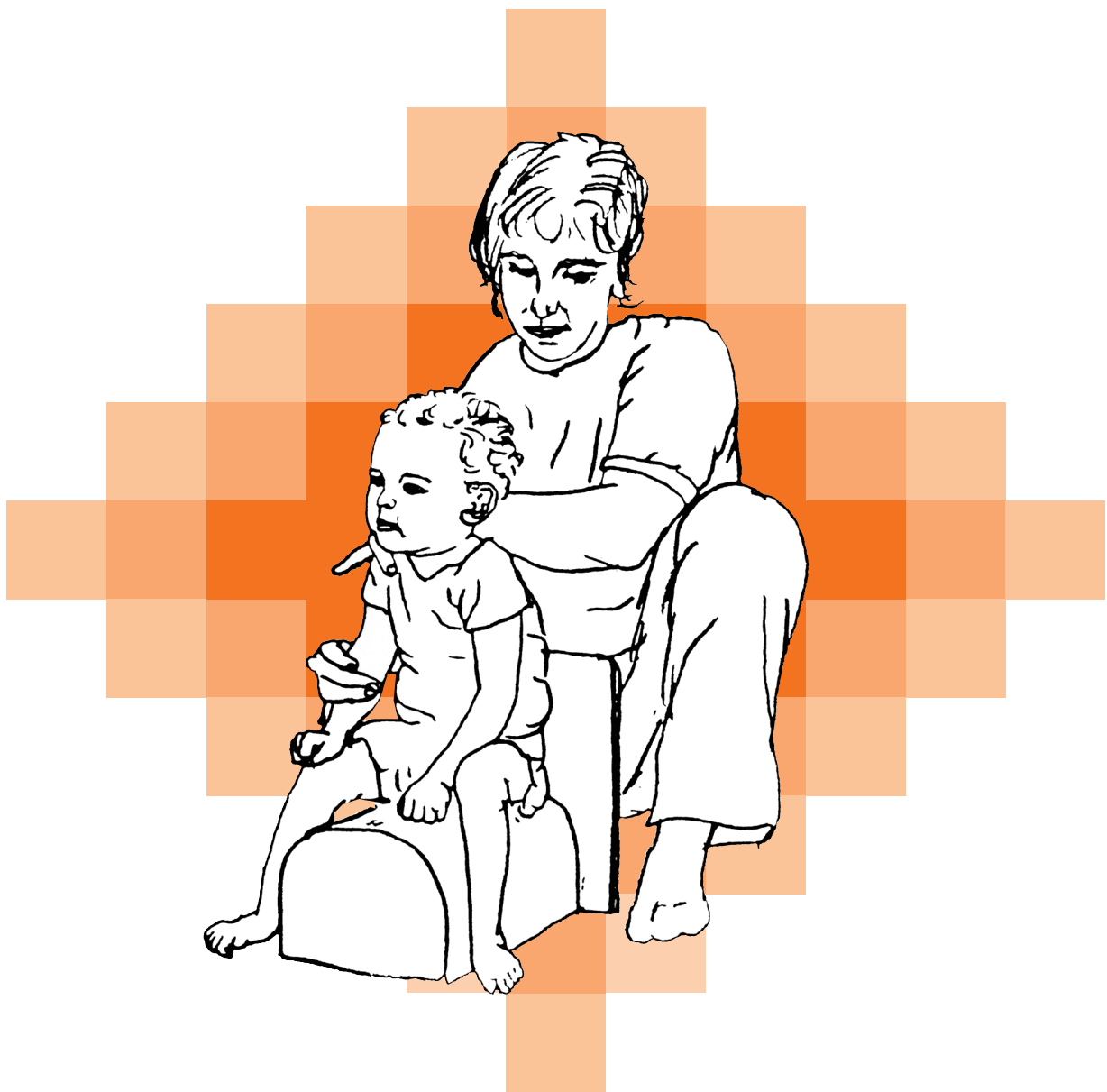


REVISED

Developing Mid-Range Control and Function in Children with Fluctuating Muscle Tone

by Regi Boehme, O.T.R.



