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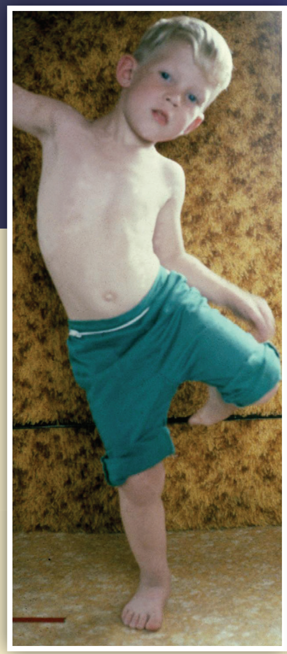


Movement and Posture Disorganization:

Clinical Observation of Posture and Developmental Aspects

By W. Michael Magrun, MS, OTR

THE CLINICAL OBSERVATION OF POSTURE IN CHILDREN WITH LEARNING DISABILITIES

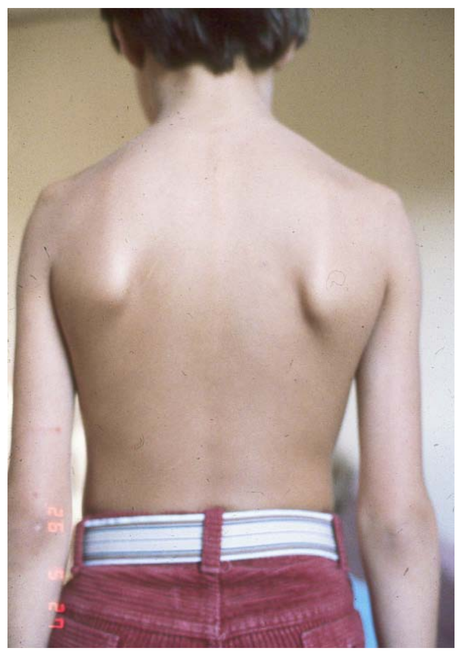


Key Concepts

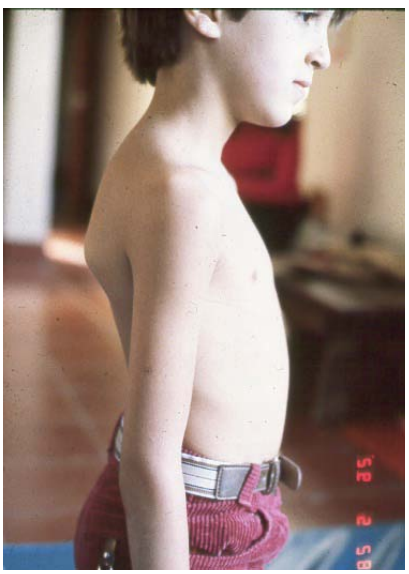
1. What are three basic consequences of postural asymmetry?
2. What is the probable result of unequal alignment of the shoulders on the neck and trunk?
3. What are the probable reason(s) for passive arm traction?
4. What is the influence of anterior pelvic tilt on the legs and feet?
5. Why is there anterior 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?

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.



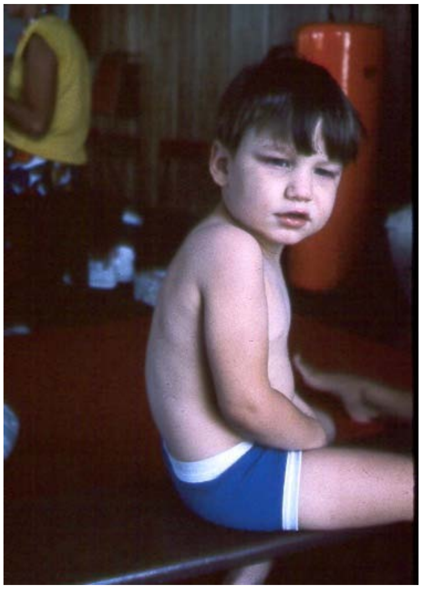
Lateral profiles also reveal the compensatory characteristics of mal-alignment. Here we see that the head and neck are forward. There is lumbar lordosis with compensatory anterior pelvic tilt due to abdominal inactivity. Again we see the scapula protracted with the inferior angle of the scapula tilted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

In this example we see similar characteristics of anterior pelvic tilt, lumbar lordosis, protraction and upward tilt of the scapula. Tightness in the thoracic area is probably a result of over use as a compensatory point of stability.

