SEQUENCE OF PRIMITIVE REFLEX DEVELOPMENT

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1. INTRODUCTION

In recent years the role of the primitive reflexes in sensory-motor development has come to the fore. It has resulted in many new movement programmes being available to children under the age of 6 and movement therapy to children of all ages.

Is this simply a new fad or is there substance to the claims that inhibiting primitive reflexes can remove barriers to learning?

2. WHAT IS A REFLEX

A reflex is an involuntary muscle reaction in response to sensory stimulation that brings about a change.

There are three types of reflexes (Ayers, 1980; De Jager, 2009; Fiorentino, 1976; Goddard, 1996):

A simple reflex responds when you touch something hot and your hand pulls away without thinking first. These reactions are controlled by the spinal cord and enable you to survive. Simple reflexes are active from conception till death. If simple reflexes are not effective, life needs to be supported mechanically (respirator, heart lung machine etc.).

Primitive reflexes develop from conception to spur on progressive development, assist during the birthing process and enable a baby to survive the first few months of life. Primitive reflexes are controlled by the brain stem and have a limited lifespan starting in utero and inhibiting before six months in life.

Postural reflexes are muscular reactions in opposition to the pull of gravity to maintain posture and prevent injury.

For the purposes of this article focus will be on the primitive reflexes only.

3. PRIMITIVE REFLEXES

Primitive reflexes are natural reactions that:

- **emerge** to start a developmental process
- **develop** a neural circuit for a specific function
- **integrate** within the first year of life
- **inhibit** (go to rest)
- **re-emerge** in case of injury or trauma.

Once a primitive reflex reaction has fulfilled its function – to build a specific neural pathway – it should integrate and inhibit to re-emerge should that specific pathway be injured or destroyed. Injury can occur due to exposure to radiation; foetal distress during prolonged labour; premature birth; illnesses involving high fever or convulsions; near drowning; accidents; oxygen deprivation or a stroke, to name a few.

In some incidents the primitive reflexes do not initiate their functions during pregnancy and as such can then not be integrated. The integration and inhibition of primitive reflexes are dependent on the myelination of nerves, which in turn is dependent on the maturation of the central nervous system through repetitive physical reaction and interaction with the environment. All primitive reflex pathways have to be myelinated, integrated and inhibited before voluntary movement can be mastered.

Irrespective of whether primitive reflex reactions were not developed during pregnancy or whether they have subsequently been damaged, the retention of Primitive Reflexes has a threefold effect:

I. An immature sensory-motor pathway exists and results in uncontrolled and inappropriate movements.
II. These uncontrolled movements have to be consciously compensated for using mental energy and focus to control movement and posture.
III. Because nerve pathways must pass through the survival brain to reach the higher functional areas of the brain, an immaturity within the survival brain will have detrimental effects upon the higher centers of the brain (emotional and cognitive centers).

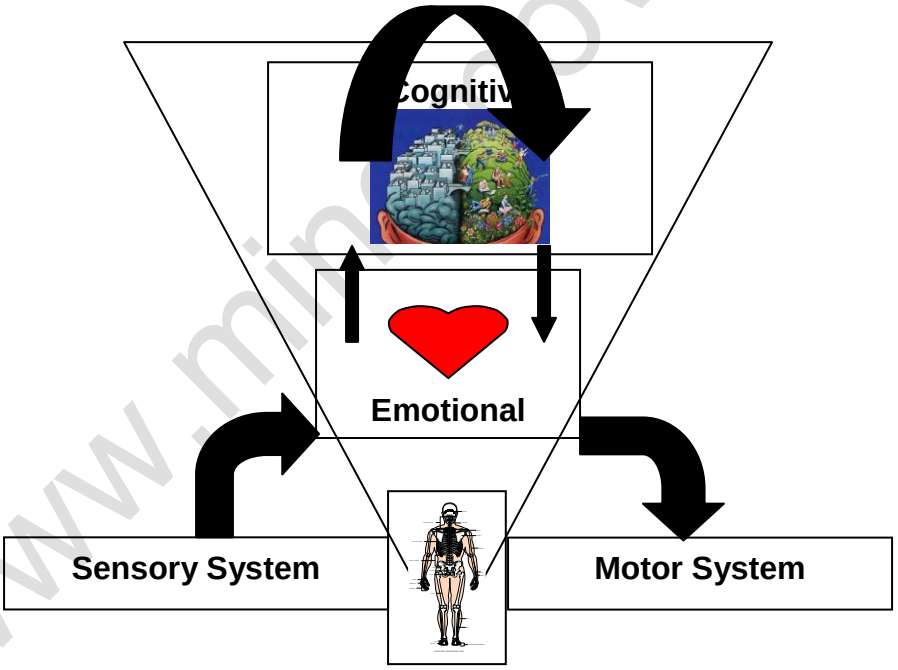

Figure 1 Flow of information through the Levels of Learning Triangle

There are many different primitive reflexes each with a specific developmental function, but due to the magnitude of investigating each primitive reflex, this article will only focus on the following primitive reflexes based on the work of Goddard (2008):

