

Essay

The Primitive Reflexes: Considerations in the Infant

Samuel A. Berne, OD

Private Practice, Santa Fe, NM

ABSTRACT

The primitive reflexes are a set of movement patterns in the newborn that emerge during the prenatal period. These primitive reflexes are present at birth and provide an indication of the neurological development of the newborn. The reflexes are movements that are automatic and do not require thinking. The reflexes help in the birthing process; they help the newborn adjust to its new environment outside the womb; and help to build a foundation for motor and cognitive skills.

The reflexes involve changes in the level and distribution of tone which primarily can affect posture and movement. These reflexes along with postural control are basic developmental patterns. They are integrated and modified into the more complex patterns which lead to voluntary movement and skills. These are integrated by the higher centers of the brain. Lack of integration of these primitive reflexes can lead to poor eye movements and poor fixation from far to near. In addition, one may have difficulty with visual coordination, hand-eye coordination and visual memory.

When an infant is delayed in the integration of these reflexes, developmentally appropriate treatment plans should be considered. Traditionally older children can

self direct themselves through treatment programs that will provide them with the opportunity to integrate the reflexes. Infants and developmentally delayed toddlers do not have the opportunity to follow these activities secondary to their lack of development. Therefore, an integration program can be initiated that can include activities in which the caregiver or therapist can move the infant through the activities as needed. This can provide an opportunity for the infant to develop more appropriately and within the developmental sequence.

KEY WORDS

Asymmetrical Tonic Neck, moro, Spinal Galant, Symmetrical Tonic Neck Reflexes, Tonic Labyrinthine

INTRODUCTION

During the prenatal period, a set of reflexes emerge that are referred to as the primitive reflexes. These reflexes originate in the brainstem, are present at birth and provide an indication of the neurological development of the newborn. They help the newborn integrate the overwhelming amount of stimuli the young child receives once they leave the mother's womb and are crucial for the baby's survival in the first few weeks.

As the child matures, the higher brain centers inhibit the primitive reflexes so more advanced movement patterns can develop. The reflexes are integrated in a sequential fashion from 6-12 months. This assimilation allows more sophisticated neural organization to increase, which then allows the infant control of intentional responses. If these reflexes are retained beyond 6-12 months post birth, they can interfere with cortical processing as well as impede normal development.

Sally Goddard's work found that the persistence of these reflexes can lead to neuro-developmental delays. She defines a neuro-developmental delay as a significant immaturity in the performance of the nervous system as

Correspondence regarding this essay can be e-mailed to sberneod@cybermesa.com or sent to Dr. Samuel A. Berne 227 E. Palace Ave Suite G, Santa Fe, NM 87501. All statements are the author's personal opinion and may not reflect the opinions of the College of Optometrists in Vision Development, Optometry and Vision Development or any institution or organization to which he may be affiliated. Copyright 2006 College of Optometrists in Vision Development.

An abbreviated version of this paper was previously published as Berne SA. The primitive survival reflexes. J Optom Vis Dev 2003;34(Summer):83-85

Berne SA. The primitive reflexes: Treatment considerations in the infant. *Optom Vis Dev* 2006;37(3):139-145.

validated by a group of retained primitive and postural reflexes in a child above three and one-half years of age. According to Goddard, such a group of aberrant reflexes is accompanied by problems with control of body orientation, gross and fine muscle coordination, visual tracking skills and visual-perceptual skills.¹

The visual system is intimately involved in the transition from primitive reflexes to cortical control of movement patterns. In 2001, Bein-Wierzbinski completed a research project supporting the relationship between the visual system and the primitive reflexes. Her findings involved a study of 52 elementary school children in Germany. She had investigated whether disturbances in oculo-motor skill and visual perception could be corrected by means of an appropriate motor training program which focused on primitive reflexes and early motor development. All of the children were examined for abnormal reflexes with the eye movements being assessed using an infra-red computerized eye tracking instrument. One half of the children who had persistent reflexes were given a reflex stimulation/integration program. The other half were examined both at the beginning and end of the program but were not included in any training. Her results showed improvement in oculo-motor functioning and reading skills as anomalous reflexes were integrated. Oculo-motor deficits continued to persist in the control group.

