

Retained primitive reflexes in children, clinical implications and targeted home-based interventions

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Abstract

This article discusses problems such as learning difficulties and behavioural problems that children may experience when they have retained primitive reflexes, which are typically only present in the first few months of life. The authors outline different types of primitive reflex present in infants and how each may affect a child when retained beyond the time when they are normally inhibited. Where relevant health professionals with expertise in this area are not available, children's nurses may need to assess and manage children with retained reflexes. This article explains how a nurse can assess a child for each primitive reflex and describes exercises that can be taught to a child and his or her parents to carry out at home to reintegrate the reflex.

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Keywords

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PRIMITIVE REFLEXES are automatic involuntary movements that occur in response to a stimulus. They develop in the fetus during pregnancy and are present fully in infants born at term. They have a developmental role and some may help the neonate to survive or to bond with a parent. However, as the infant grows, primitive reflexes should integrate into lifelong postural reflexes and disappear to allow normal motor development (De Jager 2009).

Satisfactory brain maturity is essential to allow the inhibition of primitive reflexes and the normal progression of psychomotor functions, and this requires a transition from an involuntary brainstem reflex response to one controlled by the cortex (Case-Smith 2014). The cortex is the outer layer of the cerebrum and comprises folded grey matter; it plays a pivotal role in thought, attention, memory, consciousness and motor functions among many others (Pandya et al 2015).

A brain injury, caused for example by cerebral palsy or a cerebrovascular accident, could cause primitive reflexes to be retained or to resurface (Sankar and Mundkur 2005, Gieysztor et al 2018). A child with

delayed psychomotor development may demonstrate difficulties in running, cycling, throwing and/or catching and may appear clumsy on observation. There is increasing evidence that retained primitive reflexes are associated with learning deficits and behaviour abnormalities (McPhillips and Jordan-Black 2007, Montgomery et al 2015, Gieysztor et al 2018). Neurodevelopmental disorders, such as attention deficit hyperactivity disorder (ADHD), occur in association with retained primitive reflexes and may lead to learning difficulties (Taylor et al 2004). About 48% of primary school children surveyed in the North Eastern Education Library Board Study in Northern Ireland had some level of retained primitive reflexes and other studies have found similar figures (Blythe 2005, Duncombe and Preedy 2018).

Retained primitive reflexes are not always associated with neurodevelopmental disorders. Some may have minor degrees of retention and would go easily undetected. When researchers conduct assessment batteries, many children without learning deficits and behavioural problems may be found. There is no clinical significance in this.

Children’s nurses are increasingly involved in developmental screening and may be the only health providers available in resource-limited settings. Therefore, it is important that children’s nurses have the ability to detect retained primitive reflexes and to initiate appropriate management (Gellasch 2016).

When retention of primitive reflexes is detected, the child should be taught structured home-based activities that use specific movements relating to the reflex to help develop the nervous system. There is still no high-quality evidence to say that these home-based interventions would improve learning deficits.

Primitive reflexes

There are many types of primitive reflexes (Table 1). The Moro reflex (Figure 1), also known as the startle or embrace reflex, is present at birth, peaks around the end of the

neonatal period and normally disappears by the end of the second month. The reflex occurs when the neonate’s head suddenly shifts or there is a loud noise and results in the baby’s arms and legs suddenly extending, often accompanied by crying. The palmar reflex involves flexing of fingers to grab an object and should integrate by six months. The stepping reflex (Figure 2) is present at birth and vanishes at about six months. It is seen when the sole of the baby’s foot touches a flat surface; the infant appears to attempt to walk by placing one foot in front of the other. The rooting reflex (Figure 3) is present at birth and typically goes away at four months. In this reflex, the infant turns its head toward an object that strokes its cheek. The sucking reflex is connected to the rooting reflex and induces the infant to suck an object that touches the roof of its mouth (Kliegman et al 2007, Berk and Roberts 2008, O’Connor and Daly 2016).

The asymmetrical tonic neck reflex is present from one to four months (Figure 4). When the baby’s head is turned to one side, the arm on that side of the body straightens, and the other one bends. It is a precursor of hand-eye coordination and leads to the ability to reach for objects. The symmetrical tonic neck reflex is seen later at about six months. When the head flexes forward, the upper limbs will contract, and the lower limbs will extend. The opposite is seen when the head is extended backwards, with the upper limbs extending and the lower limbs contracting. The Galant reflex (Figure 5) is seen between birth and six months and occurs when the side of the back is stroked, resulting in the infant flexing laterally to that side. The tonic labyrinthine

Table 1. Types of primitive reflex

Primitive reflex	Description	Age
Moro reflex	Primitive fight or flight reaction	Birth to 2 months
Stepping reflex	Placing one foot in front of the other	Birth to 6 months
Palmar reflex	Flexing of fingers	Birth to 6 months
Rooting reflex	Turn towards food	Birth to 4 months
Asymmetrical tonic neck reflex	Cross pattern movements	1 to 4 months
Symmetrical tonic neck reflex	Preparation for crawling	6 to 11 months
Gallant reflex	Assist with birth process	Birth to 6 months

Figure 1. Moro reflex in a baby



Figure 2. Stepping reflex in a baby



reflex is seen between birth and four months. In this reflex, tilting the baby's head back while lying on the back causes the back to stiffen and arch, the legs to stiffen and straighten, and the arms to bend at the elbows and the wrists (Kliegman et al 2007, Berk and Roberts 2008, O'Connor and Daly 2016).

