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# Visual-Postural Characteristics of Children with Disorganized Motor Control

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## Learning Outcomes:

1. Describe the importance of the visual-postural relationship.
2. Describe the categories of unilateral and bilateral movement & posture Insufficiencies.
3. List the characteristics of the categories of unilateral and bilateral movement & posture insufficiencies.

## Introduction

Children with movement and posture disorganization often have significant visual-postural inefficiencies. These inefficiencies are a result of the inability of the visual system to lead movement due to somatosensory and postural alignment dysfunction or the inability of the postural system, particularly the neck and shoulders, to provide a foundation for the development of good visual skills, both ambient and focal. For efficient sensory motor performance to exist it is necessary for the visual and postural systems to match within the context of functional demands (1).

The ambient visual system provides spatial-temporal awareness while the somatosensory system provides awareness of the body in relation to itself and the base of support. Organization of the visual system through neuropostural alignment and integrity provide a stable basis for the vestibular system to contribute to the maintenance of organized visual-vestibular-somatic control.

Postural control is essential for movement and serves as the background substrata for movement (2). Without good postural control movement efficiency is limited and compromised. Postural control involves alignment and postural tone (synergic muscle tone). Both alignment and tone must function dynamically throughout a movement task. Postural tone as well as alignment change during a movement performance and must integrate with visual and vestibular requirements of the task.

Postural control is also critical to visual organization. Children with posture and movement disorganization often show functional inefficiencies of their visual system. The effect of an inefficient neuropostural base often expresses itself in an interruption of dynamic interaction in flexibility and organization between the accommodation (focusing) process and the vergence (aiming) process. Depending on individual characteristics, inefficiency in one process may well cause inefficiency in the other process.

Learning requires an integrated awareness of time and space with internal mapping of an organized neuropostural base that maintains the integrity of alignment and control within the demands of functional movement. Effective skill acquisition requires sensorimotor consistency and matching of the visual and proprioceptive systems, both somatosensory and vestibular, as well as specific practice of functional skills.

The somatosensory system is increasingly being suggested as a primary influence on vestibular function and balance maintenance. Cruthchfield and Barnes (3) state: “the vestibular system is not as critical to maintaining certain conditions of balance as was once believed, that is, balance is not provided by the vestibular system alone.” Further they suggest that the most critical aspect efficient function is the ability to assume and maintain vertical postural alignment.

Moore (4) has suggested that the organization and matching of the Visual-Vestibular-Cervical Triad is an essential process for learning and attaching meaning to the environment. Understanding how these sensory processes interact and how motor control emerges is necessary for developing effective treatment strategies for children with learning and movement disorganization.

The drive to be upright is an innate drive and is one of the primary achievements of the first year of life. The upright posture provides the most efficient alignment for the maximal integration of all sensory systems (5). Postural control and organization against gravity is essential for sensory receptors to be in their most effective alignment for interacting and matching sensory information with each other and for maximizing sensorimotor experiences that establish foundations for learning and performance.

Movement therefore is a complex process involving many systems that must interact in an organized cooperative and integrative manner. Sensory processes activate postural reactions. Volitional anticipatory postural preparation (initiated through cognitive intent) activates additional sensory processes. These relationships are constantly shifting and adjusting. As will be further examined, this type of process requires constant re-weighting of sensory system influences and changing priorities, depending on which sensory system is the leading influence.

Further, the lack of efficient motor organization and a well established neuropostural base from which to move in and out of symmetry, contributes to ocular motility difficulties as well as difficulties organizing smooth pursuits and saccades. Eye movements require a stable base of support including neck stability and alignment, for quality performance.

Children with generally low tone will also have the same condition of low tone in the ciliary musculature of the eyes. Similarly, children with higher tone or tightness, especially in the neck and shoulder area, will also have higher tone or tightness of the ciliary musculature. The ciliary muscle is responsible for contraction and expansion of the lens of the eye to maintain focus of objects at various distances. In both cases the flexibility and amplitude of the focusing mechanism will be impaired. Low tone generally relates to a lag of, or inefficient accommodation (focusing), and high tone usually results in focusing spasm.