Asymmetrical Tonic Neck Reflex
Moro reflex
Palmar reflex
Plantar reflex
Rooting and sucking reflex
Spinal Galant reflex
Tonic Labyrinthine Reflex
Withdrawal reflex

A. ASYMMETRICAL NECK REFLEX

Recognising an ATNR reaction

When the baby moves its head to one side, the arm and leg will automatically extend to that side, while the other arm and leg will flex.

Function of ATNR

The ATNR stimulates head turning, kicking, muscle tone, the vestibular system and vision, while increasing the neural connections between these systems.

The ATNR establishes the neural connections between the eyes and the hand when the arm follows the direction of the head, focusing at arm's length and thus it promotes eye-hand coordination.

At this stage the midline cannot be crossed and homolateral movement enjoys priority to pave the way for the rolling action and hemispheric specialisation.

B. MORO REFLEX

Recognising a Moro reflex reaction

The Moro Reflex appears at a critical developmental stage of the mechanics of the vestibular system and cerebellum. The vestibular system is your balance system. The Moro reflex forms part of the group of grasping reflexes and consists of a sharp inhalation and the arms and legs being flung wide open - freezing for a moment in time. On exhalation the body gradually relaxes, with the arms crossing over the chest in a grasping or self-hugging posture and the legs flexing and moving towards the centre.

Function of MORO

The movement caused by the Moro Reflex stimulates balance, which is crucial to all functioning. Balance gives a sense of direction and orientation, in utero as well as postnatal. It is also the mechanism that reacts to gravity, and gravity is what gives you a sense of your centre, a sense of where you are in space: up/down, left/right, forwards/backwards.

All raw data pass through the balance system and the cerebellum before being directed elsewhere in the brain. A **discrepancy** between data from the balance system and cerebellum and the raw data received from the other senses can have far reaching implications for learning. This discrepancy happens when what you experience, is for example, different from what you see.

The ear and balance system share some apparatus and influence each other. As a result of the balance system's involvement when the Moro Reflex is triggered, this reflex subsequently develops the hearing apparatus.

C. PALMAR REFLEX

Recognising a Palmar reflex reaction

The Palmar Reflex is triggered when a light touch to the palm of the hand results in the fingers closing. The Palmar Reflex follows on the Moro Reflex and helps to close and relax the hands, just like the arms close over the chest after being flung wide open.

Initially the first three fingers do the grasping and the thumb remains inactive. The grasping reflex is particularly noticeable when the hands "knead" in sync with the sucking movements while the baby feeds. Weeks later, when the reflex is inhibited, the thumb joins the fingers in a purposeful grasp.

Function of the Palmar reflex

Both the mouth and hands are sensitive to touch and are important tools for exploration and early learning. Working together as though tied with an invisible string, strengthens the sensory-motor loop between the hands and the mouth. This loop is necessary for speech, articulation and communication.

The Palmar Reflex also establishes the patterning for later fine motor control when the thumb and index finger work together to hold a pencil.

D. PLANTAR REFLEX

Recognising a Plantar reflex reaction

The Plantar reflex can be observed in a baby when applying pressure just below the ball of the foot and the toes respond with a gripping action.

Function of Plantar reflex

The flexion and extension of the feet involved in the Plantar Reflex strengthens and tones the muscles in the feet in preparation for weight bearing and balance when standing up.

According to Goddard (2008) the Plantar reflex seems to 'precede vocalization, as if the motor pattern prepares the pathways for the utterance of speech".

E. ROOTING AND SUCKING REFLEX

Recognising a Rooting & Sucking reflex reaction

According to Odent (2001) the Rooting and Sucking reflex is triggered by the pressure exerted on the baby's head while it moves down the birth canal.

When the Rooting Reflex is active and a baby's cheek or the edge of the mouth is touched, the baby will turn its head in the direction of the stimulation with mouth open, lips pursed and tongue ready to grasp the nipple. Rhythmic suckling movements ensue when an object touches the palate.

Function of Rooting & Sucking reflex

While a baby is rooting, the tongue moves forward and backward in the mouth, stimulating the muscles involved to search, suckle and swallow, which in time promotes eating and communication.

According to Montagu (1986) "lips, tongue, the sense of smell, vision and hearing are all intimately bound up with each other and the experience of sucking".

The hands may grasp simultaneously while the baby is suckling, further strengthening the communication loop between the hands and the mouth in preparation for articulation, speech, reading and writing skills.

