clinician's view

The Clinical Observation of Posture and Developmental Aspects

by W. Michael Magrun, MS, OTR

THE CLINICAL OBSERVATION OF POSTURE IN CHILDREN WITH LEARNING DISABILITIES

Key Concepts

1. What are three basic consequences of postural asymmetry?
2. What is the probable result of unequal alignment of the shoulders on the neck and trunk?
3. What are the probable reason(s) for passive arm traction?
4. What is the influence of anterior pelvic tilt on the legs and feet?
5. Why is there anterior pelvic tilt in standing and posterior pelvic tilt in sitting?
6. What are 3 responses that are inhibited by a wide base of support?
7. What are the the postural and structural characteristics that may interfere with good hand function?
8. Why is it importat to correct the weight distribution on the feet?
9. What are the characteristics of somatic and vestibular dominance in one foot balance?
10. What is the influences of unequal proprioceptive tolerance between body sides.?
11. What are 3 reasons why children with disorganization tend to show stereotypic movements?
12. What are the basic postural characteristics seen in children with movement & posture disorganization?
13. Why is a neuro-postural base important as a prerequisite to sensory integration therapy?

Introduction

An important element in the observation of children with movement and posture disorganization is the observation of postural characteristics. Emphasis is placed on the identification of specific postural characteristics and how these characteristics influence and interfere with the child's movement patterns and skilled performance. The purpose of assessment is to determine specific areas in which the child experiences a lack of control or difficulties in smooth graded movements. Asymmetry in posture and imbalances in postural tone result in compensations that contribute to unequal weight distribution, bilateral integration difficulties, and poor grading of transitional movements across the midline.

Generally, children with disorganization show a fairly consistent profile. They often present with low normal postural tone, asymmetry in body alignment, selected areas of tightness (usually in proximal areas),
poor structural stability of the arches of the hands and feet, and a lack of good stability of the trunk.

Basic Areas of Postural Observation

- The Head/Neck
- Shoulder Girdle
- Arms and Hands
- Trunk
- Pelvis
- Legs and Feet

Movement and posture are two sides of the same coin. Sherrington's famous quote, "Movement follows posture like a shadow," reminds us that posture is inextricably linked to movement. Any disorganization or asymmetry in posture will cause a lack of efficient motor skills, as well as interference with learning and performance. The key elements of posture in any position, and therefore smooth graded movement into and out of positions includes normal postural tone, body alignment, equal tolerance of weight on both body sides, graded weight shifts and transitional movements initiated by weight shifts. Without these fundamental elements, motor function will be clumsy and disorganized. These elements are the critical components of a neuro-postural base that provides the organization for adaptive motor responses. Observation of posture in various positions is an important first step in investigating the possible causes of problems in motor planning and graded motor control for children with learning disabilities.

Normal postural tone refers to the level of readiness of the musculature to perform activity and to maintain stability. Normal movement requires mobile-stability; postural tone sufficient to maintain an underlying activity to provide stability for the skeletal system and therefore proper body alignment. At the same time, postural tone must

selectively increase to provide muscle power for movement. The ability to maintain stability and anticipatory increases in postural tone for dissociated movement is a key function of a normal neuro-postural base.

Body alignment refers to the relative relationships of body parts to a particular posture that support a dynamic and stable readiness to move. Normal alignment allows the ability to grade weight shifts from one body side to another. Graded weight shifts are critically essential to any movement. Without a weight shift there is no movement. Without proper alignment, there is inefficient grading of weight shifts and therefore disorganized movement. Alignment therefore is the essential component to movement. The head and neck must maintain a vertical relationship with the trunk and automatically right itself with shifts in weight from one body side to the other. The shoulders, pelvis and legs must align over the weight bearing side to allow for elongation and stability on the weight bearing side. The non-weighted side laterally flexes as the head and neck right away from the weighted side. Weight shifts and the adaptations of postural alignment allow for rotational movements that are necessary for smooth graded motor control.

The ability to maintain proprioceptive tolerance on both body sides equally is an important aspect of midline control. Equal distribution of weight on both body sides allows mobile-stability and proper grading of weight from one side to the other to initiate movement. Unequal tolerance for weight on one side interferes with the grading of weight shift, adaptive postural alignment and the ability to organize bilateral integration for adaptive motor performance.

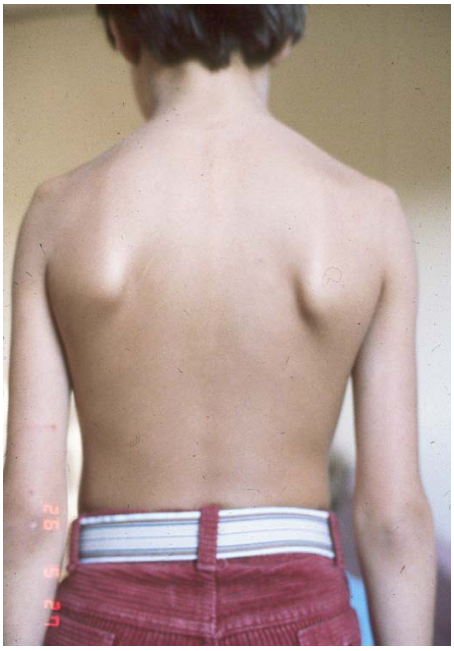
During postural observations therefore, close attention to the postural tone of the child, particularly around the scapulae and mid-trunk is important. The alignment of the head and neck to the trunk, symmetry of the shoulders, alignment of the thoracic and lumbar spine, postural tone and positioning of the arms and hands, tilting of the pelvis and the alignment of the legs and feet will provide information on the child's readiness to move. These observations provide information on the relative efficiency of the child's potential performance, as well as, specific problem areas that contribute to disorganized motor performance.

Observations in Standing

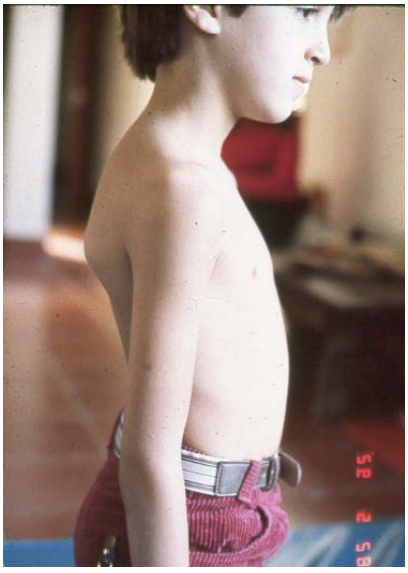
- Alignment of the Head and Neck
- Alignment of the Shoulders
- Alignment of the Scapulae
- Position of the inferior angles of the Scapulae
- Postural Tone of the Trunk
- Alignment of the Thoracic and Lumbar Spine
- Postural Tone of the Arms and Hands
- Alignment of the Pelvis
- Alignment of the Legs and Feet

Much can be learned through an initial observation of the child in standing. Almost always, the child with movement disorganization shows some basic postural mal-alignment of the body. In this case we can easily observe an imbalance in the alignment of the shoulders. The right shoulder is lower than the left and as a result the trunk is shortened on the right side. The neck is shortened on the left. The scapulae are slightly forward or protracted with the inferior angles tilted slightly up. The left scapula is higher than the right, with the mid-trunk flat and musculature appearing inactive.

This child shows a similar pattern of asymmetry, with the right shoulder lower than the left, the trunk shortened on the right side with the neck shortened on the left. The scapulae are protracted and the inferior angles of the scapulae protrude posteriorly out and up. Again the mid-trunk extensors and scapular adductors are relatively inactive.



Children with disorganization often show consistently similar characteristics in basic postural alignment. Here we again can observe imbalances in shoulder alignment, scapular protraction and protrusion, inactive mid-trunk extensors and abductors and shortening of the trunk and neck on opposite sides, corresponding to the alignment of the shoulders.



Lateral profiles also reveal the compensatory characteristics of mal-alignment. Here we see that the head and neck are forward. There is lumbar lordosis with compensatory anterior pelvic tilt due to abdominal inactivity. Again we see the scapula protracted with the inferior angle of the scapula tilted upward.

DEVELOPMENTAL ASPECTS OF POSTURE AND MOVEMENT DISORGANIZATION



Key Concepts

1. The importance of fetal and newborn experiences for normal development.
2. How a lack of early fetal and newborn development can interfere with development.
3. Important aspects of prone development.
4. How a lack of quality development in prone can result in specific movement and posture disorganization.
5. Important aspects of supine development.
6. How a lack of quality supine development can result in specific movement and posture disorganization.
7. Important aspects of development in sitting.
8. How a lack of quality of development in sitting results in specific movement and posture disorganization.
9. The importance multiple midlines in development.
10. How a lack of developing quality midline control results in specific movement and posture disorganization.
11. Important aspects of hand and foot development.
12. How a lack of quality hand and foot development results in specific movement and posture disorganization.

