

Why Movement is Vital for Children

The first few years of life are dedicated to gaining control of the body and movement. During the first 9 -12 months of life, the infant will acquire thousands of new movement patterns and movement abilities. The movement of the infant makes vital connections between the lower and the higher centers of the brain. Not only does the young child need to gain muscle strength to overcome the force of gravity so they can crawl and then walk, they need to free their arms and hands from this movement so they can develop manipulative skills. Developing the abilities that make us uniquely human; the ability to walk, talk and use symbolic language all originate from movement.

The main period of brain growth for size is in the first year of life although many fine structural changes continue into adulthood. Whilst the brain increases in size dramatically within this first year of life, it is the next period, which sees the connections explode. Between 15 months and 6 years of age the cerebral cortex appears to double in size with synaptic density reaching its peak at about 3- 3 1/2 years. At 3 - 3 1/2 years the cerebral cortex density will be 50 % higher than it was at birth and 50% higher again, than it will be at puberty. All these rapid synaptic formations become more specialized during this rapid growth period. Those that are in constant use will strengthen to form the motorways of the mind. Those that are unused will be either replaced or disappear.

The brain also goes through periods of "neural housekeeping" when redundant or inactive cells are pruned out in a "*spring cleaning*" exercise. One such *spring-cleaning* exercise occurs between 6 ½ and 8 years and another during the teenage years, so by the late teens only about half of the synapses that were present at 3 years of age will remain.

In the newborn the most active regions of the brain are those that relate to survival (breathing, heart rate and reflexes).

Primitive Reflexes:

(E.g. the Moro reflex, the TLR, the ATNR, the STNR, the palmer and plantar reflexes, the rooting and sucking reflex).

These start to emerge in the womb. These early movement reflexes are thought to exist to assist the baby in being born and to support survival in the first few weeks of life. They also provide rudimentary training for later voluntary skills. The brain inhibits primitive reflexes by 6 - 12 months of life. If they are not fully inhibited then they adversely affect movement control throughout the lifespan.

Postural Reflexes: (these are the righting and equilibrium reactions)

Postural reflexes start to emerge shortly after birth and continue to develop up to 3 ½ years of age. Once developed, they should remain for life. They are controlled by the midbrain and the cerebellum, (with the exception of eye movements which are mediated from the cortex).

Postural reflexes are the primary teachers of the basic motor skills. By providing an innate response to key stimuli they facilitate a specific motor response to particular sensory stimuli. The more a child moves, the better the control over movement becomes. Each time a movement is elicited a process of modification occurs and the movement becomes more definite and permanent with repetition. It takes time on task. In this way movement helps to map the brain and the reflexes provide the child with his earliest vocabulary of movement. The early postural reflexes when practiced transform and are integrated into higher movement skills and sequences, which further develop balance and coordination. The righting and equilibrium reactions gradually take over these reflexes in the first 3-½ years of life. This gives way to fluidity of movement, provides a sound basis for balance and improved adaptability to the environment.

Movement and the Cerebellum

Movement capabilities also reflect efficiency in other functions within the brain. The links to language skills, social adaptability, academic learning, flexible thinking and responses are all linked to movement skills.

It is also during this first 3 ½ years of life that the **cerebellum** (which is involved in the regulation and modulation of controlled movement) undergoes intensive maturation.

The **cerebellum** acts as a fine tuning switch on an old-fashioned radio or TV, modulating signals from other centers to ensure that the motor output is precise and well controlled. The cerebellum is strongly influenced by the vestibular system. It operates through the postural reflex system to maintain posture and progressive movements such as walking, running, at a subconscious or automatic level, **BUT** its functions are not confined to motor activity only. The cerebellum is responsible for practice learning, mental imagery of movements (ideation), judging the time and speed of moving stimuli, rapid shifting of attention between sensory modalities, cognitive operations in a 3D space and word association.

The cerebellum is also involved in sequencing tasks, learning multiplication, days of the week, months of the year and number patterns etc.

The cerebellum assists the motor cortex in laying down and refining the sensory motor aspects of certain tasks so that their physical action can become automatic and the cortex is free to focus solely on cognitive and executive functions.

The foundations for these abilities are laid down in the first 3-½ years at the same time that BALANCE, POSTURE and BASIC MOTOR skills are being learned.

The motor control system uses all these basic motor movements that are heavily focused on in the first 3 – 3 1/2 years of life, to further refine and develop new combinations and variations in the next 3 years from 3 1/2 to 6 years. This “**window of opportunity**” is vital in the development of fundamental movement skills, which provide the basis for all movements required throughout the lifespan.