In a study conducted by Ten Hoopen, it was noted that if vision therapy was postponed until a child had at least six months treatment with a reflex integration program, in many cases, the vision therapy was not required after the reflexes had integrated. In those cases where persistent oculo-motor problems remained, the time needed in vision therapy was halved.¹

Sally Goddard has also reported that oculo-motor and visual perceptual problems can be associated with a retained Moro reflex. She found that poor ocular pursuit movements (especially at midline) are linked to a retained asymmetrical tonic neck reflex. She has also determined that oculo-motor dysfunctions, spatial problems and visual-perceptual difficulties occur with a retained labyrinthine reflex. And finally, her work has determined that struggles with hand-eye coordination and poor near far focusing skills are related to a retained symmetrical tonic reflex.¹

Considerations of development

Integrating these primitive survival reflexes helps the infant to learn the critical processes of movement. There has been some controversy whether the reflexes become integrated or inhibited within the person. I believe that when the reflexes become integrated, attention is shifted from basic motor systems so that more

advanced motor and cognitive tasks can be undertaken. Depending on the degree of abnormal reflex activity, this poor organization of nerve fibers can affect the functioning of gross motor and fine motor coordination. These aberrant reflexes can also interfere with the development of normal sensory perception, cognition and audition. The primitive reflexes are essential for learning. If these reflexes are retained beyond the first year of life, many of the advanced cognitive and motor systems will be underdeveloped or inefficient despite sufficient intellectual ability. It is as if later skills remain tied to an earlier stage of maturity and instead of becoming automatic, can only be mastered through consistent effort on the conscious level.¹

For example, visually tracking an object, shaping letters with the mouth or holding a pencil require the intentional control of the muscles. When an unconscious reflex interferes with an intentional movement pattern, the performance will generally not be smooth or coordinated. Once a retained reflex is integrated, the performance can then become an automatic learned skill. Learning occurs when basic physical skills such as balance and interweaving of both sides of the body (right-left coordination and upper-lower body coordination) become automatic. In order for the motor skill to become automatic, it has to be learned beyond the mechanical level. To learn a motor skill beyond this level requires the patient to feel the body while doing the movement. It also requires the patient to develop better self-awareness, and ultimately become his own "error-detecting" system.² This reciprocal interweaving is vital in the development of orientation.³ If the child does not develop automatic motor control, a parent may observe behaviors such as reversals in writing and reading, poor attention and clumsiness.^{1,4} Although a child may demonstrate good potential intelligence, further development may not occur until the delay is addressed. Part of addressing the developmental delays is learning to integrate the reflexes.

Testing

Sally Goddard recommends a testing protocol of the primitive reflexes. This identification process determines what reflexes have been retained versus integrated.¹ When any of the primitive reflexes persist beyond the time that they should be no longer be exhibited, the diagnostic assessment suggests that they have not been integrated. Therefore, one expects that there will be interference in the general and specific motor skills of the child.^{2,5-7} Athletes who still have the primitive survival reflexes can become proficient with a certain specific motor movement but may not have the ability to develop more efficient movement patterns.¹

Lack of integration of these reflexes can also lead to vision problems.⁵ In cases with persistent primitive reflexes, the expectation is that eye movements are poor and fixation from near to far is difficult.¹ Visual coordination, hand-eye coordination and visual memory may be below expected levels. Our visual function is intimately influenced by our brain processes. If the primitive reflexes are still persistent then some of the cortical processing is not available for higher level information processing. If the primitive reflexes remain a powerful force and have not been integrated, encouragement of the postural reflexes alone will rarely influence related transformation in the areas of fine motor control, oculo-motor performance and academic performance. Although motor training programs may help develop postural control, these programs fall short in helping a child integrate the retained primitive reflexes.¹