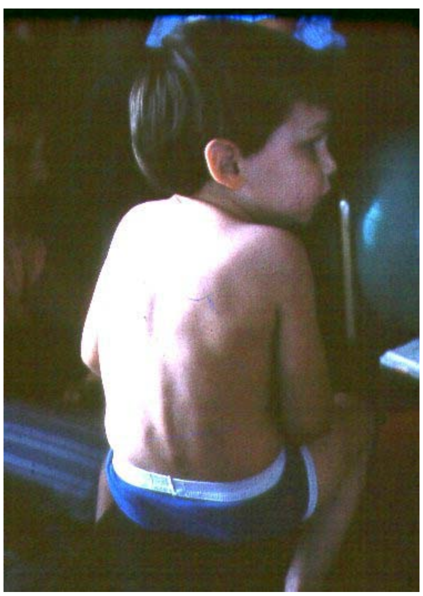
Here we see another example of the same postural characteristics. Notice the passive traction of the arms, which seem to hang in inactivity. This is usually due to the lack of good scapular alignment which compromises the stability of the shoulders and thus does not provide for dynamic alignment of the shoulders and arms.

Observations in Sitting

- Trunk Inactivity
- Posterior Pelvic Tilt
- Lack of Rotation of the Trunk
- Wide Base of Support



In sitting the compensatory result of the lack of active trunk stability is posterior pelvic tilt. In order to adjust the pelvis the trunk needs to have adequate extensor tone. Here we see a rounded back due to posterior pelvic tilt with protracted shoulders and shortening of the neck.



This posture inhibits good trunk rotation due to the position of the pelvis and shoulders. As a result the trunk cannot move on a stabile neutrally positioned pelvis with adequate extension and the shoulders cannot rotate with the trunk. The neck extends backward in an effort to turn the head as a compensation.

Children with postural disorganization often resort to a wide base of support, either in a W sitting posture or in a passive leaning to one side. Both situations are a result of a lack of good central trunk control. A wide base of support serves as compensatory stability but inhibits rotation of the trunk or ease of adaptive positioning during play.

Observations of the Hands

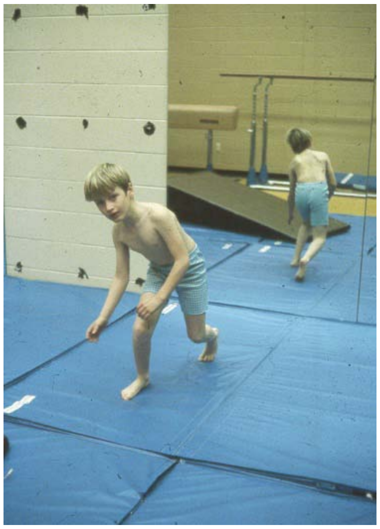
- Shoulder alignment and stability
- Structure of the hands
- Hand grip
- Proprioceptive placement.

Fine motor difficulties and writing problems are common in children with movement and posture disorganization. This is due in part to the postural elements previously discussed as well as the development of the structure of the hand itself. Good dexterity and manipulation requires interplay between the wrist and the fingers. The wrist and fingers function as a unit and the lack of stabilization of the wrist will compromise abduction of the thumb, arching of the hands and isolation of finger movements. Children often compensate for poor wrist stability by flexing the wrist. The wrist must be able to stabilize in extension for proper hand function.

Again we can observe the result of unequal weight distribution. As the child bends to retrieve an object, his left side does not accept a simple weight shift. As a result he internally rotates his left leg, hyperextends his left knee for stability and uses his left arm as a counter weight. Each attempt shows a compensatory variation, due to the inability to organize weight shift and maintain weight on both body sides properly.