F. SPINAL GALANT REFLEX

Recognising a Spinal Galant reflex reaction

When the baby is placed on its tummy and
the area on the side of the spine is stimulated, the baby would turn its hip 45° towards the stimulation. This reflex, should be equally strong on both sides.

Function of Spinal Galant reflex

The Spinal Galant stimulates hip flexion and trunk rotation.
Hip flexion, which develops parallel with learning to control the head, is most noticeable from birth onwards when the baby lies on its back, kicking vigorously and unhampered with both legs. The legs tirelessly bend and straighten to extend their range of movement until sufficient strength and control is gained to hold the legs up for a longer period.

Hip flexion without trunk rotation would not prepare the baby to roll, sit, crawl or walk. Trunk rotation occurs along the trunk of the body between the hips and the shoulders. Trunk rotation is essential for mobility, since it enables the baby to change position.

G. TONIC LABYRINTHINE REFLEX

Recognising a TLR reaction

The TLR is activated by moving the head forwards above the level of the spine and backward below the level of the spine. Moving the head above the level of the spine automatically flexes the arms and the legs; moving the head below the level of the spine automatically extends the arms and the legs.

Function of TLR

The main function of the TLR is to straighten the body out, developing head control, balance, muscle tone and proprioception. Proprioception gives the baby a sense of where its limbs are in space and assists in resisting the pull of gravity, creating a sense of balance and stability.

The TLR also defines the midline and is responsible for developing vision from scanning and tracking to the left and right, to finding an object and focusing on it in the midfield. This reflex action promotes maturing of the visual system.

H. WITHDRAWAL REFLEX

Recognising a Withdrawal Reflex reaction

As its name indicates the Withdrawal Reflex sparks an immediate withdrawal from any contact, but especially tactile contact by moving away; avoiding hugs or touch.

Function of the Withdrawal Reflex reaction

Soon after conception the embryo consists of three layers of cells. The outer layer develops into the nervous system and skin. Since the nervous system and skin come from the same origin, tactile stimuli have a primal role to play in neural organisation (Ayres, 1983).

The Withdrawal Reflex emerges to stimulate tactile awareness, and therefore the sense of touch is the first sensory modality to develop. The upper lip is the first area to become sensitive to touch. From there the area of sensitivity spreads to the palms of the hands and the soles of the feet, until eventually the entire body surface is responsive to touch. Between five and seven weeks in utero, touch (sensory awareness) results in an instinctive withdrawal reaction (motor activity), thereby establishing the first pattern of how to cope with stress.

For more information on these primitive reflexes refer to Book Shop button on www.mindmoves.co.za

Research at the Mind Moves® Institute has found that not only is knowledge of each primitive reflex of importance, the sequence of primitive reflex development is also important to support a therapist, teacher or parent recommending a movement programme to enhancing development.

4. A suggested sequence of primitive reflex development

The sequence of sensory and motor development as propelled by the primitive reflexes is crucial for sensory integration as well as for sensory-motor development, enabling a child to function independently with confidence.

Primitive reflexes are essential in normal development. Response to these reflexes prepares the child for progressive development
Fiorentino

According to Goddard (2002) when a cluster of 3 or more primitive reflexes remain, it becomes counterproductive to normal neuro-development. Kephardt (1971) calls such a cluster of reflexes 'chaining' – a process by which the response of 1 reflex becomes the trigger / stimulus for reflex 2, et cetera. Such a chain may then give rise to physical, emotional, social and intellectual developmental difficulties resulting in a spiral of learning difficulties.

In an attempt to determine the optimal sequence of primitive reflex reactions for purposes of developing effective movement based therapies, the date of emergence of the primitive reflex was taken into consideration. The second consideration is that the body develops from top to bottom (cephalo-caudel) and from inside out (proximal-distal).

The following sequence has been used as the basis to design customized movement programmes to address each client's needs systematically. The sequence has been tested by numerous Mind Moves Instructors and clients and found it to be effective. Mind Moves® is a developmental movement programme that mimics the primitive reflex reactions to develop specific neural circuits. Once these circuits have been developed, Mind Moves* serves to integrate and inhibit the relevant primitive reflexes.