There are five primitive survival reflexes that most affect visual motor development. They are: Moro Reflex, Tonic Labyrinthine Reflex (TLR), Spinal Galant Reflex (SG), Asymmetrical Tonic Neck Reflex (ATNR) and Symmetrical Tonic Neck Reflex (STNR).⁵

Moro Reflex

This reflex emerges at 9 weeks in utero. It should be integrated by 2-4 months post-natally. The moro reflex is an involuntary reflex to threat. It is a survival mechanism that is composed of a series of rapid movements of the arms upward away from the body. A retained Moro reflex can cause vestibular (inner ear) related problems such as poor balance, and coordination. It can also lead to poor visual control of eye movements that may cause information processing problems. A retained moro reflex can cause a person to experience a hypersensitivity to light, sound, and temperature—a



Figure 1. Moro Reflex-Starting Position for Infant



Figure 2. Moro Reflex-Starting Position

response to external stimuli which is perceived as a threat. One of the coping mechanisms to this stress is an over stimulation of the sympathetic nervous system. If the stress is chronic, one may see an alpha omega pupil response and a constriction in the functional visual fields.^{1,8,9} The arousal system in the brain and the neurological muscle tone may also be affected in the body. Chronic stress can also affect the glandular functions and digestive system. Therefore a retained Moro reflex can cause biochemical and nutritional imbalances.¹ One specific problem is the higher incidence of ear and throat infections that lead to lower immunity and allergies.¹

A persistent Moro reflex depletes energy and can cause fatigue and mood swings. The Moro reflex is the earliest primitive reflex to emerge and forms a strong foundation for future life experiences.

Tonic Labyrinthine Reflex (TLR)

This reflex emerges at 16 weeks in utero. It should be integrated at approximately 4 months postnatally. There is a gradual progression of integration from 6 weeks up to 3 years after birth. The TLR is stimulated by the vestibular system. This reflex is initiated in response to the head moving backwards or forwards, below or above the level of the spine. This head control is crucial



Figure 3. Moro Reflex-Response Position



Figure 4. Moro Reflex-Positive Response (arms move outward).



Figure 5. Tonic Labyrinthine Reflex-Starting Position

for later postural reflexes that involve neurological tone and balance. When the infant learns to lift his head using his neck muscles, he has begun to understand how to work with the forces of gravity. When the infant's head movement becomes automatic, an integration of the Tonic Labyrinthine Reflex (TLR) is observed. If the TLR lingers, this may lead to poor balance, low muscle tone, and poor eye movement control. This can further lead toward difficulties in information processing problems.¹

Spinal Galant Reflex

This reflex is first seen at 20 weeks in utero. It should be integrated postnatally by nine months. The reflex is seen when the baby is placed on its stomach, a finger lightly stimulating one side of the back near the spine resulting in a rotation of the hip on the side of the response. The spinal galant reflex is used in the birthing process by helping the baby work its way down the birth canal. It also enables the fetus to hear and feel the sound vibrations in the aquatic environment in the womb. If the spinal galant reflex lingers beyond the 9 month postnatal period, the reflex may interfere with the ability for the child to control his bladder. This can be seen as bedwetting in the child beyond the age of 5. In adults, if the reflex is still present in adult, some studies suggest that that it can lead to irritable bowel syndrome.¹ Commonly seen behaviors in school-aged children include fidgeting in their seat, squirming, wiggling or difficulty sitting still. Children with a persistent spinal gallant reflex don't like clothing to fit tightly around the waist. A persistent Spinal Galant Reflex competes for the child's attention and short-term memory because the child is distracted by movement initiated by the reflex. This reflex can also interfere with the development of one's orientation.