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(REVISED)

Regi Boehme, noted NDT instructor, offers practical treatment ideas in this revised edition of her workshop manual. This easy-to-use reference tool gives you an easy-to-understand overview of the child with athetosis or ataxia.

The neuro-developmental treatment approach is included in the illustrated treatment rationale.

This "hands on" resource includes–

- principles of neuro-developmental treatment as it relates to fluctuating muscle tone
- classification of tonal differences in athetosis
- basic problems related to both athetosis and ataxia
- treatment principles
- grading of environmental stimulation

Clear line drawings and descriptions will help you understand conditions and treatment techniques.

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Introduction

This material is designed to support the clinician in assessment and treatment of those children who exhibit fluctuating muscle tone. Simply stated, the degree of stiffness used to stabilize or move the skeleton is constantly in a state of variability. The degree of stiffness changes throughout a given movement. The child usually can move and in some cases appears to be in a state of constant motion. The child has a sense of wanting to move a particular way, but the movements are experienced as uncontrolled, disorganized, and unpredictable in terms of range, direction, timing, and speed. Fluctuations in postural tone vary from mild proximal instability with distal tremors, as in ataxia, to extreme proximal instability and unintentional wide range motions of the extremities, as in some types of athetosis. Since treatment varies according to the type of fluctuating tone, athetosis and ataxia will be handled separately.

Generally, the child is able to initiate muscle activity but is unable to sustain it with graded mid-range control and may not be able to terminate it in a way that is appropriate to the function. This text offers suggestions to improve postural control, movement, and function when fluctuation in muscle tone is a presenting problem.

Postural control and functional movement are focal points of Neuro-Developmental Treatment, a therapeutic approach created by Berta Bobath, a physiotherapist, and Karl Bobath, M.D., in 1942 for the management of cerebral palsy. Because the material in this text is based on the work of the Bobaths, a review of the principles of Neuro-Developmental Treatment is in order.

Neuro-Developmental Treatment addresses those neurological conditions that interfere with the normal maturation of the central nervous system and result in delayed development of motor skills, abnormal postural control, and abnormal patterns of movement. Consequently, a thorough understanding of normal postural control and movement is necessary. The study of motor development includes the process by which the components of movement develop and the way that process is altered in abnormal development.

Efficient movement requires adequate postural tone. Adequate postural tone exists when the body has high enough muscle activation to maintain a posture against gravity and yet low enough activation to allow the body to move through gravity. Holding the head in an upright position while turning the head to visually scan the environment is an example of adequate postural tone to support function. Postural tone is changeable and treatment utilizes the child's self-initiated activity to alter tone. Automatic responses to changes in posture are stimulated in therapy as a basis for voluntary movement. Righting and equilibrium responses support the child's potential to eat and dress without help, to move

Classification of Types According to the Quality of the Fluctuating Postural Tone

		LOW	HIGH	
Range of normal tone		Low-Normal	Normal	High-Normal
Athetoid with spasticity			Normal	High
Pure athetoids (rare)	Low		Normal	
Choreo-athetoid athetoid	Low			High-Normal
Athetoid with tonic spasms	Low			High
Ataxic	Low	Low-Normal		

	Involvement	Quality of tone	Involuntary movements
Athetoid with spasticity	Usually quadriplegia with head and upper body more involved than lower body	Moderate spasticity Fluctuations range from normal to high	Fluctuating tone seen more distally than proximally
Athetoid with tonic spasms	Quadriplegia only with full body distribution	Fluctuations range from low to very high The rapid change in tone creates a tonic spasm	Both proximal and distal Seen in the form of excessive extension or flexion
Choreo-athetoid	Quadriplegia only	Fluctuations range from low to high-normal	More proximal than distal Fluctuation in muscle tone creates movements that may look intentional but are often involuntary
Pure athetoid	Usually quadriplegia	Fluctuations range from low to mid-normal	Fluctuates more proximal than distal Large range fluctuations with facial grimacing
Ataxic	Usually quadriplegia, hemiplegia seen in head injury	Fluctuations range from low to low-normal	Rapid fluctuations seen more distally in the form of a tremor, but with proximal instability