Knowing that the brain lays down extremely important information in these years means we need to see this as a major learning and development goal and one that should be given the utmost importance above all else (perhaps with the exception of language) in a child’s development. Activities that are not directly related to movement in some way and that are sedentary and passive should be given lesser priority.

From 3 – 6 years of age children need to engage in daily, very regular, extended times, rich variety, outdoor and indoor motor play. This time period is vital for the child to use his body in various ways, with different equipment and with minute variations to movement sequences, to build their movement pathways. They need time to practice force, timing, rhythm and anticipated adjustments so that movement is fluent, efficient, has economy of effort and range for maximum effect.

Between 6 ½ years and 8 years a major period of myelination takes place, in which the connections between the vestibular system the cerebellum and the corpus collosum are strengthened.

BALANCE AND MOVEMENT

Balance: the Art of Not Moving

Balance (the vestibular system) is primarily primed to facilitate orientation and postural behavior and for the body to function within the force of gravity. This means we need to “know our place in space”. It provides a primary reference place from which all other spatial judgments and adaptations become possible. The vestibular sense is unique in that we are not conscious of it as a sensation on its own, we only become aware of it through other sensory systems (e.g. butterflies in the tummy, visual swaying etc.).

The vestibular system maybe the expert in movement but it receives all its training **through movement**.

The vestibular system is made up of three semi circular canals, which detect movements by the motion of the fluid inside, rather like a spirit level of the body. The vestibular system sends messages to the developing brain to control posture, muscle tone, body movement, arousal, eye movements and sensory integration with other organs.

Balance is crucial to efficient functioning of many other processes we do. Balance is not something we have – its something we do. Even walking is a constant process to prevent us from falling over. The main issue is that because most of our balance happens unconsciously we do not think about it on a conscious level unless our balance is particularly challenged.

Our muscular strength and postural tone develops against gravity as a direct result of our vestibular system.

Each semi circular canal responds to motion in a different plane in space: horizontal, vertical axis and rotational spinning axis.

Balance supplies the brain with information regarding the body's position in space. It gives us our sense of "center in space". Knowledge of ones own position in space is essential for orientation, directional awareness and effective operations in space. Imagine being given a map and being told to find your way to specific points on the map, without knowing where you were.

Our balance system is like an internal compass system, which reflexively tells us spatial relationships such as right and left, up and down, front and back, east west north and south.

Higher cognitive skills such as reading and writing, which require a directional awareness, depend upon stable balance to underpin accurate left to right progression and awareness. Writing *was* instead of *saw*, *no* instead of *on*, scanning from left to right. Reading and writing require good foundational spatial awareness skills.

The vestibular system also has links to emotions. The limbic system is the part of the brain where raw feelings, instincts and emotions are processed and generated. The vestibular system directly affects the limbic system by causing flight/ fright/freeze responses and it affects both the sympathetic nervous system and parasympathetic systems. If you are not grounded physically you are not grounded emotionally.

Mothers know instinctively that slow movement has a calming effect and rapid movement has an alerting effect as it raises arousal and excitement. Rapid vestibular stimulation is part of normal playfulness and rough and tumble play. That is why hands on parents interacting and roughhousing with their kids is vitally important.

During the early years, movement is definitely the food that the brain needs.

Types of movement that train balance involve changes in movement in space.

1. Up and down movement - jumping, trampolines, slides, bouncing
2. To and fro - running, starting and stopping, swinging
3. Centrifugal force - carousels
4. Turning movements of the body - spinning, dancing, rolling, sommersaults
5. Depth - riding on a scooter board, skateboard

Movement develops and improves:

- Balance skills and vestibular skills
- Muscle strength
- Proprioceptive skills and efficient movement
- Gross Motor control to perform a myriad of tasks
- Attention and focus
- Level of arousal for optimal performance of tasks.
- Regulation of emotions and coping
- Regulation of mood and behaviours via neurotransmitter secretion
- Learning and memory function via secretion of dopamine
- Fine motor control strength and dexterity
- Eye hand co-ordination
- Language development
- Comprehension and concept development
- Reduction of anxiety and mental health disorders
- Bone density and joint function
- Metabolic functioning to reduce insulin related diseases
- Maintaining healthy weight and BMI
- Cardiac function (heart functioning)
- Lung capacity
- Fundamental movement skills for all movement sequences needed throughout the lifespan.
- Ocular (visual acuity) in children.
- Social interactions and social communication skills
- Regulation of behavioural disorders

And.... despite this list of benefits, it is so very undervalued as having critical importance in childhood and indeed for all of us, throughout our lifespan.

Sue Beurteaux

Gymworks OT March 2016

Move More Learn Better

***The Well Balanced Child -Movement and Early Learning.
2011 Sally Goddard Blythe***