The Asymmetrical Tonic Neck Reflex (ATNR)

The reflex develops at 18 weeks in utero and is postnatally integrated by 6 months of life. The ATNR reflex is demonstrated by moving the baby's head to one side and seeing an automatic extension of the arm and leg on the side that the head is turned while the opposite arm and leg are in a flexion posture. In utero, the ATNR helps the fetus move the head from side to side while swinging the arms and kicking the legs. This pattern helps develop the muscle tone and the vestibular (inner ear) system. This reflex is also needed at birth so that the fetus can help rotate itself through the birth canal. This movement pattern is the infant's first experience in understanding the coordination of both sides of the body together (reciprocal interweaving). This is done in a twisting action and is why children taken by Cesarean section are at a higher risk for developmental delay. The ATNR not only supports the birth process, but is strengthened by the



Figure 6. Spinal Galant-Starting Position



Figure 7. Spinal Galant-Positive via Hip moving outward



Figure 8. ATNR Quadruped-Starting Position



Figure 9. ATNR Supine-Starting Position-note no arm extension

experience. This may be one reason why some children who are born by caesarean section or require forceps delivery are in jeopardy of becoming developmentally delayed.¹ Without experiencing the twisting they do not directly learn the right-left and upper body-lower body coordination that is needed for developing the interweaving patterns of crawling, walking and skipping. The ATNR is important in the development of activities requiring the integration of both sides of the body. Thus the ATNR can lead to problems of balance- orientation both mentally and physically and lead to confusion while using both sides of the body together. A retained ATNR may also interfere with symmetrical release of both eyes while moving from near to far. Tracking will also be impaired, with later effects upon reading, writing and spelling.¹

Symmetrical Tonic Neck Reflex (STNR)

The STNR reflex presents at 6-9 months of life.¹ It should be integrated at 9-11 months postnatally. This reflex helps the infant learn to rise up on hands and knees and experience the force of gravity. This reflex is displayed when the infant while on his knees, lifts and



Figure 10. STNR-Starting Position

extends his head which causes the legs to flex and the arms to straighten. If this reflex lingers too long it will interfere with the infant's ability to learn creeping and crawling. This is vital as this is the first opportunity for the vestibular, proprioceptive and visual systems to integrate information during movement.¹ Creeping is an essential aspect of visual development as it helps the

eyes to cross midline on the body. As the infant begins to creep from one hand to another, this helps the infant with the control of eye movement patterns to cross the midline of the body. Later when the child is learning to read, they need to have the skill of moving the eyes across the middle of the page without losing their place. Studies have shown that children who don't learn to creep and crawl have a higher incidence of reading and learning problems.¹⁰

Treatment of infants

The early use of treatment for infants is based on four factors.

1. Abnormal developmental landmarks during gestation. This period includes a history from the embryonic phase (the first eight weeks of pregnancy) through the third trimester. Some other factors in this history include the mother's activity level, her overall health and nutrition, and her stress levels during the pregnancy. Any abnormal findings can create a risk factor that the primitive reflexes may not integrate normally.
2. The Birth Process: The newborn endures the labor, delivery, and post-delivery. The fetal head may be a battering ram when used to dilate the birth canal. There can be shock to the fetus even in a normal birth. These initial experiences are the first imprint the newborn has to deal with when leaving the womb. Fetal distress, Breech, Forceps, Vacuum Extraction, and C-section are all risk factors that can affect the development of the primitive reflexes.
3. Infant Movement Patterns that may signal a problem with normal reflex development:
 - The infant stiffens when picked up
 - Tends to startle when touched or crib is jostled.
 - Hates being bathed, dressed, changed
 - May be difficult to feed, does not suck well.