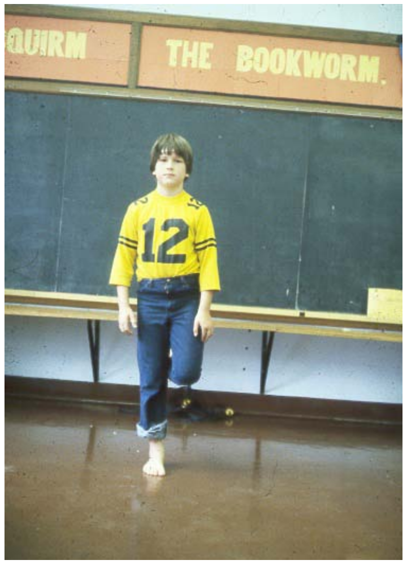
As he stands he does not adequately diagonally transfer his weight. His trunk remains flexed, his shoulder remains dropped and due to the internal rotation of his right leg he is unable to align his right side while standing. The pattern is disorganized and poorly coordinated as his weight is transferred to his less normalized side.

Another example of the influence of unequal weight distribution on movement can be seen in alternating one foot kneel to standing. Here we observe that the child is able to maintain his weight in good alignment on his left side. His right shoulder however is dropped, his trunk is shortened on the right and his right leg is slightly internally rotated with his foot not positioned optimally for standing. This indicates the possibility of more disorganization on his right side.



As he stands he does not adequately diagonally transfer his weight. His trunk remains flexed, his shoulder remains dropped and due to the internal rotation of his right leg he is unable to align his right side while standing. The pattern is disorganized and poorly coordinated as his weight is transferred to his less normalized side.

When he assumes one foot kneel on his right side, his alignment is not as optimal, as one would expect from his less normalized side. The poor alignment influences the position of his more organized side as well. However when he stands, shifting his weight to his more normalized weight bearing side, he is able to make a more organized adaptation.



It is not uncommon to see a somatic-dominant response on one side and a vestibular-dominant response on the other. Although the somatic reliance is subtle in this case, this child does hold his raised leg to his standing leg and assists stability with his left hand on his raised leg. These types of responses reflect an inability to integrate vestibular and somatic proprioception. Without organized matching of these systems, balance is compromised.

Organized and controlled motor learning requires organized sensory-motor systems. Children with co-ordination difficulties have specific characteristics of postural and movement adaptation that contribute to disorganized motor learning and influence efficiency in motor co-ordination, hand function, handwriting and other areas of learning.

Functional vision is another area often overlooked in children with learning disability. Children may have been given a standard eye chart exam and glasses for near or farsightedness, however, often times they are not carefully examined for functional vision skills. Whereas "sight" refers to the ability of the eye to receive light, functional vision refers to the motoric process of how the eyes work together to maintain binocular focus to be able to identify objects as well as use ambient vision for spatial-temporal awareness. A functional vision exam, should be performed by a qualified functional optometrist who can not only evaluate basic eye health, refractive error and acuity, and also can determine how the child uses his eyes at various distances, whether there is any indication of suppression, how the eyes are able to accommodate and whether there is efficiency in rapid changes of focus are varying distances. These among other skills are essential for learning and go far beyond simple acuity.

Basic functional vision skills include visual regard, fixations, saccades or tracking, pursuits, rotational movements, convergence-divergence and binocular function. All of these skills need to be addressed if the child is to perform optimally in learning. Raquel

Benabib, M.S. has developed an excellent functional vision screening tool and a "Goal-Oriented Curriculum to Establish Functional Vision Skills In The Clinic And Classroom." She has identified four categories of functional vision efficiency that are well defined and can be easily screened. The success of any vision therapy program is in properly identifying specific efficiencies and inefficiencies and using appropriate vision therapy activities to develop better functional binocularity. Functional vision will be the subject of additional courses in this series on learning disabilities.

Here we see the result of mal-alignment of the eyes as this child attempts to converge. His left eyes turns in, which is a clear indicator that binocular fusion is compromised. This has a great influence on reading skills and maintaining focus at near distance.

Notice the inability of this child to converge on the bead in front of him. His eyes move in and up and indicates he cannot smoothly control the motoric demands of maintaining binocular focus.

Monocular tracking is also important to establish. In this example the child is unable to maintain his head in mid-line as he tries to follow the moving object.

These are but a few examples of visual function difficulties experienced by children with learning disabilities. The area of functional vision is essential to address and to actively treat through vision therapy in children with learning problems.