Basic Problems of the Child with Athetosis

1. **Early signs:** The child often begins life with a hypotonic base and may resemble the premature infant in tonal qualities. This low tone base may be evident for the first two to three years of life. As the child grows older and attempts more movement, the fluctuation in tone surfaces as sudden stiffening of muscles and intermittent spasms. The child may begin to use marked extension of head, spine, and hips in supine and supported sitting. Head control will be difficult in all positions and the child may not tolerate the prone position. As the fluctuating tone continues to emerge, asymmetrical posturing of the head, neck, jaw, and shoulders may become a major long-term problem. The degree of involvement and the type of tonal dysfunction will vary greatly among children. When central nervous system damage is extensive, the child begins life with significant feeding and respiratory difficulties.
2. **Quality of tone:** Fluctuations in the child's postural tone are sudden and cause movement in extreme ranges. The child is unable to generate and time the appropriate amount of stiffness where it is needed in the body to achieve function. The Bobaths describe this as an inability to grade antagonistic activity during movement. Instead, contraction of one group of muscles leads to complete relaxation of the opposing group. For example, as the child activates spinal extension, the trunk flexors do not slowly elongate and therefore do not grade the intended movement. Consequently, as the child extends the spine to move the body into an upright position, the unopposed extensors forcefully pull the child backward. It appears as if the child is throwing the body backward. When the child attempts to bring the body forward, the trunk flexors activate unopposed by the extensors and the child produces a total flexion pattern.
3. **Quality of movement:** In general a variety of involuntary movements can occur as the child attempts to coordinate a purposeful movement. In an attempt to control these involuntary movements, the child uses strong asymmetry as a point of stability and consequently moves with poor alignment of head, trunk, and limbs. One side of the body is usually more involved than the other, and arms are usually less functional than legs. Manual skills are very difficult because there is little grading of the flexors and extensors in the lower arm and hand. The child may posture strongly in wrist flexion with extended and weak fingers.

Righting, equilibrium, and protective responses are poorly developed and may continue to be limited throughout life. The child is unable to work off the base of support because the hips are not dynamically mobile in sitting and the feet are poorly aligned in standing. Standing