- Substantial delay in head control, sitting, crawling
- Poor muscle tone
- Cholic, frequent ear infections
- Abnormal response to vaccinations
- 4. Optometric Findings
 - Strabismus/ amblyopia
 - Anything over 2 diopters (non-cycloplegia) of hyperopia, myopia, astigmatism

Motor guidance program

If the infant shows the need for reflex integration activities, they are prescribed an Infant Motor Guidance Program. In this program, the difference between working with an infant versus a child three years of age and older is that the parent/therapist will make the movements for the infant as opposed to the child making the movements himself. I recommend both mom and dad make the movement patterns on the infant together. The benefits of applying an Infant Motor Guidance Program short term is to assist the infant to continue along the normal sequence of development. The long term benefits of applying an Infant Motor Guidance Program are to reduce developmental motor delays with children diagnosed later on along the ADD-Autism spectrum of disorders. Another long-term benefit would be more efficient visual skills and visual processing abilities. No contraindications have been found if applying the Infant Motor Guidance Program. The Motor Guidance program is done in the following manner. Spend five minutes twice a day for one month on each reflex. After the month, continue to the next reflex movement pattern until all five reflex patterns have been integrated. The best times to apply the movement patterns are upon waking and before sleep.

Moro Reflex Exercise Starfish

1. Infant lies on her back in the crib. Use a blanket and pillows under infant's back so that her back is in a 20 degree inclined position. Support her head with your hands.
2. Start in the "Starfish" position. The arms and legs are spread out in a loose, relaxed position. In other words, the legs and arms are open. Hold the head slightly back.
3. In a synchronized movement, move the arms and legs in towards each other until they reach a fetal position with arms and legs drawn into chest. Move the head so the chin can touch the chest.
4. Stay in this fetal position for two seconds and then slowly move the arms and legs back to the "Starfish" position. Pause two seconds in the "Starfish" position as well. The movement should be safe and relaxed. The left leg and left arm cross over the right leg and

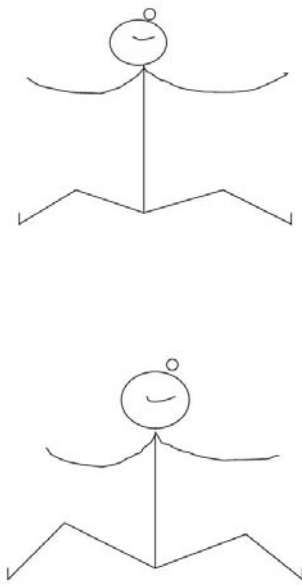


Figure 11. Moro Reflex Diagram

right arm, then when the infant repeats the movement into fetal position the right leg and right arm cross over each other.

5. It is very important to move the head and neck all the time. For example, starting in the “Starfish” the head is back. When moving to the fetal position, the head moves forward. When moving the “Starfish” the head and neck move back.

6. Repeat for five cycles.

Because the moro reflex is connected to vestibular stimulation, at another time, I recommend these additional movements to help stimulate and develop the vestibular system:

1. Hold infant in the air so she is facing you. Make eye contact. Lift her up and down slowly for 20-30 seconds.
2. Rock infant in a rocking chair and change her posture when rocking her. She can lie on her stomach on your knees, she can lie on her back on your knees, and she can stand in your lap so her head is resting on your shoulder. Rock for 5-10 minutes.
3. Swing infant in an arcing swing for 20-30 seconds and pause for 10 seconds and repeat for a total of four cycles.

Tonic Labyrinth Reflex Exercise

The infant lies on the floor or in her crib on her stomach. Her arms and legs should be relaxed. Lift right arm while looking at the thumb. If she can hold a bright/colored rattle in her hand that makes a sound that is even better. Move right hand to the right and see if she