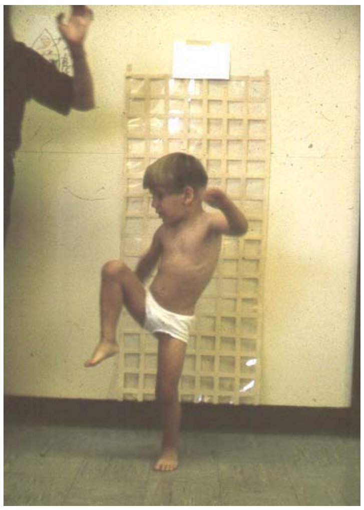
Establishing a neuropostural base is a good step in organizing functional vision potential. The eyes need a stable reference point in space and therefore establishing a good midline orientation, alignment of the head-neck and trunk are essential. Improving the child's neuropostural base may have an impact on how the eyes move and can improve ocular motility and alignment. However direct and specific intervention is necessary on a vision therapy level to train efficient visual behaviors and correct mal-alignments of the eyes and the ability of the eyes to work together smoothly.

Treatment Emphasis

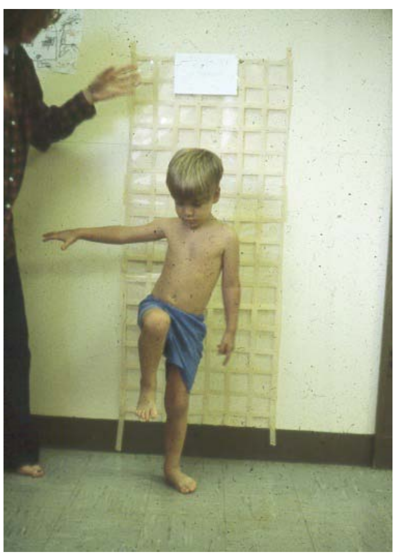
The treatment emphasis for these children should be the establishment of a normalized neuropostural base. Specifically the establishment of normal body alignment in various positions, equal distribution of weight and tolerance for weight bearing on both body sides and ease in transferring weight from one side to the other. Central to these needs is the establishment of good proximal stability of the shoulders and pelvis, an active trunk for central stability and activation of the abdominal musculature and activation of the musculature around the scapulae. Much of the activation required to establish better postural tone can be accomplished through establishing proper body alignment and the facilitating movement and postural adaptation through functional activities. Muscular areas are automatically activated when movements are carried out from a proper base of support with proper alignment. Only under these circumstances can agonist and antagonist relationships properly function to provide the mobile-stability needed to perform smooth and graded motor activity. Often major changes in a child's posture and movement can be accomplished in a relatively short period of intensive treatment. The following two children are examples of the change that can be achieved in a two week period of daily treatment. Treatment addresses the specific areas of disorganization that are determined through clinical assessment. Establishing equal distribution of weight, graded weight-shifts, normalized body alignment and postural adaptation to movement through organized rotational components is an essential prerequisite for developing efficiency in motor performance. Additional aspects of assessment of movement disorganization and specific treatment approaches are the topics of additional texts in this program. Treatment must emphasize organizing alignment and adaptability in movements over the base of support. Physical handling requires clear understanding and expertise in facilitating postural reactions that will integrate posture and movement to be more efficient.

These are just a few examples of the type of physical treatment that is required to establish a neuropostural base. Specific on-line courses will deal in depth with treatment activities and clinical problem solving for determining physical handling treatment. Hopefully it is obvious by the video clips of postural movement problems and sample treatment clips, that without a well established neuropostural base the child cannot easily make efficient and integrating adaptive motor responses to sensory integration activities.