Once the accommodation system has been disturbed the vergence or aiming system reacts by trying to compensate resulting in the eyes turning in (eso) or the eyes turning out (exo). In both cases vergence is disrupted and binocular vision is impaired.

**Categories of Movement & Posture Insufficiencies**

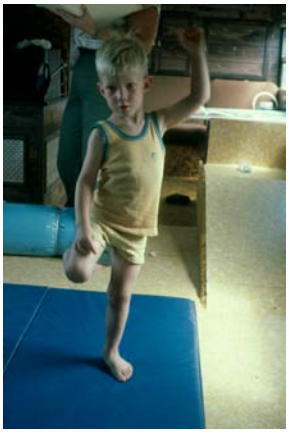
The following categories reflect a theoretical clustering of postural behaviors and compensations and visual characteristics as they may relate to sensory processing of the visual-vestibular-cervical triad. These are not absolute categories but may assist in clinical impressions of the interaction of sensory systems and the interaction of posture and vision on sensory processing.

**Categories include Unilateral and Bilateral Movement & Posture Inefficiencies.**

**Unilateral Insufficiencies**

Unilateral insufficiencies relate to an overuse of one side of the body. The more preferred side for weight bearing has more control. The less preferred side is not as well organized to sustain weight and the child shows less control on that side. This unilateral imbalance can exist on either the right or left side. In both cases it is likely that there is both a somatosensory and visual midline shift.

**Type I: Right Side Insufficiency**


In this example we see a young boy who prefers taking weight on his left side. When asked to assume one foot balance on the left he has relative ease. When asked to assume one foot balance on the right he has much more difficulty maintaining alignment and in controlling balance. This is an example of right side insufficiency.

**Postural characteristics:**

- More comfortable or consistent taking weight on the Left side of the body.
- Better one foot balance on Left Side (May be well established or may use proprioceptive cues by holding raised right foot against left side for somatic proprioceptive control.
- Right side balance usually shows lack of control with righting and equilibrium imbalance, flailing of arms due to poor graded control of weight shift causing over-reaction to balance demands and over-reliance on vestibular reactions.
- May show lateral VMS shift to more normalized somatic proprioceptive side (L)
- May rotate better toward the Left side than the right side. May show collapse or ungraded shortening of the trunk on the right side when rotating right.
- May show anterior-posterior skew of pelvic alignment from right to left side. Right side more posterior (retracted) while left side more anterior (protracted)
- Postural alignment may show lower alignment of right shoulder, shortening of the neck on left side, slight head tilt to left.
- May show problems in diagonal control going toward the less normalized (right) side. May show poor alignment on right side but improves when diagonally going to left side.
- Observations from the Movement & Posture Disorganization Assessment will tend to show left side over control and tilting or leaning to the right side on such subtests as standing from supine, flexor hold, prone extension. long sit to side sit, etc.

**Visual Characteristics:**

- Less precise fixations and erratic pursuits with the right eye.
- Slight head tilt toward the preferred left eye.
- More disorganization and jerkiness in pursuits crossing midline toward the right eye.
- May be a visual midline shift to the left.
- More attention to visual field on the left side.
- In the presence of low tone there may be a tendency toward an exophoria (turning out) visual posture at near. In the presence of high tone there may be a tendency toward an esophoria (turning in) visual posture at near.
- Difficulty with pursuits in diagonal patterns with jerkiness crossing the midline to the right.

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This boy shows postural asymmetries between the right and left sides of his body. His right shoulder is lower than his right and his trunk is slightly shortened on the right side. There is more tension in the neck on the right side due to the right shoulder alignment. This imbalance will have consequences in movement as we can see below.