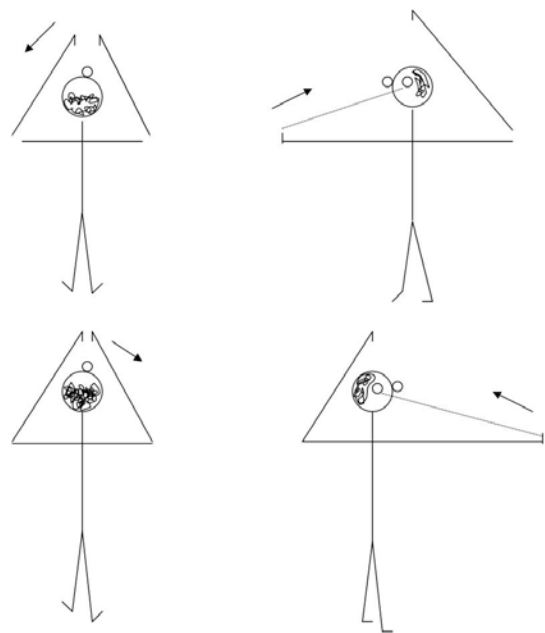


Figure 12. Tonic Labyrinth Reflex Diagram

can follow the hand until the arm is straight. You may need to prompt her with verbal cues. Make sure arm is lifting as you move it. Once the arm is straight, then move the arm back until it is straight ahead. Repeat with the left arm while it is lifted moving it in the same manner as the right arm. When the left arm has returned to being in front, let the arms and hands rest on the floor with the head down, that is one cycle. Repeat for three cycles. The key is relaxing the legs and move the arms as slowly as you can.

The Spinal Galant Exercise

This exercise is similar to angels in the snow. The position for beginning is both feet together with legs straight and arms down to the side while lying on the back. In a really *slow* movement begin moving the arms and legs out like a jumping jack. The arms need to be stretched and the hands need to touch each other just as the legs reach their widest position. Then bring arms and legs back to the starting position slowly. Each angel in the snow should last at least 20 seconds. Do three angels to complete the reflex. (If moving the arms and legs together is too difficult then break the movements down by moving the arms by themselves and the legs by themselves) (Up and down equals one cycle) Repeat for three cycles if doing for 20 seconds per angel.

Asymmetrical Tonic Neck Reflex Exercise

Begin the exercise by lying the infant down on his stomach face down. Ask him to lie very quietly on the floor or in his crib. Then place his body lying on his left

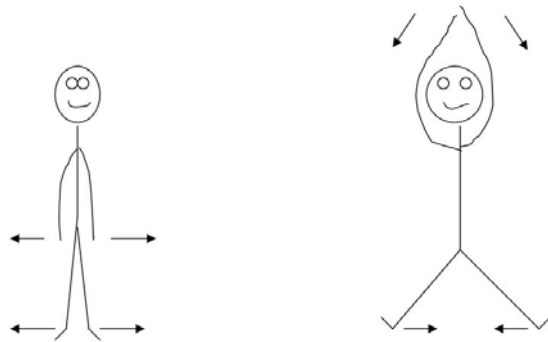


Figure 13. Spinal Galant Diagram

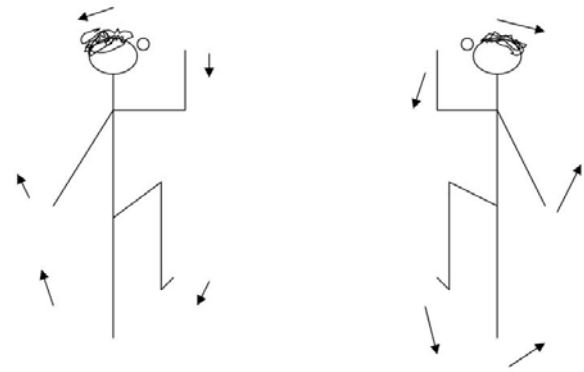


Figure 14. Asymmetrical Tonic Neck Reflex Diagram

side with legs and arms in proper position. (See diagram below)

1. Nose is facing the side the where the arms and legs are bent. Palms are facing down. Move his head to the other ear.
- 2-3. Then move his bent arm down then move his bent leg down until he becomes straight. When he gets to the point where he straightens his leg, so that both legs are straight have him pause with both legs straight for 5 seconds before you begin to roll him to the other side. *The stopping is important.*
- 4-5. Move his straight leg until it bends then move straight arm until it bends.
6. Move head to other ear.
7. Move his bent arm down, then bent leg until it straightens. When he gets to the point when he straightens his leg, so that both legs are straight have him pause *again* with both legs straight for 5 seconds before the begin to roll to the other side. *The stopping is important.*
8. Move his straight leg until it is bent
9. Move his straight arm until it is bent. At this point you have completed 1 cycle.