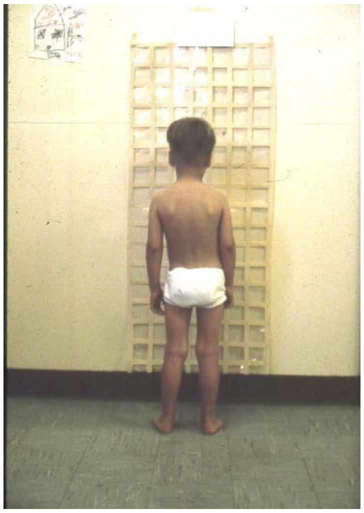
Before and After Results of Intensive Short Term Treatment

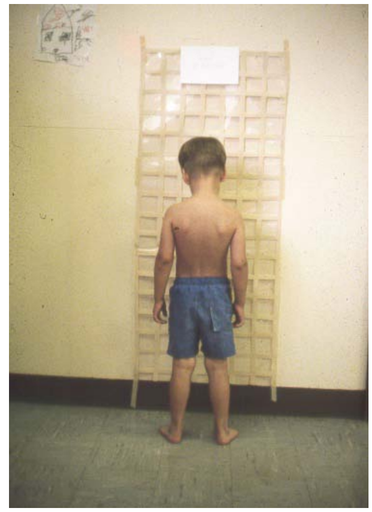


In this example we can observe this boy attempting to balance on one foot. He is unable to grade his weight shift over the standing leg, and therefore cannot control proper alignment on the weight bearing side. As a result he experiences an exaggerated equilibrium reaction.



After 9 hours of neuropostural treatment his balance attempt is much more normalized. He has good alignment over the weight bearing side, and as a result is able to grade his weight shift and allow controlled elevation of the other leg.





Here we see the before and after standing alignment. Before treatment (on the left) we observe mal-alignment of the shoulders over the hips. The trunk is shortened on the left side and the right shoulder is lower than the right. The left leg is internally rotated and the neck is not elongated. After 9 hours of treatment (on the right) we see that this child's alignment is improved with his shoulders more aligned over his hips, his neck elongated and his scapulae more even. His pelvis is more aligned and there is no internal rotation of his left leg.

In this example we can again appreciate that this child is unable to align his weight bearing side. He must use his elevated leg for postural security and his arms posture in extension as a counter balance.

After 5 hours of treatment he demonstrates good alignment of the weight bearing side and the ability to easily control the elevated leg away from his standing leg. His arms no longer need to posture for stability.

Standing posture before treatment shows legs touching, knee hyperextension, left shoulder lower than the right and his pelvis not aligned well with his trunk.

After 10 hours of treatment, his legs are separated with knees relaxed with more equal weight distribution on both body sides. His shoulders are aligned over his hips and his pelvis is aligned under his trunk. His legs no longer touch for compensatory stability.

Neuropostural treatment requires physical handling to establish equal weight bearing on both body sides, graded weight transfer from one side to the other, activation of rotational patterns and smooth transitions through an established midline of the body.

Hopefully it is clear that movement and posture disorganization is a consequence of various postural characteristics that interfere with smooth motor performance. And equally important to understand s that before children are confronted with movement and sensory challenges such as are used in Sensory Integration Therapy, it s essential to establish a normalized neuropostural base from which the child can make postural adaptations and organized adaptive responses. Without this preliminary emphasis on postural control, the child is likely to become more disorganized or strengthen his already inefficient compensations to the demands of motor challenges.

Prior to sensory integration therapy activities it is essential to establish a normalized neuropostural base. In so doing, it is possible for the child to initiate adaptive postural responses to the challenges of sensory integration activities. Without the ability to make an efficient postural adaptation, the child will use compensatory patterns to accomplish the activity and therefore will reinforce inefficient compensatory adaptations.

This program has demonstrated the postural compensations often seen in children with movement and posture disorganization associated with learning disabilities. These clinical characteristics of postural compensations have critical relationships with the ability to activate, initiate and grade controlled movement and skilled motor function.

Short-term intensive treatment over a two-week period can be effective in reestablishing a neuropostural base that allows more organized motor function.

Summary

1. What are three basic consequences of postural asymmetry?

Postural asymmetry influences motor control. Compensations to normal weight distribution influence normal body alignment of the head, neck, shoulders, pelvis and the base of support. It influences the distribution of postural tone that is critical to anticipatory initiation of controlled motor responses to the dynamic organization of movement. It influences the ability of the body to accept sustained proprioceptive tolerance to both body sides equally and therefore the graded control of weight shift required for transitional movements.