Again we see the differences in motor control between the right and left sides of the body. This boy (same boy as above) was asked to stand up from a half kneel posture. His right side alignment shows the shoulder leaning over the hip. There is not complete elongation of the trunk on the right side. When he stands up however diagonally shifting his weight to the left he is able to control the shift toward the more organized left side. When asked to stand from left side half kneel, we can see very good alignment of the shoulder and hip with good elongation of the trunk on the left side. When he stands he must diagonally shift to his less well organized right side resulting in a lack of smooth control coming to standing. This is another example of right side insufficiency and how it impacts diagonal and bilateral function.

**Unilateral Insufficiencies**

**Type I: Left Side Insufficiency**

This boy's shows a tendency toward left side insufficiency. When asked to assume one foot balance on the right he has relative ease. When asked to assume one foot balance on the left he has much more difficulty maintaining alignment and in controlling balance. This is an example of left side insufficiency.

**Postural Characteristics:**

- More comfortable or consistent taking weight on the Right side of the body.
- Better one foot balance on Right Side (May be well established or may use proprioceptive cues by holding raised right foot against right side for somatic proprioceptive control.
- Left side balance usually shows lack of control with righting and equilibrium imbalance, flailing of arms due to poor graded control of weight shift causing over-reaction to balance demands and over-reliance on vestibular reactions.
- May rotate better toward the Left side than the right side. May show collapse or tendency of shortening of the trunk on the right side when rotating right.
- May show anterior-posterior skew of pelvic alignment from right to right side. Left side more posterior (retracted) while right side more anterior (protracted)
- Postural alignment may show lower alignment of left shoulder, shortening of the neck on the right side, slight head tilt to right.
- May show problems in diagonal control going toward the less normalized (left) side. May show poor alignment on left side but improves when diagonally going to right side.

- Observations from the Movement & Posture Disorganization Assessment will tend to show left side over control and tilting or leaning to the right side on such subtests as standing from supine, flexor hold, prone extension. Long sitting to side sitting etc

**Visual Characteristics:**

- Less precise fixations and erratic pursuits with the left eye.
- Slight head tilt to the preferred right side while performing near tasks.
- More disorganization and jerkiness in pursuits in crossing the midline toward the left.
- Probable visual midline shift to the right.
- More attention to the right visual field.
- In the presence of low tone there may be a tendency toward an exotropia (turning out) visual posture at near work and in the presence of high tone may be a tendency toward esotropia (turning in) visual posture at near work. Both cases may indicate the presence of a strabismus.
- Difficulty with diagonal pursuits with jerkiness in crossing midline to the left.

**Bilateral Insufficiencies**

**Type I: Expanded Range Insufficiency**

These children tend to like to stay in one place, move generally in straight planes, avoid rotational movements, are very in touch with what is in front of them but not as aware of their surroundings, tend to avoid large movements that require excursion of the extremities or lateral weight shifts.



**Postural Characteristics:**

- Tends to be biased toward flexion
- Tends to move in straight plans.
- Tends to avoid rotational movements.
- Shows poor weight shift to both sides and tends lock legs together in one foot balance attempts. If legs separate will have exaggerated balance reactions
- Tends to be most comfortable with a wider base of support and weight slightly forward.
- May tend to be barrel-chested with poor accommodation of respiration to rotational movements.
- Tends to avoid extensor postures or be unable to maintain extensor postures well.
- May show fear of movement through space.
- May seem to react as if vestibularly hyper sensitive.
- May be insecure if elevated on a surface such as a ball or high stairs.
- Postural alignment may show slight hip flexion, posterior pelvic tilt shoulder more over feet than hips, hands tend to clutch together etc.
- Observations from the Movement & Posture Disorganization Assessment will tend to show more difficulty in extensor postures such as prone extension, kneel walking, lateral shifts for one foot balance, initial alignment during one foot kneel to standing.