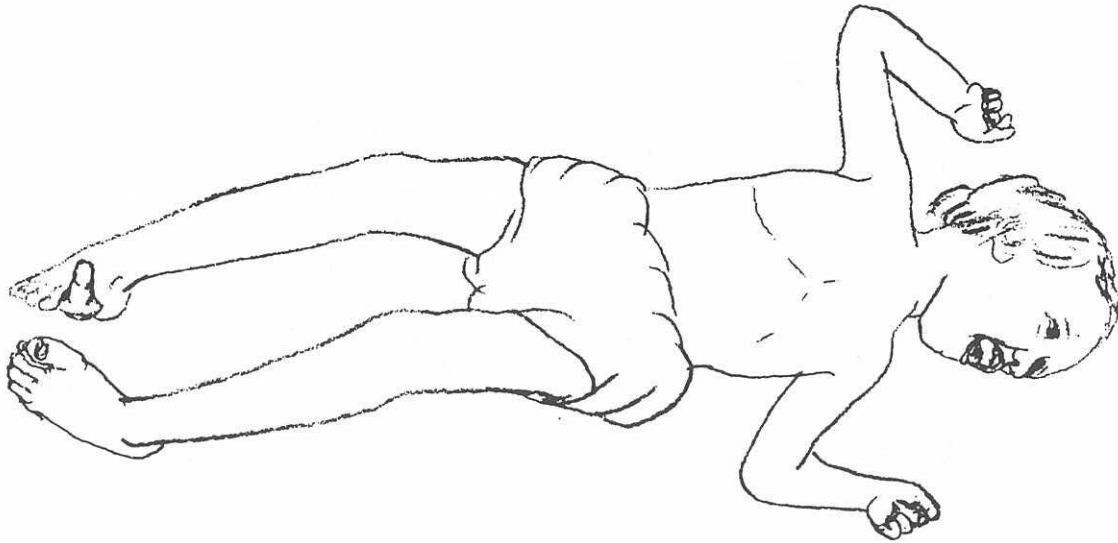


Figure 1

The child with athetosis uses asymmetry and distal holding in an attempt to stabilize the skeleton and control the range and speed of movements. Proximally, the child unconsciously creates a twist in the pelvis, spine, and rib cage to gain postural security. This is how the child adapts to lack of muscular coactivation and attempts to coordinate purposeful movement against the background of the unstable skeleton. Notice how the child's pelvis in Figure 1 is twisted toward the right, while the rib cage, shoulders, head, and neck are twisted toward the left. If you were to take a piece of rope and twist it in this fashion, you would feel the increased stability of the fibers.

Distally, oculomotor fixation is used in an attempt to control the movement of the head and neck. The eyes are usually held in an upward, diagonal direction often consistent with the direction of asymmetrical extension of the head and neck. The child finds it difficult to isolate movements of the eyes from the head. Wrist and ankle flexion may be used to stabilize the extremities.