Introduction

Postural and movement characteristics seen in children with postural disorganization are compensatory patterns that develop over time. The relationships between developmental experience and later observed characteristics seen in children with postural and movement disorganization are important to understand in order to fully appreciate the compensatory structure and function often observed in these children. These patterns result from inefficiency in organizing basic postural mechanisms and a mismatching of proprioceptive information from the visual, vestibular and cervical-somatic systems. Mismatches in the organization of the Visual-Vestibulo-Cervical Triad (VVC) can be the result of developmental factors of low postural tone including the musculature of visual the system,

lack of experience in weight-bearing postures, inadequate development of rotation, and inefficient postural stability of the body and visual system. These developmental factors influence the development of structure, alignment, midline control, central stability and overall efficient sensorimotor performance.

Fetal and Newborn Considerations

Oral histories from parents are helpful in understanding and appreciating the parent's observations and experience during labor and with their child's development. In some cases the mother reports a long labor. Long labors may be stressful on the fetus, especially if the fetus has low tone or tone that is less than optimal. The fetus may fatigue and not be able to participate as effectively in the birth process. The opportunity for brief periods of hypoxia or anoxia is present under such circumstances.

Milani Comparetti (1) studied fetal motor patterns and termed the repertoire of these fetal motor patterns, PMP's (Primary Movement Patterns). From his observations he concluded that, "no neonatal pattern could be considered to originate at birth." He found that the fetus had a full repertoire of movements before birth; flexion, extension and rotational patterns. Functionally PMP's allow for fetal locomotion for changing positions and thrusting or propulsion patterns that are used to assist in pushing off the uterine wall during the birth process. These fetal patterns, which require sufficient postural fetal tone are very important not only to the birth process but the adaptation to gravity after birth for developing functional movement patterns.

Moore (2) suggests that in some cases there may be less than optimal migration of daughter cells into all 6 cortical levels that do not establish higher-level dendritic associations. If we consider that the high risk fetus may experience short periods of anoxia it might follow that this could impinge on the development of higher order dendritic branching. Diminished dendritic branching in the 3rd and 4th cortical levels especially, can affect motor development. Although in cases of children with learning disabilities these signs may be subtle and not sufficient to show up on standard brain scans, microscopic damage may be present and therefore cause an inability for the developing child to reach optimal efficiency neurologically for developing skill and learning. Dendritic branching results in synapses from other neurons synapsing with first level primary dendrites. The more dendritic branching, the more synapses and the thicker the cortex and the more neurotransmitters. A lack of higher order dendritic branching can be caused in utero as well as in the neonate due to sensory deprivation or a less than optimally enriched environment. When there are less dendritic branches there will be less neurotransmitters, a thinner cortex and a diminished ability to learn and establish coordination of motor control with sensory information, thus a less efficient sensorimotor system for learning.

Moore coined the term "pruning and tuning" to describe another important neurological and developmental concept. Moore (3) and Diamond (4) point out that infants over the first 3 months develop a huge number of dendrites, many more than needed. As the baby develops verticality and functional motor patterns, some connections are reinforced and become "tuned" or more predominant. Other connections are "pruned" and die off. Interestingly Diamond (4) suggests that ADD/ADHD children may not go through an inadequate pruning process and therefore are more neurologically sensitive to stimulation from the environment. They are therefore more distractible and less able to focus their attention and deal with

environmental and learning demands. Since we know that pruning and tuning develops from specific sensorimotor experiences, it is quite possible that the lack of developing a good neuropostural base by children with learning disabilities and movement and posture disorganization may inhibit the necessary pruning and tuning required of an organized central nervous system (CNS).

In addition it has been reported that teenagers often seem to "outgrow" ADD/ADHD during adolescence. This phenonmena is explained by Diamond (3). She points out that a major neurological tuning and pruning process takes place during puberty and that this more mature level of neurological organization helps to diminish the symptoms of ADD/ADHD. Both of these situations underline the importance of organizing sensorimotor development in children with movement & posture disorganization.

In any event it is most likely the case that the child who develops posture and movement disorganization is born with a tendency toward such future development. Considering the possibility of the fetus having low-normal or less than optimal tone, and therefore, somewhat diminished level of fetal locomotion and possibly periods of anoxia during labor, it would seem reasonable to assume that the newborn, under such circumstances, may have more of a struggle adapting to the changes and demands of gravity and therefore more difficulty in establishing a firm neuropostural base for future function.

Prechtl (5) has identified what he terms spontaneous motor patterns in the newborn. He has analyzed and categorized these patterns and successfully used them to identify potential problems in the developing newborn. These early general movements occur spontaneously without known external stimuli. Flexion and extension movements of the arms and legs are superimposed with rotation. These findings follow the conclusions of Milani Comparetti. If we consider that children who develop posture and movement disorganization, may have had some tonal problems in utero, and less experience and strength in fetal locomotion patterns, it would follow that their spontaneous movement patterns may also show some mild or subtle inefficiency or diminished frequency and amplitude.

Remember that the fetus has a variety of movements in utero. Now after birth there is gravity. These spontaneous movements provide a progressive process by which fetal motor patterns can be modified by the force of gravity. Historically these movements where seen as random movements. Most concern was given to reflexes and "milestones." Prechtl (5) has assisted us in understanding that there are no random movements but specific patterns that are consistent in all newborns. So what might these movement patterns do for the newborn in terms of functional development?

These flexion, extension and rotational movements, help to elongate muscles constricted in utero. Distal movement also assists in developing central trunk activity as well as initial experience in flexion-extension interplay of the musculature, essential later for controlled movement into and out of gravity.

Watch Text 1 Video Clip Part 12: Early Newborn Movements.

Early newborn movements have been studied and rather than being random they are specific movement patterns that are centrally generated that have identifiable amplitude and frequency characteristics.

Although Prechtl studied spontaneous movements in supine it is just as important to realize these spontaneous movements also occur in prone. With the body weight against gravity in prone these spontaneous movements serve to increase joint compression as the limbs extend and flex, particularly in the cervical area as the body weight is mostly forward in prone in the newborn.

The prone experience provides body weight stresses into gravity and results in compression into the joints to assist the development of proximal stability of the shoulders, trunk and pelvis.

Figure 1
Early prone experience with forward weight distribution

Watch Text 1 Video Clip Part 13: Spontaneous Movements in Prone.

Spontaneous movements can also be observed in prone. These movements may be centrally generated but also may be facilitated due to weight and proprioceptive contact of the face, neck, and upper body against the surface.

As Moore (6) points out, the cervical area is critical to the efficient development of what she terms the Visual-Vestibular-Cervical Triad. The neck provides the stability for the head and thus the ultimate orientation of verticality that allows efficient organization and cooperation of the visual and vestibular systems with the body somatosensory system. Low tone infants are therefore at a disadvantage in organizing the visual-vestibular-cervical triad and thus efficient spatial-temporal organization. From observational analysis we know that many if not all learning disabled children with movement and posture disorganization have a low tone base.

Given this backdrop we can begin to understand how the newborn adapts and compensates to the effects of gravity and therefore develops an inefficient structural and functional developmental foundation. A lack of efficient fetal motor patterns, a lack of normal fetal tone, coupled with compensatory adaptation to the demands of gravity, results in an inefficient developmental foundation.

Premature infants are at higher risk. Premature babies obviously have a diminished developmental capacity at birth as development in utero has been incomplete.. It is estimated that 50% of premature babies who do not have bleeds develop learning problems, motor

coordination problems and developmental delays (7). Premature babies are lower in birth weight and therefore have less postural tone and muscle mass. They are at a disadvantage for adapting against the force of gravity. They have perhaps not developed sufficient PMP's prior to birth and have less frequency, amplitude and quality of spontaneous motor patterns after birth, as has been found by Prechtl.

Watch Text 1 Video Clip Part 14: Differences in Spontaneous Movements.

Differences in spontaneous movements can be observed between full-term and premature newborns in supine.

Developmental Experiences That Integrate Sensorimotor Systems for Function

Early Prone Experiences 0-3 Months

Parents often report their infant did not like to be on their stomach and preferred being on their back. Developmentally early prone experiences are very important for establishing control against gravity. The newborn demonstrates physiological flexion in the first weeks after birth. The functional benefit of this posture is to place weight forward onto the neck. In development one "rule" of experience is that "where the weight goes, the bones grow" and structure and function develop. This initial experience helps to develop the cervical area. In addition it most likely serves to enhance trunk stability and facilitate the development of trunk extension.

Figure 2
Representation of physiological flexion.

Normal infants are born with physiological flexion. Notice how the infant's body weight is distributed onto the cervical area. A stable cervical neck is critical for maintaining the head in upright.

Low tone infants do not have this weight distribution forward. There are no stresses on structure to develop postural control and therefore no weight-growth/structure-function relationship.