This should be repeated 2 more full cycles. The goal is to move the arms and legs as *slowly as possible*. Try to relax the body as much as possible.

Symmetrical Tonic Neck Reflex Exercise

First, put the infant into a position so she sits on her feet and calves. Lower her head and the forehead is touching her thighs. Straighten the infant's arms so the ears can just fit through the arms. The arms are always straight during the movement of the body and head as it moves forwards and backwards. Begin by moving the head and body together (synchronize this movement) and move the infant as forward as you can (to a crawling position). Then move the infant backwards down to the beginning position with the forehead touching her thighs.

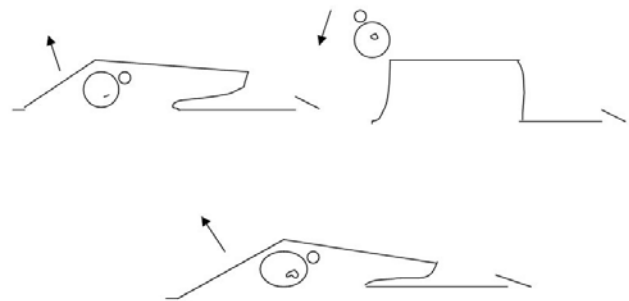


Figure 15. Symmetrical Tonic Reflex Diagram

There is a continuous movement back and forth for three minutes. Try to do between 18-25 cycles during this period.

CONCLUSION

The primitive reflexes are a set movement patterns found in every child. The main purpose of these reflexes is to help the newborn survive the cold, harsh environment outside the mother's womb. These reflexes begin developing in-utero and should become integrated by the first year of life. If the reflexes are retained or aberrant, they can represent an impediment in the development of the Central Nervous System. If the reflexes are tested and found to be persistent beyond the normal period, a reflex integration program can be started. This program involves specific repetitive movement patterns practiced five to ten minutes per day for a period of 4-6 months. In the infant and young developmentally delayed child, the patient must be moved through the pattern vs. self guiding them self. The reflex movements are based on a thorough understanding of the primitive reflex sequence of development and normal child maturity.¹ It should also be noted that many of these reflexes can inhibit various activities in the older

child and when treated appropriately may improve academic¹¹ and other areas of function.

Acknowledgments

A special thank you goes to Drs. Curtis Baxstrom and Albert A. Sutton who helped in the editing of this paper.

References

1. Goddard S. Reflexes, learning, and behavior. A window into a child's mind. Eugene, OR: Fern Ridge Press, 2005.
2. Berne S. Without Ritalin. Los Angeles, CA: Keats Publishing, 2001:105.
3. Sutton A. Building a visual space world. OEP Curriculum II 1984;1(1):47-78.
4. Blythe SG. Neurological dysfunction as a significant factor in children with dyslexia. J Behav Optom 2001;12(6):145.
5. Sutton A. The basis for visual development from prenatal through infancy. J Optom Vis Dev 1996;27(2):80-6.
6. Blythe S. Screening for Neurological Difficulties in the Specific Learning Difficulty. Br J Occupational Therapy 1998;61(10):459-464.
7. Fiorentino M. Reflex testing methods for evaluating CNS development. Springfield, IL: Bannerstone House, 1981.
8. Edelman ES. Visual signs of reduced form fields. J Optom Photother April 2004.
9. Fast D. Syntonic blue book. Ithaca, NY: College of Syntonic Optometry, 1985.
10. Pavlidis G, Miles T. Dyslexia research and it's applications to education. New York: Wiley Publications, 1987.
11. Wahlberg T, Ireland D. Can replicating primary reflex movements improve reading ability? Optom Vis Dev 2005;36(2):89-91.