2. What are the probable results of unequal alignment of the shoulders on the neck and trunk?

Unequal alignment of the shoulders is a result of poor central trunk stability. When one shoulder is aligned lower than the other, there is a compensatory alignment of the trunk. The trunk is shortened, usually on the same side as the lowered shoulder. The neck is usually shortened on the opposite side of the lowered shoulder. This influences the ability of the neck to elongate and maintain good vertical head-trunk alignment. Often times the pelvis compensates with lateral excursion to the opposite side of the lower shoulder.

Figure 22
Early activation of posterior pelvic tilt With lifting of the legs in flexion.

Figure 23
Early dissociation of upper and lower body.

Two month old normal infant has the ability to begin to elongate the neck, maintain visual gaze, depress the shoulder girdle with elevation of the knees with the activation of posterior pelvic tilt.

This infant demonstrates dissociation of upper and lower body. Elevation of the knees with posterior pelvic tilt and symmetry of the lower extremities is present while at the same time rotating the upper trunk without any distortion or compensatory posturing.

During this same time the normal infant bridges in supine with the pelvis anteriorly postured. This provides additional tension on the shoulders to functionally help establish stability of the shoulder girdle and neck. Remember “Weight equals Structure equals Function.” This normal experience is in stark contrast to that of pushing into gravity illustrated in figures 19-21.

Figure 25a

Figure 25b

Early posturing resulting in using the feet to push up and arch.

Normal bridging involves the entire body in an active state, providing proprioceptive input into the feet, into the neck, and into the shoulders and pelvis.

The important concept here is that this experience of posterior pelvic control and anterior pelvic control develops the ability for the pelvis to establish “mobile-stability.” Mobile-stability is a term that was used by Quinton (8) as a way of understanding the functional consequence of stability first and then movement expression superimposed on that stability to allow function to be initiated from a stable base of control. This results in the future ability for the pelvis to maintain a midline orientation or neutral control with graded postural adaptations into and out of anterior and posterior postures which are important to activate the abdominals and support a variety of movement adaptations of the trunk.

Although the child with developmental delay or low postural tone may prefer supine because it offers less challenge against gravity, their passive experiences in that position, as has been previously described, do not assist them in developing an active ability to flex forward against gravity. This is important because it helps to establish abdominal strength and activity, the ability to elongate the neck and develop neck-shoulder synergies, as well as coordination with the pelvis and lower extremities for a dynamic posture. The ability to assume and maintain dynamic postures provides the stability for mobility. In other words, dissociation of the body into a variety of functional synergies cannot take place on a passive and inactive postural base. The importance then of the ability to assume postures such as supine flexion or prone extension is not so much that it is a milestone accomplishment or some demonstration of reflex integration, but that they demonstrate a dynamic postural set that can allow dissociation, synergistic movement components, and an infinite variety of organized sensorimotor learning experiences.

What might be the consequence later on in development for a child who did not experience quality in supine experiences? A number of postural characteristics observed in children with movement and posture disorganization relate to a lack of these early experiences in supine. They include a lack of good control in supine flexion, lumbar hyperextension with anterior locking of the pelvis in standing, passive posterior tilt of the pelvis with rounding of the back in sitting, and difficulty in organizing and sustaining lateral weight shifts equally well to both sides.

Children who do not develop good supine skills often show head lag in movement attempts requiring antigravity flexion. Poor prone development also contributes to this phenomenon as previously described. Good neck control and stability is critical for initiating most all movement patterns, not only in initiating body reactions but in organizing head on body responses, visual pursuits, and maintenance of gaze etc. Poor supine flexion experience is demonstrated in older children when asking them to stand up from supine.

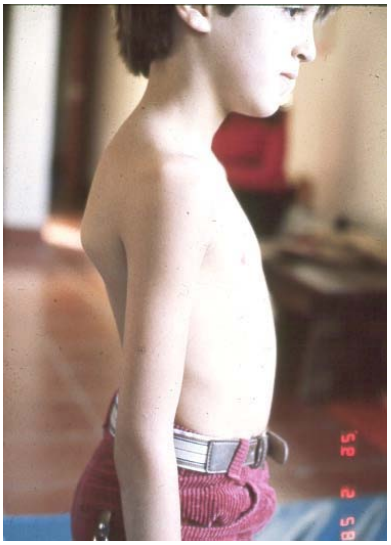
Figure 26
Inability to assume supine flexion due to lack of neck stability.