Notice the distribution of weight of an infant with low tone. Weight is distributed widely and there is no specific weight being distributed in the cervical area.

Figure 3
Representation of low tone newborn without physiological flexion.

The lack of this initial experience will affect development in the future. Even though the child with movement and posture disorganization does establish functional head and neck control there may be residual deficits in postural tone and movement.

Watch Text 1 Video Clip Part 15: Newborn Movement Patterns in Prone

Newborn movement patterns in prone can be observed and differentiated between full-term normal newborns, premature newborns and newborns with identified problems.

What consequence might such a lack of early experience have on the development of the child in later years? In many children we observe what is sometimes termed poor neck co-contraction. The prone experience for newborns is extremely important for developing cervical stability and neck control for supporting the head. A consequence of less than optimal prone experience may contribute to what is observed later in child as head lag.

This 5-year-old shows residual head lag when being pulled up to sitting on a ball. There is no indication of spontaneous contract of the neck to stabilize the head and assist in initiating forward flexion. This is an example of how a lack of cervical development early in life can result in later functional difficulties.

Figure 4
Example of head lag in a 5-year-old boy.

In addition, a lack of establishing good neck co-contraction and stability may influence head righting reactions to weight shift. The neck is critical in maintaining the head and allowing visual-vestibular-cervical somatic information to match and maintain upright control. If there are early developmental experiences that are less than optimal or not completely integrated, this will affect many aspects of later function.

Figure 5
Kneel standing showing an inactive postural readiness and unequal weigh distribution and alignment.

Figure 6
Side sitting showing a lack of active extension (elongation) on the weight bearing side and collapse of the opposite side.

This 10-year-old girl in kneel standing demonstrates a passive posture, with the appearance of low postural tone and an imbalance in weight distribution between the right and left sides. When she shifts to side sitting to the right we see a very inactive and inefficient righting reaction. She does not elongate her right side actively and her head leans to the left rather than initiating an active righting reaction.

During the first several months the infant begins to turn and raise his head in prone. Initially head turning may be mostly associated with clearing the breathing pathway but shortly thereafter there is head bobbing and head raising by the infant. This provides an early experience in organizing the visual-vestibular-somatic proprioceptors.

Figure 7
Early head lifting in prone

Figure 8
Early head turning in prone

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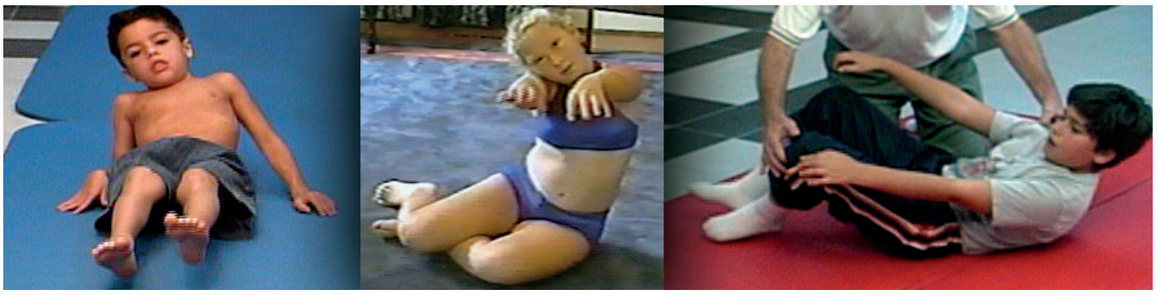

Evaluating Movement & Posture Disorganization

A Criteria-Based Reference Format for Observing & Analyzing Motor Behavior in Children with Learning Disabilities

By W. Michael Magrun, MS, OTR

3RD EDITION

EVALUATING MOVEMENT AND POSTURE DISORGANIZATION

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About the 3rd Edition

This 3rd edition of “The Evaluation of Movement and Posture Disorganization," condenses and modifies some of the observational criteria in each subtest. The subtests are reorganized to reflect specific criteria for the movement sequences in the categories of starting position, initiation, transition, and final position. This assists the examiner in identifying more specifically the critical components that result in disorganization, such as alignment, initiation of compensatory patterns, poor grading and weight shifting during the transition of the sequence to the final posture, and asymmetries between body sides. In addition, examples of disorganized responses are presented for each subtest.

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INTRODUCTION

One of the challenges in the assessment of motor behavior is the determination of the quality of motor behavior and performance. In children with movement and posture disorganization, the clinician is often faced with making judgments about the child's level of performance and the underlying difficulties that impact motor organization and coordination.

There is a growing emphasis on establishing efficacy of assessment and treatment through research that depends on statistical analysis and standardized measures. Whereas this approach has merit to professionalism and establishing the effectiveness of therapeutic intervention, it is important to remember that we are dealing with a dynamic process. When we consider movement, it is clear that it can never be fully understood by studying isolated or individual variables based on calculated "standard deviations." There is a lack of depth of consideration into the underlying factors that contribute to the performance deficit.

Standardized testing of specific motor skills may be helpful in establishing a level of performance in relation to a normal population of similar age. Standardized tests, however, do not explain the "reason" for failure or below average outcome of a particular performance skill. They provide a standard deviation from a statistical norm. They are essentially meaningless in terms of developing effective intervention strategies.

Variables of performance are difficult to isolate because normal movement and motor function is dynamic and ever changing, incorporating numerous components required for a normal performance outcome. The "reasons" for a child's poor performance therefore cannot be fully understood through standardized testing. Insight into the child's difficulty requires good observational skills to determine how the child's performance is attempted and carried out from a functional point of view. The "reasons" for the child's performance problems are what the clinician wants to know so that appropriate treatment strategies can be determined to remediate the underlying dysfunction.

The use of standardized testing is appropriate for establishing base-line data on specific skill performance prior to treatment. Treatment however, if it is to be specific to the child's needs, must be determined through good clinical observation of the underlying characteristics of dysfunction that are present and must have some relationship to the performance being measured.

Ultimately the most important result of any assessment is that it provides the clinician with an understanding of the child’s underlying problems and directly leads the clinician to treatment priorities. The criteria-based format of this assessment, if used properly with a knowledge of normal movement and clinical experience, should be effective in guiding the clinician to an understanding of the child's functional inefficiencies and to specific treatment priorities.

Observing Quality in Motor Performance

The intent of the criteria-based design of this assessment is to assist the clinician in the observation of specific movement and posture characteristics that may be contributing to inefficiency in performing the movement sequences of each subtest presented.

Disorganized movement "looks" different than smooth coordinated movement. It may first appear to the observer as labored or inefficient. Disorganized movement lacks fluidity and adaptability. It is often characterized as stereotypic or recurring because the child's effort to move through a sequence does not demonstrate a smooth grading of flexion, extension and rotation. The child usually does not efficiently activate rotary patterns in transition. Flexion or extension may dominate a movement or posture with the child activating extension too forcefully (jumping up or thrusting up) or sinking into flexion rather than grading into gravity with stability. All disorganized movement is characterized by a disharmonious combination of flexion, extension and rotation. Understanding normal movement allows the clinician to appreciate the components of movement that are dysfunctional and that lead to dyspraxia or poorly coordinated motor patterns.

There are several guides that can assist the clinician in observing and analyzing quality in movement and posture. They are:

1. Starting Position
2. Initiation of Movement
3. Transition
4. Final Position

The **starting position** determines a great deal in the outcome of control of a movement. Movement initiation changes with a change in starting position and the sequence of movement is therefore different in terms of the cooperation of flexion, extension and rotation that is required to perform the movement.

The patterns used to stand up from supine require a completely different sequence than the patterns required to stand up from a sitting position. The particular patterns required are dependent entirely on the starting position. The alignment of the body and its relationship to gravity, bias what movement patterns are used to accomplish the movement.

The distribution of weight influences, and is influenced by, the alignment and postural tone of the body. An imbalance in alignment, whether structural or postural will result in an imbalance in the distribution of weight and the ability to shift weight smoothly from one side to other. Postural tone will be unevenly distributed to compensate for alignment or weight distribution imbalances.

For instance, lying in supine with the shoulders, hips and lower extremities in a straight alignment allows the body to symmetrically assume standing from an alignment that is prepared to support symmetrical movement. If the starting position is initially misaligned with one side out of alignment, the movement initiation would be biased and therefore the body would need to make some type of compensatory adaptation to come to stand. This might include propping to one side or even rolling to one side to gain support for moving against gravity. The starting position and its relative alignment are therefore important in terms of how the motor plan is initiated. Alignment is determined by the distribution of weight, postural tone and structural characteristics of the child. Any imbalance of these factors between body sides will inhibit a smooth initiation of the movement attempted.