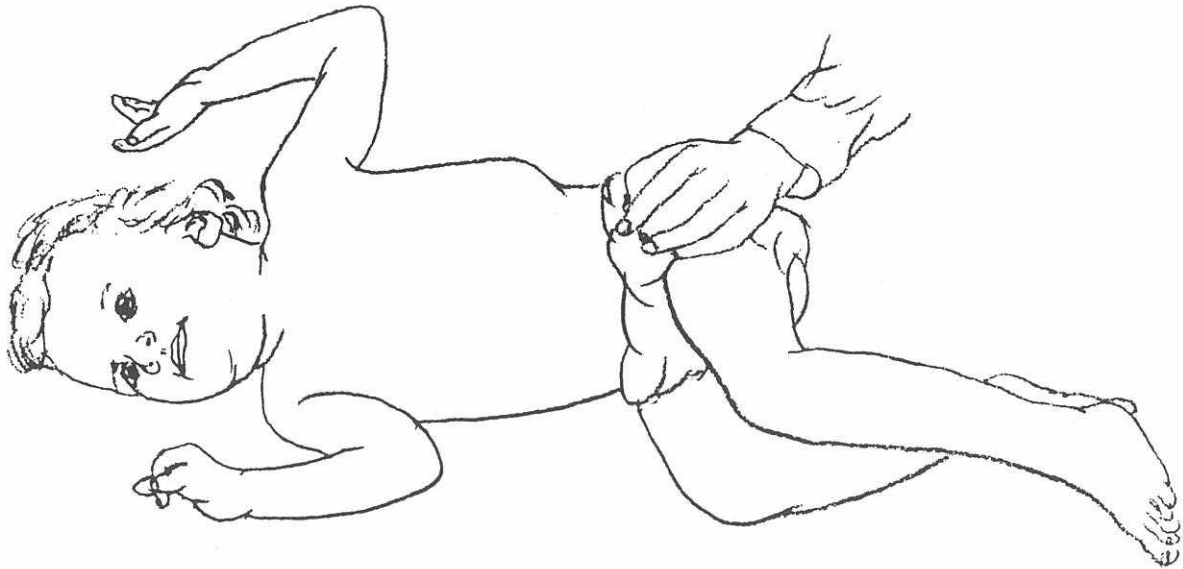


Figure 2

Respiration is usually insufficient for sustained vocalization. Breathing is often shallow, irregular, and noisy. This is partially due to fluctuation in the tone of the diaphragm. The problem is compounded by rib-cage instability. Inactive abdominal obliques fail to support the biomechanical development of a mature rib cage. The abdominal obliques are an important connection between the top and bottom of the body. They elongate the intercostals and provide a primary point of stability for efficient and deep respiration as well as whole-body motion. The child may attempt to stabilize the breath by contracting and holding with the rectus abdominis, a strong trunk flexor. This compensation creates an inward and caudal pull at the xiphoid process of the sternum, producing excessive lower rib flaring. The upper four to six ribs may be immobile due to short intercostal musculature and retraction of the shoulder girdles, creating an inability to draw air into the upper lungs. These adapted patterns are the child's attempts at basic survival.



Figure 11

This child responds to input with strong, full-body, asymmetrical extension. The therapist needs to find the alignment that will allow the child's body to be quiet and organized.

Basic Problems of the Child with Ataxia

1. **Early signs:** Ataxic movements do not usually predominate in the infant. The child begins life with a low-toned base and development is delayed. Initially, the child's movements may be slightly jerky and somewhat disorganized. Visual control may be poorly coordinated as well. When moving up against gravity, the child experiences proximal, small-range fluctuations with distal tremors during reach, grasp, and focused hand function. The more intentional the movement, the more obvious the tremors become.
2. **Quality of tone:** The child with ataxia experiences fluctuations in tone in much smaller ranges than the child with athetosis. The overall tone continues to be low but fluctuates within this continuum of low tone.

Most children with ataxia have mild to moderate involvement in all four extremities. Generally, the legs are more involved than the arms. Head trauma patients have varied patterns of tonal distribution. It is not unusual to see a child with acquired spastic hemiplegia on one side and ataxia on the other. Meningitis, encephalitis, and viral infections can be responsible for acquired cases of ataxia. Some children with athetosis may have underlying ataxia.

3. **Quality of movement:** Although intention tremors during upper-extremity function are more apparent than the proximal fluctuations in tone, the child is experiencing significant postural instability resulting in poor coordination of movement. Like the child with athetosis, this child lacks coactivation around the joints and has faulty grading of movement. Flexion is used in an effort to gain stability and lower the center of gravity. The child tends to stay close to midline and will resist lateral and rotational movements.

Gross motor skills are usually delayed, but many of the children will sit by 15 to 18 months of age with less than full head control and poor balance. Although there may be a two- to three-year delay in walking, many of the children do walk, preferring a wide base of support. The child is usually unstable during walking and experiences many falls. Injuries to the head and mouth are due to slow protective responses. The child may lock the knees with hyperextension in stance and gait to compensate for the lack of graded muscle control around the joints. Locking the elbows during upper-extremity weight bearing is common as well. The child often cannot stand still because balance adjustments are made by taking steps rather than correcting alignment of the head and trunk. The child may use the correct combination of muscles in the correct sequence for movement, but with a significant problem in the timing of the motion.



Figure 25

This child was basically hypotonic for the first two years of life. Now at age three there is significant ataxia. In independent sitting, the child pulls into flexion to stabilize the trunk and lower the center of gravity by strongly contracting the rectus abdominis, which forces a sitting position on her sacrum. The child's legs are widely abducted and externally rotated, to block lateral weight shifting. The lateral borders of the feet are planted firmly against the supporting surface. The toes flex for stability. The child's arms are kept close to the body and two fingers are placed in the mouth. In spite of using creative ways to stabilize the skeleton, the child continues to tremor.



Figure 26

Here the therapist aligns the lumbar spine and activates the hips by applying light compression through the spine and pelvis toward the weight-bearing surface. The therapist moves the child's pelvis in front of the hips to elicit spinal extension. Although posture has improved, the child's shoulders are not active on the trunk. Consequently, arms are held close to the trunk, which limits the child's capacity for reach.