Figure 27
Example of normal supine flexion.

The 8-year-old boy (upper left) demonstrates an inability to initiate a flexor response primarily because he is unable to elongate his neck and provide stability for the head to come forward to initiate abdominal flexion. As a result his head drops back with neck hyperextension and his lower extremities struggle to elevate of the surface. The 9 –year-old girl (upper right) demonstrates a controlled response lead by the neck and head and is able to initiate and maintain a supine flexion posture. Notice the chin position indicating "chin tuck" which is possible only with neck elongation and stability to allow capital flexion of the head.

Another observation in children with movement and postural disorganization is a locking into anterior pelvic tilt in standing or posterior pelvic tilt in sitting. It is reasonable to assume that inadequate early supine experiences contribute to this inability to maintain mobile-stability of the pelvis later on. In addition the lack of mobile-stability of the pelvis influences the trunk and rotational patterns.

The ability of the infant to posteriorly tilt the pelvis in supine as seen in figures 23 & 24 allows the legs to elevate off the surface and together with abdominal flexion and neck elongation the baby is easily able to maintain this posture wile they play with their feet or a toy in midline. Bridging as seen in Figure 25 provides experience in anterior pelvic tilt to support extension during the bridging activity. Therefore the baby begins to experience a controlled range of anterior and posterior tilting of the pelvis. This dynamic process is necessary later on to allow for grading flexion and extension of the trunk and lower extremities. A lack of development of midrange control of pelvic tilt contributes to a "locking or fixing" of the pelvis as a compensatory stability point in older children.

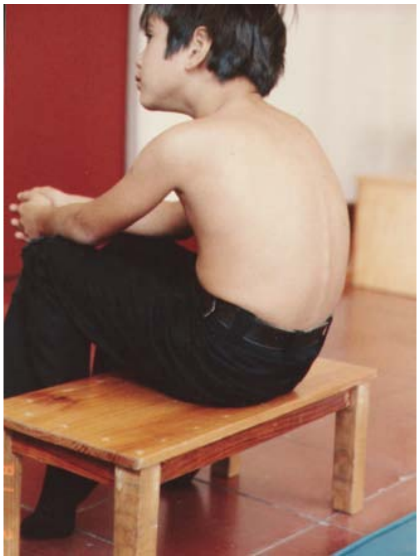


Here we can observe a child with lumbar lordosis with the pelvis in anterior tilt. In addition the knees are often hyperextended. This is a very static posture and one that does not allow smooth transitions to other dynamic movements without a complete release of the stability fixation, which generally leads to another compensatory fixation.

Figure 28
Example of lumbar lordosis with anterior pelvic tilt.

Here we observe a similar posture that shows anterior locking of the pelvis with lumbar lordosis, and hyperextension of the knees. This is a static posture that is compensatory for a lack of good midrange control of the pelvis and active trunk extension through the thorax.

Figure 29
Example of anterior pelvic tilt, lumbar lordosis and hyperextension of the knees



Here we see posterior tilt in sitting that does not allow for a dynamic trunk and therefore a static compensatory posture using the pelvis as a stability point.

Figure 30
Example of trunk compensation due to posterior pelvic tilt.

At about four months the normal infant begins to roll in a total pattern and then refines that into a rotational pattern later in development. “Log-rolling” as it is sometimes called is initiated through a lateral shifting of weight over the center of gravity, often initiated by turning of the head due to visual interest. This experience results from the baby’s spontaneous movements that allow weight to be distributed in various degrees laterally. This is a culmination of earlier experiences in prone and supine from physiological flexion which displaces weight forward into the cervical area, to lifting and turning the head in prone which displaces weight laterally, to asymmetry in supine (ATNR) which displaces weight toward the flexed arm side and provides lateral compression of the neck musculature, to the elevation of the pelvis in supine through posterior tilt that displaces weight both forward and laterally through the action of the legs. The normal infant is able to roll to either side in supine and can soon thereafter roll from prone to supine using emerging rotational components.

Figure 31

Figure 32

Log rolling initiated by visual interest.

This 4-month-old visually engages a toy and manages to distribute enough weight laterally to cause a rolling toward the toy.