Initiation of movement refers to what part of the body begins the movement first, (initiates the movement pattern of intent.) Most movement is initiated by the head and neck, led by or

supported by the visual system. In many movement sequences, if not most, motion is initiated through an initial flexor component. Standing up from a chair, for instance, requires the initiation of flexion before extension. It is nearly impossible to stand up using only extension. Flexion therefore, serves as a catalyst or a preparation for extension. By activating flexion, the body is tensing for support against gravity to provide the stability to activate extension.

Simultaneously with initiation of movement there is weight shift to allow freedom for the body to move. Weight shift is an integral part of the initiation of movement. It provides the interplay of stability-mobility that is required during movement.

If the initiation of movement is compromised by poor alignment from the starting position, there will be difficulty in smoothly executing a motor plan without compensatory adjustments or disorganization. Imbalances in postural tone and the distribution of weight can also interfere with the initiation phase. Difficulties in the initiation of movement will cause progressive movement disorganization in the transitions required in moving from posture to posture.

Transitions during movement, primarily through rotational components, grade extension and flexion and provide organization to movement. Rotational components of transition also grade weight shifts through midline and integrate bilateral cooperation between body sides. Transitions in movement refer to the movements that are used between postures and link into a sequence of functional motor patterns. Normal movement does not just include flexion or extension and is not limited to symmetrical straight plane movements. Transitional components include rotational patterns of the trunk, spine, and shoulder girdle. Rotational components help to grade weight shift laterally, forward and backward, through a sequence of movements.

Children with movement and posture disorganization do not efficiently use transitional components of rotation. Therefore, they have difficulties controlling weight shifts during dynamic movement patterns and this affects smooth balance reactions. Transitional movements can be inhibited through poor starting alignment and/or inefficient initiation of movement.

The final position is the final or ending posture of the movement sequence. The ending posture serves as the new starting posture for the next series of movement components that are initiated. Motor planning depends on good kinesthetic feedback and good kinesthetic targeting of the pattern, or feed-forward information. If motor function is continually disorganized from the starting position through initiation and transitions to the ending posture, then there is little opportunity for the child to gain consistent sensory-motor constancy to establish the kinesthetic mechanisms required to perform a smooth movement sequence.

Clinical Observation

Movement consists of a series of postures chained together by organized components, or synergies, of flexion, extension and rotation. All movement has a starting and ending posture and at any point during the sequence the movement can be stopped and the posture at that point revealed. For a posture to be functional and organizational it must be maintained with normal alignment and normal distribution of postural tone and weight. Before analyzing the child's movement it is important to observe any structural or alignment asymmetries and any compensatory habit patterns in the distribution of weight and postural tone.

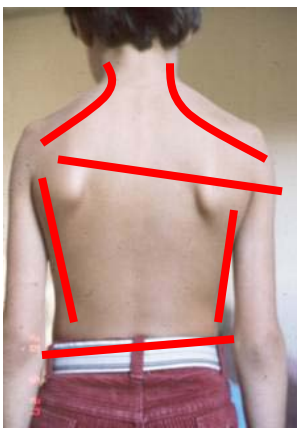
Children with movement and posture disorganization often show misalignments of the body and compensatory postural patterns:

- Observed in standing, the shoulders may be uneven, with one shoulder lower than the other.
- The neck may be shortened on one side as a consequence of shoulder misalignment.
- The scapula may be abducted and protracted with inactivity of the mid-trunk.
- The lateral trunk may also be shortened on one side corresponding to the lower shoulder.
- The arms may hang in passive traction.
- The legs may be internally rotated, knees in hyperextension and the feet medially collapsed with poor arch support.
- The hands may also suffer from poor arch structure and weak stability at the wrist.
- There may be a definite preference to take more weight on one side of the body and not the other.
- In sitting the child may also be observed to sit with more weight on one side of the body with a consistent posterior pelvic tilt and the trunk in passive flexion.

These are typical postural findings in children with movement and posture disorganization.

Neck-Shoulder-Trunk-Pelvis Asymmetry

In this example it can be observed that the right shoulder is slightly higher than the left. There is poor stability around the scapula with passive mid-trunk postural tone. As a result of the uneven alignment of the shoulders, the neck is shortened on the left, which tilts the head slightly to that direction. Due to the lower alignment of the right shoulder, the trunk is shortened on the right and the pelvis is slightly higher on the right side.

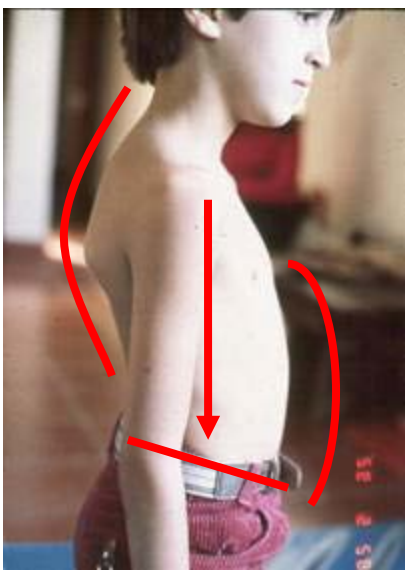


Inefficient Sitting Posture

This sitting posture is characteristic of children with movement and posture disorganization. The weight is distributed more to the right side. The neck is shortened and the trunk is in passive flexion with the pelvis tilted posterior. It is a stable position but does not allow a readiness to move or smoothly activate weight shifts, extension, or rotational patterns.

Passive Traction of the Upper Extremities

Poor proximal stability of the shoulder girdle and general low tone support of the trunk result in a passive traction posturing of the arms. The arms appear long and there is not a good readiness to move or initiate distal movement from a stable proximal point of control. The abdominals also appear inactive and the head is positioned slightly forward of the shoulders as a postural compensation for the lack of shoulder girdle stability. The pelvis is anteriorly tilted and there is lumbar lordosis.



SUBTEST 5: LONG SIT TO SIDE SIT

This subtest is designed to evaluate the child's ability to use rotational components and the ability to organize bilaterally to cross midline from a symmetrical starting position. The child starts in long sitting and is asked to side sit to each side, always coming back to long sitting before moving into side sit. This movement pattern requires rotation with trunk extension and lower extremity flexion. The child also must shift weight laterally and activate elongation on the weight bearing side and lateral flexion on the opposite side of the trunk.

Children with movement and posture disorganization may have difficulty in the starting position of long sitting. They may tend toward posterior pelvic tilt which will inhibit good rotation and weight shift. They may need to prop with a hand to the surface and they may not easily return to long sitting as a transitional posture, preferring to maintain lower extremity flexion and simply shifting weight side to side. There may also be difficulty in maintaining and alternating trunk elongation and lateral flexion from one side to another.

Disorganized Examples

Key Observations

- Is the starting position symmetrical?
- How is the movement initiated?
- Is the movement symmetrical?
- Does the child maintain good body alignment during movement?
- Is the end position symmetrical?

This movement sequence is initiated from long sitting and requires alternating rotation from one side to the other while grading lateral weight shifts. Note any compensations such as:

- Lateral shifting better to one side.
- Knees flex without full weight shift or rotation.
- Arms flex and shoulders elevate.
- Loses balance to one side or both sides.
- Trunk collapses on the weight bearing side.

Administration

Starting Position: Child starts in long sitting after demonstration.
Command: "Now you do the same thing. Extend your arms and sit with your legs straight. Now sit with both legs to one side and then go back to long sitting and then sit with both legs to the other side."

Starting Position
a.) Does the child start from a symmetrical position? Yes___ No___

If No:
b.) Is the pelvis in posterior tilt? Yes___ No___
c.) Are the legs internally rotated? Right___ Left___
d.) Does the child lean to one side? Right___ Left___

Initiation
a.) Does the child shift easily to the left side, rotate to side sit and maintain good alignment with elongation on the weight bearing side, and lateral flexion on the opposite side? Yes___ No___

If No:
b.) Does the trunk flex forward? Yes___ No___
c.) Does the trunk lean over the hip so the shoulder and hip are not in alignment? Yes___ No___
d.) Do the arms excessively flex and shoulders elevate? Yes___ No___

Transition
a.) Do the arms remain extended during side to side shifting? Yes___ No___

If No:
b.) Do the arms excessively flex while rotating? Yes___ No___
c.) Do the hands prop for support to either side? Right___ Left___
d.) Do the shoulders elevate during rotation? Yes___ No___

Final Position
a.) Does the child return to long sitting between each side rotation? Yes___ No___

If No:
b.) Do the legs only partially flex and move side to side without returning to long sitting? Yes___ No___
c.) Do the legs remain extended as the child shifts side to side? Yes___ No___

Repeat Several Times

Repeat the sequence several times. If the performance becomes more disorganized, it is an indication of significant neuropostural disorganization. If the performance shows initial disorganization and either stays the same or improves slightly, it is an indication of a more mild neuropostural disorganization.