**Visual Characteristics:**

- Eyes may tend to look down
- More likely to attend to visual focal process.
- May not attend well to ambient stimulus
- Tends to have better ocular motilities in vertical and horizontal plans, but disorganized in diagonal planes.
- Tends to show lack of amplitude in accommodation.
- Tendency to avoid gaze at the end points of the visual fields.
- Tends to have poor ability to maintain visual attention when changing from near to far focus or far to near focus.

- May show fear of heights and avoidance of open spaces.
- May have anterior visual midline shift.
- Tends to avoid rapid movements or activities requiring rapid movements.

Some examples of postural adaptations and compensations that may be seen with children who appear to demonstrate expanded range insufficiency include:

- Lack of active rotation from postural alignments that are not active or show readiness to move, such as this boy in posterior pelvic tilt with arms clutched to body.


- Wide base of support that inhibits spontaneous active responses in favor of more security in a stable position. When this boy does move it is in straight planes with very little variation of movement or postural adaptation.

- Wide base of support that allows stability in a position but a lack of ability to make dynamic postural adjustments.

**Bilateral Insufficiencies**

**Type II: Limited Range Insufficiency**

These children tend to be all "over the place," are described a clumsy, distracted, impulsive etc. They do not like sitting still, and their movements are large and expansive without good mid-range graded control. They are not likely to do well with flexor postures that require midline control.

**Postural Characteristics:**

- Shows over-reaction to lateral shifts to both sides.
- Difficulty controlling forward and backward weight shifts, especially backward weight shifts.
- Not well organized to maintain proprioceptive weight bearing.
- Fidgets when required to maintain a position.
- Tends to avoid flexor postures.
- May tend to react as if vestibularly hypo-sensitive.
- Shows little fear of heights and may be risk taking in activities.
- May lack good central trunk control
- May tend to like to be up on their toes as a means to gain stability and inertia for movement.
- Tends to always move fast.
- Shows poor balance in slow movements or specific postural demands such as one foot balance.
- Alignment tends to show elevated shoulders, anterior pelvic tilt, hyper extension of knees and slight extension of head/neck.
- Observations from the Movement & Posture Disorganization Assessment will tend to have more difficulty in flexor postures such as supine flexion, initiating standing from supine, long sit to side sit to both sides, kneel walking, etc.

**Visual Characteristics:**

- May tend to posture eyes upward.
- More driven by the ambient visual process.
- Difficulty distinguishing figure-ground relationships and tends to use ambient process for focal needs.
- Tends to avoid close spaces.
- Constantly distracted by environmental stimulus.
- May show a posterior visual midline shift.
- Tends to avoid near tasks, may be disinterested in TV or electronic games.
- When looking at an object the eyes tend to "aim" away from the visual target.
- Tends to have difficulty in bilateral tasks.
- May show an exophoric eye posture; sometimes a bilateral exotropic strabismus.
- Tends to stare in space.
- Tends not to stay engaged on a task long enough to complete it.
- Tends to show inefficient ocular motilities with disorganized saccades and scanning.
- Fatigues quickly when working at near.

Notice the erratic postural adaptations of this eight year old attempting to assume and maintain several different postures, indicating an inability to organize a motor plan to assume and maintain simple postures. There is poor anticipation, cognitive visualization,

and internal body awareness. One part of the body responds at an excessive level while another part does not activate at the required minimum for postural transition. There is an excess of movement attempts. These responses may indicate an inability to sustain proprioceptive input through the joints and musculature that provide a stable base of support for visual and vestibular information to match properly to sustain postural control.

**Summary**

Vision and posture are interrelated and are critical for efficient performance of functional activities. Sensory motor control and learning are dependent on the organized matching of the visual and postural systems. To intervene effectively with children with movement and posture disorganization, it is important to understand this dynamic interplay. Preparation activities to establish musculoskeletal integrity may be necessary along with facilitating controlled equilibrium and righting reactions. Specific visual therapy will be necessary and must be matched with the appropriate postural reactions within dynamic function.

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