For more information on each Mind Moves kindly visit www.mindmoves.co.za BOOK SHOP and TRAINING

PRIMITIVE REFLEX	EMERGE in utero	DEVELOPMENTAL FUNCTION	MIND MOVES®
1.Withdrawal reflex	5-7 weeks	Tactile system Proprioception Sensory cortex	* Mind Moves massage * Antennae adjuster
2. Moro reflex	9 weeks	Vestibular system (back/front) Auditory system Motor cortex	* Power On * Rise & Shine * Lip workout * Confidence booster
3. Rooting reflex	10-12 weeks	Olfactory and gustatory systems (smell and taste)	* Tongue Workout

		Speech organs Limbic system Primitive vision	* Lip massage * Jaw dropper
4. Palmar reflex	11 weeks	Hands & fingers Gross & Fine motor Primitive communication	* Bilateral Integrator * Palm stretch * Finger fight
5. Plantar reflex	11 weeks	Feet and toes Gross & Fine motor Preparation for weight bearing & balance	* Foot massage * Leg workout
6. Tonic Labyrinthine reflex	12 weeks	Vestibular system (top/bottom) Auditory system Head control Core muscle tone (flexion/extension) Visual system (near/far) Proprioception	* Neck rotator * Neck flexor * Trunk twister
7. Asymmetrical Tonic Neck Reflex	18 weeks	Vestibular system (left/right) Head control Core muscle tone (limb flexion/ extension) Visual system (eye/hand coordination) Head stability	* Core workout * Visual Workout * Focus Adjuster * Mouse pad * Homolateral Walk * Bilateral walk
8. Spinal Galant Reflex	20 weeks	Core stability Trunk rotation Auditory system	* Spine walk * Midline workout

Table 1 Sequence of Primitive Reflex development

As indicated certain movements are initiated by primitive reflex reactions. Incorporating these movements into a movement based programme or movement therapy can assist in sensory development.

Based on the time frame when a primitive reflex emerges and based on the primary function of each reflex, the following sequence of sensory development has been found beneficial and can be recommended:

I. skin
II. near senses (vestibular, Proprioception, kinesthesis)
III. tongue & nose
IV. ears
V. eyes.

5. SUMMARY

Is the increasing number of movement programmes a fad? Numerous research studies have indicated that movement programmes can enhance physical development and can address developmental delays. It is however suggested that the progressive nature of a movement programme should be questioned to determine if that specific programme would be beneficial.

According to Cheatum & Hammond (2000) "children progress through an orderly and predictable **sequence of development**. One stage in the sequence leads to another. While the order of reaching each skill may be recognizable and separate, a child may be involved with developing several skills all at once".

BIBLIOGRAPHY

Ayres , J. 1983. SENSORY INTEGRATION AND THE CHILD . LOS ANGELES: WESTERN PSYCHOLOGICAL SERVICES.

Cheatum, B.A. & Hammond, A.A. 2000. PHYSICAL ACTIVITIES FOR IMPROVING LEARNING AND BEHAVIOUR. Illinois: Human Kinetics.

De Jager, M. 2006. MIND MOVES – removing barriers to learning . LINDEN: THE BG CONNEXION.

De Jager, M. 2009. MIND MOVES – INSTRUCTOR MANUAL. LINDEN: THE MIND MOVES INSTITUTE.

Fiorentino, M. 1976. REFLEX TESTING METHODS FOR EVALUATING CNS DEVELOPMENT. ILLINOIS USA: THOMAS PUBLISHER.

Goddard, S. 2002. REFLEXES, LEARNING AND BEHAVIOUR. OREGON: FERN RIDGE PRESS.

Goddard, S. 1996. A TEACHER'S WINDOW INTO THE CHILD'S MIND. OREGON: FERN RIDGE PRESS.

Kephardt, N. 1971. THE SLOW LEARNER IN THE CLASS ROOM. COLUMBUS OHIO: CHARLES E ERRILL PUBL.

MacLean, P.D. 1980. THE TRIUNE BRAIN IN EVOLUTION: ROLE IN PALEOCELEBRAL FUNCTIONS. NEW YORK: PLENUM PRESS.

Montagu, A. 1986. TOUCHING: THE HUMAN SIGNIFICANCE OF THE SKIN . NEW YORK: HARPER AND ROW PUBLISHERS.

Odent, M. 2001. THE SCIENTIFICATION OF LOVE. LONDON: FREE ASSOCIATION BOOKS.

Retained Primitive Reflexes have been found to cause neurological underdevelopment in some areas affecting learning, behavior, development, vision and sensory processiing. Find out what they are and how to Integrate Primitive Reflexes. What are They? Primitive Reflexes are the special reflexes that Read More Helda Torres. Primitive Reflexes. What others are saying. Primitive reflexes and motor development were evaluated in 127 very low birth weight (VLBW) infants (birth weight less than 1501 grams) at four months corrected age. The asymmetrical tonic neck reflex, tonic labyrinth reflex, and Moro reflex were assessed for each child. The ability of each child to reach (obtain a red ring) and roll were observed. The child's performance on the gross motor scale of the Denver Development Screening Test was recorded. Thirty-seven term infants were administered identical evaluations at four months of age. The VLBW infants retained stronger primitive reflex...