Subtest 5: General Level of Disorganization

Adequate response with no indication of disorganization or difficulty. ☐

Slight indication of disorganization seen in several disorganized criteria initially, but improving or remaining the same over repeated attempts. ☐

Mild disorganization as identified by presence of a number of disorganized criteria and not substantially improving over repeated attempts. ☐

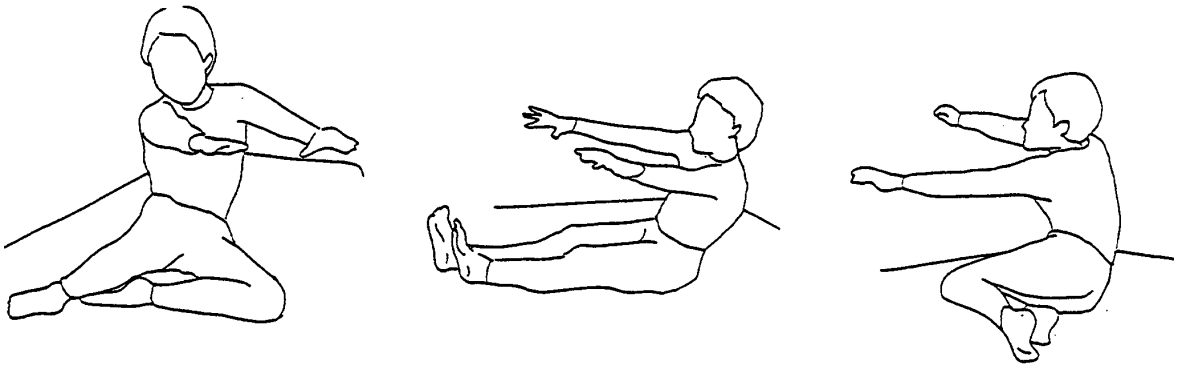
Significant disorganization as indicated by numerous disorganized criteria and remaining the same or becoming more disorganized over repeated attempts. ☐

Interpretation of Subtest 5

When interpreting the child's performance of **Long Sit to Side Sit**, it is important to observe the key components of elongation, lateral flexion and rotation of the trunk and shoulder girdle. The child should be able to flex the legs and laterally shift weight to the side with forward weight shift over the hip. The trunk should elongate on the weight bearing side and laterally flex on the other side. The arms should remain extended with the trunk and shoulder girdle rotating for counter balance. The pelvis should align in neutral or in slight anterior tilt and laterally tilt with the weight shift.

Children with movement and posture disorganization often show a better ability to one side. They may perform side sitting from a long sit starting posture with good lateral shift and trunk reactions, however, when shifting to the opposite side there may be a need to prop or to eliminate long sitting transition and there is often difficulty maintaining good elongation on the weight bearing side. Some children experience difficulty to both sides due to a poor pelvic starting position of posterior tilt and a tendency to keep the trunk flexed forward which inhibits good lateral shifting and rotational components. If the child has more difficulty to one side, make a note and reference with other subtests to determine if there is a consistent presence of difficulty to a particular side.

Summary of Findings:



SUBTEST 6: KNEEL STANDING TO SIDE SIT

This subtest is designed to evaluate the child's ability to grade into gravity from a kneel standing starting position to a side sitting position. Grading the movement requires a component of rotation with abdominal flexion. Returning to kneel standing requires initiation of flexion with a forward weight shift.

Children with movement and posture disorganization often have difficulty in grading flexion with rotation and may have even more difficulty returning to a kneel standing position. There may be more control to one side. The child may need to prop with the hands to maintain balance and push off with the hands to return to the starting position. They may assume a wide base which prevents lateral shifting and rotation.

Disorganized Examples



Key Observations

- Is the starting position symmetrical?
- How is the movement initiated?
- Is the movement symmetrical?
- Does the child maintain good body alignment during movement?
- Is the end position symmetrical?

This movement sequence is initiated from kneel standing and requires grading of lateral shifting and lowering to the surface with controlled elongation from one side to the other while rotating the shoulder girdle and trunk. Note any compensations such as:

- Do the hands prop for support?
- Is the movement to side sitting graded with elongation and rotation?
- Is the transition to each side equally smooth?
- Is there any difficulty returning to kneel standing?

Administration

Starting Position: Child starts in kneel standing after demonstration.
Command: "Now you do the same thing. Extend your arms and sit to the side. Then return to kneel standing and side sit to the other side."

Starting Position
a.) Does the child start in a symmetrical position? Yes___ No___

If No:
b.) Does the child lean more to one side? Right___ Left___
c.) Is the pelvis in posterior tilt or the trunk in flexion? Yes___ No___

Initiation
a.) Does the child maintain graded elongation to the weight bearing side? Yes___ No___

If No:
b.) Does the child lower to side sit better on one side? Right___ Left___
c.) Does the head laterally right better to one side? Right___ Left___
d.) Does the child collapse to the surface? Right___ Left___
e.) Do the shoulders rotate without flexion of the legs? Yes___ No___
e.) Does the child sit on his heels instead of lowering his hips to the surface? Yes___ No___

Transition
a.) Does the child grade the movement smoothly from kneel stand to side sit and back to kneel standing well to both sides? Yes___ No___

If No:
a.) Does the child need to prop with his hands? Right___ Left___
b.) Does the child flex forward only without using rotation? Yes___ No___
c.) Do the shoulders elevate and/or the arms flex? Yes___ No___
d.) Does the child need to push off with a hand to return to kneel stand? Yes___ No___
e.) Does the trunk actively elongate on the weight bearing side? Yes___ No___
f.) Does the trunk actively laterally flex on the opposite side? Yes___ No___

Final Position
a.) Does the child maintain good alignment in side sit? Right___ Left___
b.) Does the child return to kneel stand in good alignment? Right___ Left___

If No:
a.) Does the child lean to one side? Right___ Left___

Repeat Several Times

Repeat the sequence several times. If the performance becomes more disorganized, it is an indication of significant neuropostural disorganization. If the performance shows initial disorganization and either stays the same or improves slightly, it is an indication of a more mild neuropostural disorganization.

Subtest 6: General Level of Disorganization

Adequate response with no indication of disorganization or difficulty. ☐

Slight indication of disorganization seen in several disorganized criteria initially, but improving or remaining the same over repeated attempts. ☐

Mild disorganization as identified by presence of a number of disorganized criteria and not substantially improving over repeated attempts. ☐

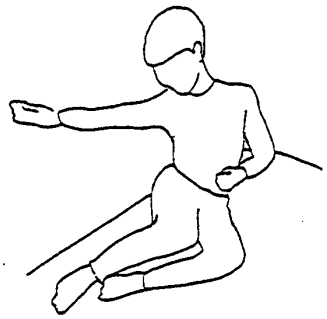
Significant disorganization as indicated by numerous disorganized criteria and remaining the same or becoming more disorganized over repeated attempts. ☐

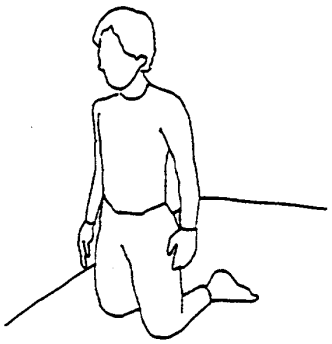
Interpretation of Subtest 6

When interpreting the child's performance of **Kneel Standing to Side Sit**, it is important to observe if there is smooth grading from the starting position to side sitting and if there is more difficulty on one side than the other. The ability to grade flexion into gravity is an important movement component because it allows the time needed to activate rotation. Further, flexion usually precedes extension and serves as a catalyst to initiate the required extension to return to kneel stand from side sitting.

Children with movement and posture disorganization often do not demonstrate good grading of movement components. They tend to collapse, lean into the supporting surface and quickly change from posture to posture. This lack of grading is probably due to poor experience in combining rotation with flexion and extension. Observe the quality of the child's grading action on each side and note if there is more difficulty on one side. Refer to other subtests to determine if this is a consistent finding. If the child has problems in grading there may also be a corresponding elevation of the shoulders and flexion of the arms in a compensatory attempt to assist flexor control. If the child has difficulty returning to kneel standing it may be the result of poor activation of abdominal flexion, poor activation of the lateral trunk, and difficulty with forward weight shift. The pelvis may be anteriorly tilted in the kneel standing and inhibit the initiation of abdominal control and lateral weight shift.

Summary of Findings:





IMPLICATIONS FOR TREATMENT PLANNING

A comprehensive treatment program should include a progressive approach of establishing a neuropostural base. In order to provide a child who has movement and posture disorganization a chance to succeed, a firm relationship with gravity that supports organized motor planning must be established. Further, the child must be able to refine those skills which are critical to the learning process. These are the functional skills by which children demonstrate, and to a large extent, develop their cognitive abilities.

Once the child has been assessed for movement and posture disorganization by using the subtests included in this assessment, the clinician should carefully consider the child's postural characteristics and movement trends before planning specific intervention activities. By referring back to the interpretation suggestions of each subtest and looking for trends in the child's performance, it should be possible to determine initial treatment priorities.