Conclusion

Throughout development one tenant is consistent. Where the weight goes structure develops and function emerges. This function can be efficient or inefficient. Function is a consequence of the structural development of the body. Weight bearing and proprioceptive stresses against gravity result in structural development. Structural development results in functional skill. This musculoskeletal matrix is the basis for the foundation of function and the ability to demonstrate skill. This matrix is dependent on an organized visual, vestibular, and proprioceptive process and the efficiency of this process is dependent on normal alignment, normal distribution of weight and the ability to grade weight shift, thus coming full circle to the concept of weight-structure-function.

Any developmental anomaly to alignment, distribution of tone and the distribution of weight results in a lack of stabile proximal control, central trunk instability and a lack of quality dissociation of movement. And as a consequence, this results in an inefficient system of motor control.

Key Concepts Review

1. **What is the importance of fetal and newborn experiences for normal development?**

Fetal movement patterns are the basis for movement after birth. When exposed to gravity these patterns or reactions begin to modify to more organized control. Children with low to low normal tone begin at a disadvantage to gravity because they lack the tonal integrity to work efficiently against gravity. As a result they are apt to develop compensatory movement patterns that over time become more and more inefficient.

2. **How does a lack of early fetal and newborn development interfere with development?**

The early experiences in development establish the shoulder girdle and the pelvis as proximal areas of stability. This is initiated first through weight forward on the shoulders, chest, and neck in physiological flexion in prone and through surface contact and spontaneous movement patterns in supine. Without these weight bearing experiences and sufficient tone to establish the ability to work against gravity the infant does not develop efficient stability control for supporting future postural development.

3. **What are the important aspects of prone development?**

Critical competencies in prone include the ability to raise and turn the head, prop against the surface to support the head in vertical and strengthen shoulder stability, establish full extension through the trunk, push up on open hands, and push up off the surface with only feet and hand contact.

4. **How does a lack of quality development in prone result in specific movement and posture disorganization?**

Without dynamic prone experiences the child will have difficulty developing efficient stability of the shoulders and pelvis, thus there will be compensatory postures used for stability. The shoulders will elevate and the pelvis will “lock” in anterior or posterior tilt, inhibiting the ability for the trunk to activate and provide central core stability.

5. **What are the important aspects of supine development?**

Critical competencies in supine include the ability to maintain the head in midline with neck elongation, raise the legs and feet toward the hands, maintain and move out of midline postures, and develop the beginnings of rotational patterns through diagonal movements of feet and arms.

6. **How does a lack of quality supine development result in specific movement and posture disorganization?**

Without dynamic supine experiences the child will have difficultly efficiently orienting to midline, establishing forward flexion and elongation of the neck musculature, developing midrange control in posterior-anterior pelvic tilt, and efficient rotational patterns.

7. **Important are the important aspects of development in sitting?**

Establishing verticality in sitting is a critical competency and provides the child with the ability to use rotational patterns, move into and out of sitting to reach and pursue objects, and allows vision to guide motor activity for more specific cognitive learning.

8. **How does a lack of quality of development in sitting results in specific movement and posture disorganization?**

Without efficient development in sitting the trunk will not become dynamic as a central core of stability. The pelvis will lack efficiency in midrange control thus preventing the trunk from initiating stable extension as a base to initiate rotational movements.

9. **What is the importance of the concept of multiple midlines?**

Mary Quinton’s unique concept of multiple midlines helps us understand and visualize the interaction of body sides, diagonals, rotational components, and the dissociation of the limbs from the trunk in various planes of movement. This concept allows the understanding of the organization of movement components necessary for normal motor learning to occur.

10. **How does a lack of developing quality midline control result in specific movement and posture disorganization?**

Without the development of efficient midline relationships in various planes and postural orientations, the child will have difficulty with bilateral coordination, lateral weight shifts, diagonal movements and rotational control.

11. **What are the important aspects of hand and foot development?**

The development of the structure of the hands and feet along with the ability to stabilize proximally allows for the efficient development of manipulation skills of the hands and forefoot-hind foot organization of the feet. The process of developing distal skill is a continuous developmental process dependent on proprioceptive weight bearing and the relationship of stability-mobility factors. Poor structure leads to poor development of motor patterns and will impact on the quality of sensory experiences to the hands, and stability factors of the feet.