Generally the goal of physical handling is to facilitate functional control of flexion and extension against gravity combined with functional rotation. Treatment must center around the following parameters:

- Establish alignment of body parts to each other.
- Establish equal distribution of weight.
- Establish graded weight shifts in all directions.
- Establish controlled upper and lower body organization.
- Establish bilateral control throughout movement transitions.
- Establish graded control of flexion, extension, and rotational movement components.

Critical to this approach is the understanding that comprehensive sensory motor organization is dependent on specific facilitation through physical handling. Sensory stimulation is not an integrating force for these complex motor patterns.

Misalignments need to be identified and corrected. The use of techniques for changing tone is effective in reestablishing normal body alignment. Establishing normal alignment is the first goal. Without normal alignment other aspects of motor function and control cannot be efficient.

Another important issue is to determine if the child has more difficulty unilaterally. This can be observed initially in the standing alignment if the child tends to take more weight over one side than the other. If this observation is a specific problem it will also be observed in the child's attempt at other movement sequences in the assessment. The child may lean consistently to one side during **Supine to Flexion Hold** and **Prone Reach.** This type of somatic preference can also be easily observed in **Alternating One Foot Kneel, Kneel Standing to Side Sit,** and **One Foot Balance.** Obviously a tendency to over rely on one side somatically indicates that the child has more tolerance for proprioceptive weight bearing on one side of the body. This unilateral imbalance in somatic tolerance for weight will influence the internal perception of the body midline and the ability of the child to grade weight shifts across midline from side to side.

Intervention strategies need to include specific guiding of the body weight over the less normalized side, first through direct facilitation of weight shifting and then through

functional movement combinations which require weight shifting and weight loading to the less normalized side to achieve the purpose of the task. Functional tasks requiring these components should be done to both sides. However, the less normalized side should be given somewhat more experience.

It is also important to determine if the child has a deficiency in either flexor or extensor control against gravity. In some cases there will be a general disorganization in both flexion and extension against gravity. Specific subtests are designed to establish these determinations, among them, **Supine to Stand, Supine to Flexion Hold, Prone Reach** and **Alternating Prone Reach.**

Intervention strategies need to first isolate the components of flexion or extension which are inadequate and develop mid-range control, progressing more dynamically to lateral weight shifts and transitions out of flexion or extension into different and more variable combinations of movement. Once the child has established more strength and control it is important to begin to combine flexion and extension and rotation.

Rotation is the component of movement that is most often deficient in children with movement and posture disorganization. Rotation can be assessed through **Kneel Stand to Side Sit, Long Sit to Side Sit, Backward Kneel Walking,** and **Alternating Kneel Standing.**

Before rotational components can be effectively initiated the child needs to have some control of flexion and extension against gravity and the ability to control weight shifts. Movement activities should provide the child with various and constantly changing combinations of flexion and extension with rotation.

Treatment should not be linear in the sense that only one movement or postural issue is given priority at any one time. Treatment needs to be progressive in integrating all components. Some time should be spent on preparation of specific components before attempting to combine components into more complex movement patterns.

For a detailed discussion of treatment strategies for children with movement and posture disorganization, the reader is referred to the text, **Sensory-Motor Integration In Learning Disabilities: A Neuropostural Approach to Direct Treatment Strategies, 2nd edition** and the video, *The Treatment of Movement and Posture Disorganization,* 3rd edition, both by W. Michael Magrun, M.S., OTR, and available from **Clinician's View**®.

ADJUNCT ASSESSMENT PRIORITIES

Children with movement and posture disorganization require additional assessment in specific performance related areas. These areas include functional vision and the use of the hands. It is unlikely that children who experience motor control and movement disorganization do not have additional difficulties in specific "distal" areas of function such as vision and hand function.

Vision

The visual system plays an integral part in the development and efficiency of postural control. Ambient vision is a visual proprioceptor that orients the body in space. The Focal

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Sensory-Motor Integration in Learning Disabilities:

A Neuropostural Approach to Direct Treatment Strategies 2nd Edition

by W. Michael Magrun, MS, OTR

Introduction

The difficulties in motor performance in children with learning disabilities come from a lack of integration of sensory-motor processes, in specific, the efficient proprioceptive matching of visual-vestibular-somatosensory information. Inefficiency in the organization of these systems interferes with the child's ability to learn and his ability to express what he knows.

To effect a change in disorganized movement and posture, one must control, modify and grade sensory input and shape and refine and repeat functional motor output. This text suggests that the most effective and comprehensive way to achieve positive change in sensory-motor integration is through direct physical handling which incorporates the principles of:

- Facilitation and inhibition
- Musculoskeletal alignment
- Postural stability-mobility
- Organization of movement components

Treatment strategies presented in this text are based on the necessity of establishing a normal neuropostural base in relation to gravity, reorganization of somatic-vestibular proprioception, facilitation of graded movement components for functional motor patterns, and the establishment of efficient motor learning through improved feed-forward and feedback processes.

A Neuropostural Perspective

The neuropostural approach utilizes principles of facilitation and inhibition and is a therapist-directed physical handling approach to foster the organization of an efficient neuropostural base for functional movement and posture.

Facilitation requires an active response from the client. The therapist uses various techniques to activate musculature, establish alignment, and prepare postural tone, but the actual organized response is always initiated by the client. Facilitation techniques by the therapist allow the child to be more successful in initiating an adaptive response to controlling the center of mass over the base of support and efficiently grading movement components necessary for efficient function.

Inhibition is a component of facilitation in that it prevents through the use of positioning or specific input, inefficient compensatory responses so that the child can initiate a more organized response.

An efficient neuropostural base includes:

- Normal postural alignment
- Equal distribution of weight

- Ability to weight shift in all directions with graded control
- Efficient righting and equilibrium reactions as an underlying foundation for volitional movement
- Efficient organization of flexion-extension-rotational components of movement
- Dynamic interaction of stability and mobility requirements for movement
- Anticipatory initiation for efficient functional movement
- Volitional movement with efficient underlying postural control and support

For movement and posture to be organized, the child must be able to make a sensory-motor adaptation to the demands of gravity, sensory stimulation and environmental influences. To make a normal adaptive response, the child must have a firm base of support; a neuropostural base, from which to activate his adaptations to sensory demands. As such, a neuropostural base is considered a critical and necessary prerequisite to sensory integrative activities that stress sensory input but do not directly prepare the postural basis for adaptation to occur.

- **Normal Postural Alignment**

Normal postural alignment is the most critical prerequisite for establishing efficient functional movement capabilities. The ability to maintain dynamic alignment provides the basis for an organized initiation of movement with graded control of movement components during the process of performing a functional task or movement sequence. Alignment refers to the relationship of each body part to each other and to the relationship of the body to the base of support (BOS). Body alignment is dependent on the kinesiological alignment of muscle groups which in turn depends on joint alignment.

Normal postural (musculoskeletal) alignment establishes:

1. Kinesiological alignment of joint and muscles to activate dynamically and in the best possible efficient functional manner.
2. Alignment of the sensory systems (visual-vestibular-cervical triad) in the best possible vertical orientation for maximizing efficient integration and matching between systems.

Normal postural tone refers to the resting tension of the musculature and the modulation of muscle tensions during movement demands. The tension of the musculature must be sufficient to maintain the body against gravity while allowing tonal changes to produce movement. The background tone must be sufficient to maintain stability and there must also be a corresponding increase or decrease in tone surrounding the demands of movement and the mobility of the joints required to accomplish that movement. Postural tone therefore modulates in a normal range from a resting state to higher or lower levels of tone within and around structural factors of the body's musculature. Without normal postural tone there is inefficiency of equilibrium and righting reactions and the organization of synergies of movement components.

Postural tone therefore is a dynamic and constantly changing process which must be interactive and competitive in order for there to be sufficient tone to allow mobility while at the same time sufficient tone to maintain stability. Postural tone is never too low to jeopardize stability against gravity nor too high to restrict movement. Different parts of the body's musculature achieve different levels of postural tone simultaneously and interactively so that this dynamic process is possible.

The dynamic nature of postural tone allows for reciprocal innervation. Agonist and antagonist, within muscle groups and motor patterns, provide a balance of postural tone to allow stability and mobility by constantly modulating increases and decreases of the tonal relationships needed to accomplish a movement pattern. Reciprocal innervation allows for the combination and competition of flexion, extension and rotational components of movement and their organization to perform a functional motor behavior.

Normal postural tone and reciprocal innervation, provides the skeletal system with the possibility of establishing and maintaining normal bony alignment, articulation of joint function, stability around the bony structures and an adequate range for function.

- **Equal Distribution of Weight**

Normal postural alignment allows for the body to distribute weight over the base of support in all planes of movement. In a standing or sitting alignment, weight should be able to be evenly distributed on both body sides. Although we are rarely in a perfect vertical standing or sitting alignment, it is important that this be easily achieved.

Without this ability, weight shifting and crossing the midline for lateral or rotational movements becomes much less efficient and indicates asymmetry of graded control. Observing weight distribution in standing and sitting allows for the determination of a possible postural midline shift and proprioceptive preference in sustaining weight unevenly. This can be a lateral distribution on one side of the body over the other, or an anterior, posterior distribution of weight, or a combination. The distribution of weight over the base of support will determine the efficiency or inefficiency of the initiation of movement, the transitions of that movement and the alignment of the end posture. We move from posture to posture through graded transitions of movement components. The distribution of weight of the starting position and the ability to anticipate the adjustments required to initiate movement and grade the transitions required are critical to efficient sensorimotor function.

For example, if we are sitting and leaning to one side resting on the arm of a chair, our weight is not equally distributed. However if we decide to get out of the chair, our first initiation is to reorganize midline and distribute our weight more evenly. We don't stand up with all our weight on one side of our body. We anticipate the action required and make the initial adjustment to midline and more equal weight distribution before shifting our weight forward over our base of support to stand up.

The ability to control and grade weight shift and weight distribution over the base of support establishes a bilateral relationship between body sides around an organized and stable central midline core. Without such an ability and relationship, efficient coordinated movement and functional performance with adaptability is compromised. Movement and functional performance become compensatory to the underlying postural inefficiencies and splinter skill learning results. Normal alignment allows weight to be distributed appropriately to the task and allows the task to be performed in a coordinated and efficient way.

- **Ability to Weight Shift in all Directions with Graded Control**

Graded control of transitional movements requires the ability to dynamically shift weight and modify the amount of weight shifted in all planes of movement throughout a motor sequence or performance of a task. All movement requires a synergy of flexion, extension and rotational components. Graded control of weight shift allows these movement components to interact efficiently and provide movement of the body over the base (flexion), movement away from gravity (extension) and transitional movements (rotation). Various combinations of these movement components are required for any particular task as well as throughout the task. For such a dynamic synergy to be efficient there must be normal postural tone (stability-mobility synergies) normal postural alignment over the base of support (equal distribution of weight) and the ability to shift and sustain weight over various aspects of the body (proprioceptive tolerance for sustained weight.)

- **Equilibrium and Righting Reactions**

Equilibrium and righting reactions can only occur efficiently when there is musculoskeletal alignment in relation to the base of support and sufficient postural tone to provide the activation of postural responses to visual-vestibular-somatosensory information related to the changes in the center of mass over the base of support. The primary function of the righting reactions is to maintain verticality of the head and neck to the midline of the body. Equilibrium reactions, both fixing reactions and tilting reactions relate to a shift in the center of mass outside the base of support which compromises the integrity of the body's balance. Righting and equilibrium reactions occur in concert with one another to provide reactive motor responses as background maintenance for proactive volitional motor control during movement through space and in relation to the surface upon which the movement takes place.

The normal functioning of the postural system is essential for a normal neuropostural base against gravity. Without the integrity of a normal neuropostural base, organized motor behaviors for learning and the performance of functional activities become inefficient and less adaptable.

Equilibrium reactions consist of fixing reactions, tilting reactions and protective extension reactions.

Fixing reactions are activated when there is an outside force to the body, such as being bumped or pushed. **Tilting reactions** are activated when there is a change to the base of support such as uneven terrain or being on a tilt board. **Protective extension reactions** are activated to protect against a fall when balance cannot be maintained.

Fixing reactions are important because they activate elongation of the weight bearing side and lateral flexion of the opposite side. This is important in physical handling because as we shift the child's weight laterally it should activate fixing reactions. These are centered around the midline and are important for grading weight shift and managing control of the center of gravity. If the child has low resting tone and cannot react spontaneously to the shift in the center of gravity, then the reaction is less efficient and gets exaggerated with less graded control.

Fixing reactions activate the ankle-foot strategy. Balance reactions in the foot and ankle are first initiated from an outside force. This is important to realize since many children with movement and posture disorganization have instability in the ankles and medial arch collapse of the foot. The foot is not prepared for the reaction and thus the response is slow and the balance reactions are more exaggerated. Once the center of gravity is more challenged without firm fixing reactions, balance shifts to a hip strategy with more trunk participation. Again, this is significant because children with movement and posture disorganization often have slow pelvic adaptation and a lack of quick active trunk control.

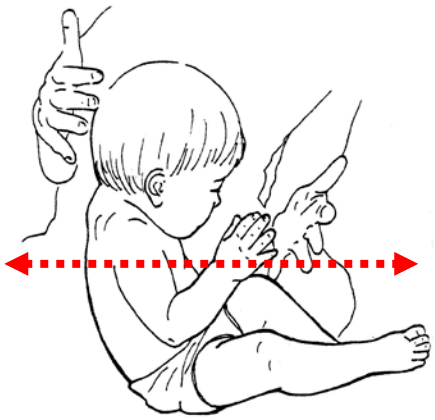
Tilting reactions are initiated from changes in the base of support. As the tilt gets more extreme or happens more quickly, it causes more activation of elongation stability and greater lateral flexion, with abduction of the opposite side seen both in upper and lower extremity reactions, depending on whether in sitting or standing and the degree and speed of the tilt. Without graded midline control and efficient fixing reactions, tilting reactions will be less controlled and more extreme and inefficient.

Young babies with low tone who use a wide base of support, such as w-sitting or sitting with a wide base with legs spread apart inhibit any experience in developing efficient fixing and tilting reactions. This contributes to the disorganized movement and posture that is seen later.

Righting reactions include the optical and labyrinthine reactions and the neck, head and body reactions. Optical and labyrinthine reactions are dependent on the neck. They don't appear until around two months when the neck musculature is sufficient to support the head. This is important to consider since many children with movement and posture disorganization have less than efficient neck co-contraction and neck activation. Poor neck co-contraction in children with learning disabilities affects the efficient expression of equilibrium and righting reactions. Efficiency in these reactions can only occur when postural tone is normal, the body is aligned to the supporting surface, and body parts are aligned to each other.

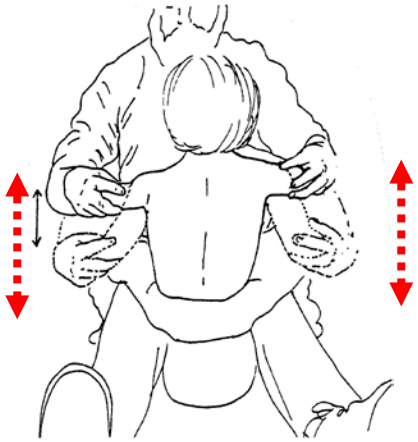
also be used with deep pressure to tight muscle groups in the direction of the desired response, such as slow deep pressure sweeping of the biceps to reduce tone and facilitate an extensor response of the arm. **Alternating tapping** is used to control a small range of movement to increase graded control. It can be used to inhibit low tone collapse into gravity or to maintain active tone for stability.

Alternating Tapping



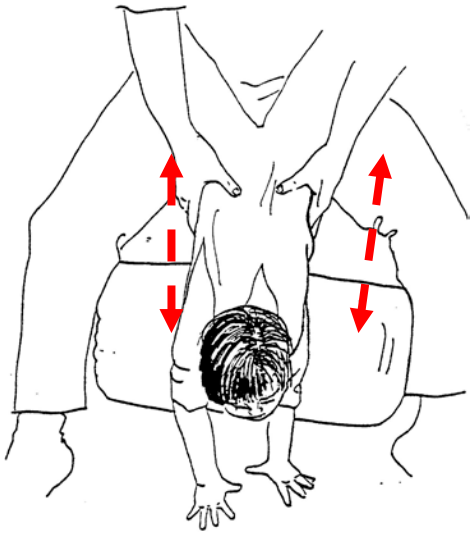
Oscillation is a term that is used to describe a repetitive swinging or swaying of a limb. As with all sensory techniques, the speed of application determines the sensory-motor response. Fast oscillation tends to decrease tightness when applied distally to a limb. However, this fast oscillation may need to be interspersed with times of no oscillation or slow oscillation, to avoid compensatory tightness from returning. Prolonged oscillation, applied bilaterally to the arms, has a tendency to increase trunk tone in a low tone child as it stimulates arm motion for the joint receptors. Slow oscillation, particularly with slight traction of the limb can result in decreasing tightness, while repetitive quick traction has the tendency to increase tone around a joint. Extreme care must be exercised during these techniques to protect the joints from subluxation or dislocation.

Oscillation



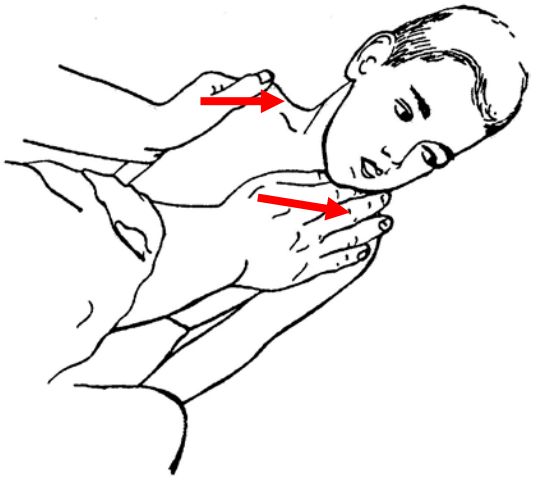
Intermittent support is a term used to describe active stabilization within a range of movement. It is essentially a hold and release technique that supports body weight and releases it with various frequency and duration as needed to enhance active stability and equilibrium. It can be performed with the body weight slightly off center to activate automatic responses or in a stable midline position to enhance stability. It is a good technique for stabilizing fluctuations in midline postures and activating low tone responses to a shift in the center of gravity.

Intermittent Support



Compression is a sustained pressure into a joint in alignment. Sustained pressure into a joint has the effect of reducing tone or tightness around the joint. Intermittent compression into a joint, or approximation can increase joint stability and tone if repeated rapidly or decrease tone if performed in a slow and rhythmic manner. Deep sustained pressure over a muscle belly has an inhibitory influence and is effective in reducing tightness.

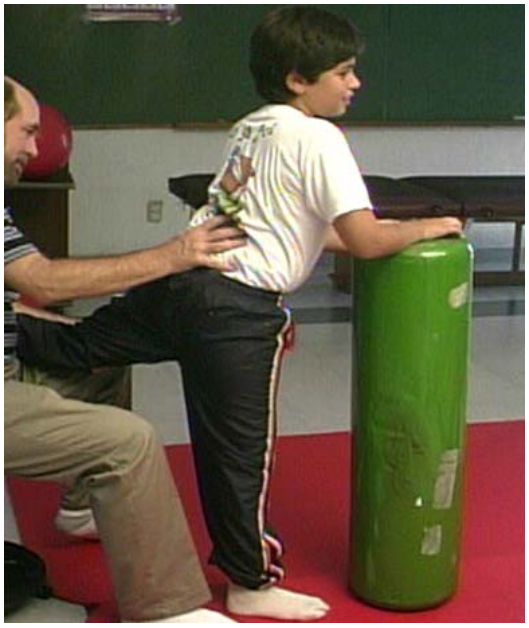
Sustained Pressure/Compression



Facilitate the child's weight forward over the stepping foot as he steps up on a block. This facilitates trunk extension with anterior weight shift.

Once the opposite leg is elevated, ask the child to swing the leg forward and back. This adds challenge to the activity and requires more controlled weight-bearing on the standing leg, as well as grading anterior and posterior weight shifting.

Lift one leg up to weight-load the standing leg. Add movement forward and backward to enhance the grading of anterior and posterior weight shifts. Asking the child to place his hands on his head helps maintain active trunk extension.




Lifting a bolster or other semi-heavy object requires a grading of flexion and extension. Have the child lift slowly and then return the bolster slowly to the surface to maximize the gradation of response. Controlled and smooth gradation of response is important to establish dynamic synergies of mobility-stability movements.

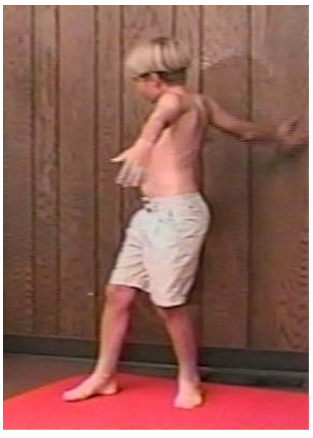
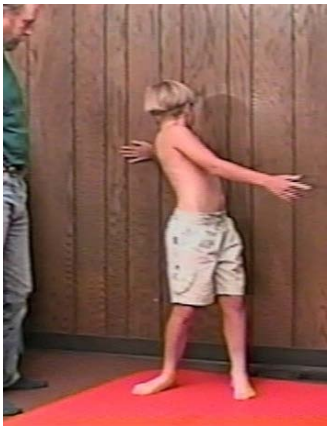
Weight-load the standing leg by asking the child to place one knee up on a large ball. Hands on the head encourages more trunk extension and stability. Ask the child to roll the ball forward and backward and side to side, to facilitate controlled weight shifts in all directions.


Use your leg to glide the child's leg out laterally. Input should be into the base of support with displacement laterally.


Trunk extension is increased when the hands are placed on the head.



While maintaining weight on one leg, ask the child to write numbers or letters in the air while holding a ball. This activity requires more active adaptation of weight-bearing and weight-shifting.

Add rotation to the weight-shifting and weight-loading by varying the requirements of the activity.

The Importance of Foot-Ankle Alignment

Another area of concern is the alignment and dynamic structure of the feet. Many children with movement and posture disorganization have weak arches and tend to take their weight on the medial border of the foot. Alignment of the ankle to a dynamic foot is essential for initial balance reactions. The activity of the ankle in response to weight shifts over the foot activates the musculature of the legs and hips to participate in balance reactions.

The following are examples characteristic of children with low postural tone and disorganization in movement and posture. The arches are flat and the body weight is displaced medially on the feet.

Della 10 years old.

Della's mother contacted this author after reviewing some material on the neuropostural approaach. She videotaped her daughter performing a Neuro-Postural Assessment developed by W. Michael Magrun, MS, OTR/L. After analyzing the assessment video, a home treatment program was provided to the parents. Prior to using a neuropostural approach, Della had been receiving sensory integration therapy with an emphasis on vestibular sensation through spinning in a net. That approach was discontinued and a neuropostural treatment plan was initiated. Treatment consisted of several times a week over a several month period of time, following the program recommendations. The emphasis and specific activities were modified based on observations and video provided by the mother. The following stills were taken from the pre-treatment assessment and post-treatmnt assessment.

Pre-Treatment **Post-Treatment**

Supine to Stand




Supine to stand shows significantly more bilateral organization and graded control.

Supine Flexion


Supine to stand is now easily initiated and maintained.

Alternating Side Sit




Alignment is maintained with elongation on the weight bearing side. Head righting is active and aligns vertically with the trunk.

One Foot Kneel

Better alignment on the weight bearing side and placement of the forward leg.

One Foot Balance

Better separation of the legs and more active balance.

The Integrating Effects of Physical Handling: A Prerequisite to Sensory Integration Therapy

Physical handling is a dynamic treatment technique that provides the foundation for integrating sensory systems with organized motor control. In other words, it provides the possibility to match neural systems with performance outcome. The very nature of physical handling requires movement and manipulation designed to integrate alignment, postural control and musculoskeletal performance matched to the sensory information and demands of the activity. Physical handling by its very nature must organize visual, vestibular, proprioceptive, kinesthetic, and other sensory systems within a motor response for a successful outcome. This is much more specific than practice or forced use on an ill- prepared postural system, or sensory stimulation activities on an inefficient postural system unable to make an efficient musculoskeletal adaptive response. Preparation of the musculoskeletal system is essential.

Sensory processing and matching of sensory systems with an organized neuropostural base and musculoskeletal system provides an opportunity for coordinated motor responses. Sensory information is essential but it must be organized and interrelated throughout the sensory systems. Sensory stimulation without intra-sensory processing and organized motor responses is inherently less effective in developing efficient sensorimotor control.

It follows that if we allow "child-directed," "hands-off" therapy for the child with a developmental disorder or delay with associated learning problems, we risk developing inefficient sensorimotor mapping. A child who learns exclusively through his own effort, within the state of his own CNS organization, will be dependent on the level of CNS organization that that child possesses at the time and will learn more entrenched compensatory strategies within the range of his dysfunction.

What kind of compensatory maps will be developed if there is inadequate neck co-contraction or control to maintain head to body relationships quickly and efficiently to allow activation of the central body for adjustments to movement demands, or if the child has unequal distribution of tone, using compensatory shoulder elevation for a lack of trunk stability or the inability to grade weight-shifts in the center of gravity, or lacks the ability to tolerate weight bearing equally on both body sides? Add sensory stimulation demands, particularly vestibular stimulation (fast rotary and acceleration) to the activity, and the stress and inefficient compensations may very well increase. In other words the child performs within the range of his dysfunction rather than being prepared with a more dynamic foundation for skill acquisition.

Children with movement and posture disorganization and learning disabilities have many postural deficiencies that are not routinely evaluated before being exposed to sensory based therapy. Prior to using sensory based therapies, it is imperative to establish a more normalized neuropostural base and underlying postural foundations that contribute to efficient and organized adaptive responses and skill acquisition.