Clinical importance of retained reflexes

The retention of different types of primitive reflexes may have specific and general implications for a child. For example, the retention of the asymmetrical tonic neck reflex may indicate poor ability in eye tracking and difficulty crossing the visual midline. This is associated with reading problems, inability to tell the time, left-right confusion and spinal deformities (Kawakami et al 2013, Gieysztor et al 2018). The symmetrical tonic neck reflex may be associated with poor posture, impaired hand-eye coordination and difficulties in focusing on a task. Children who retain this reflex may dislike games where they would be expected to catch a ball. They would also find it hard to learn to swim and to sit still (Gieysztor et al 2018).

When the tonic labyrinthine reflex is retained, it may be associated with poor balance, disorientation and emotional dysregulation. This may affect binocular vision and could lead to careless mistakes and a poor sense of timing (Gieysztor et al 2018).

Enuresis beyond the age of five years has been associated with the retention of the Galant reflex. The Moro reflex is related to imbalance and poor coordination (Berne 2006). A study has shown that ADHD is

associated with retained Moro and Galant reflexes in children. This association of ADHD with primitive reflexes highlights the possibility of abnormalities related to brain processing causing a conflict between higher and lower levels of cognitive and motor functions in the disorder (Konicarova and Bob 2012).

The persistence of primitive reflexes, such as asymmetrical tonic neck reflex, is also seen in specific learning disorders such as dyslexia and is associated with low reading scores (McPhillips and Jordan-Black 2007, Montgomery et al 2015). The retention of the palmar reflex is associated with difficulty in tying shoelaces, poor hand-eye coordination and irregular handwriting (Bilbilaj et al 2017). There is only limited emerging evidence on specific difficulties of other retained primitive reflexes.

Structured assessment

In a multidisciplinary setting, a child who is suspected to have retained primitive reflexes – due to delayed motor development and the presence of learning and behavioural problems – should be referred to the paediatric occupational therapist for a structured assessment. The child will then be assessed using specific primitive reflex tests and the Bruininks-Oseretsky motor proficiency test, which is the most precise and comprehensive measure of gross and fine motor skills (Blythe and Blythe 2012). After clinical observations and discussion with the child's parents, the child should be managed with a view to integrating any retained reflexes, and how this is done will depend on the availability of staff with the necessary expertise.

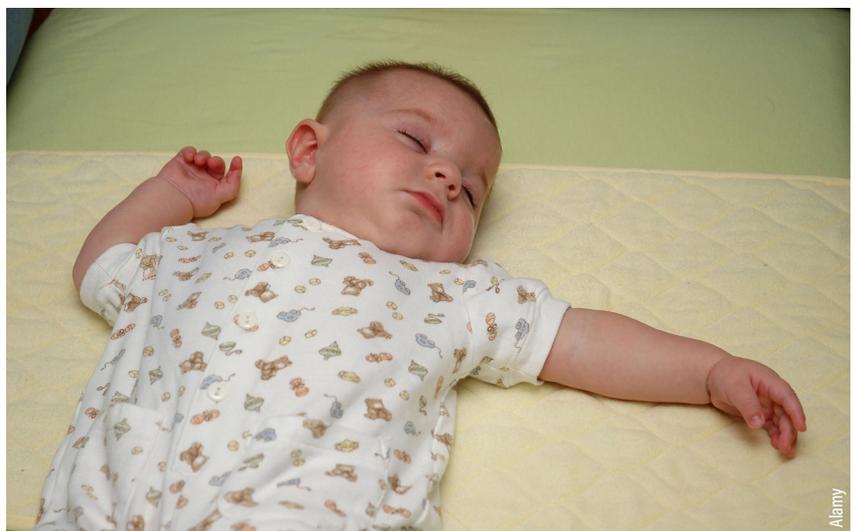
Key points

- Children's nurses should look out for signs of retained primitive reflexes, particularly in children who have learning difficulties and behavioural problems
- Teaching children exercises that they can carry out at home to reintegrate retained reflexes can help them with problems, such as difficulties with schoolwork, reading, balance and coordination
- Child healthcare workers need to be aware of retained primitive reflexes and their clinical implications, especially in settings where trained professionals are scarce

Figure 3. Rooting reflex in a baby



Figure 4. Asymmetrical tonic reflex in a baby



In resource-limited settings, children's nurses might play a central role in encouraging activities at home and school that can improve the functional capabilities of a child with retained primitive reflexes (Mountstephen 2011).

How to assess for primitive reflexes

To test for the asymmetrical tonic neck reflex, the child should be on all fours with their arms straight, their fingers pointing forwards and their head in a neutral position. The child needs to bear their weight on their hands, and the examiner then turns the head to the right or left. If the elbow of the child bends while the head is being turned to the opposite side or the weight shifts posteriorly from the hands, the reflex is likely to be present. The symmetrical tonic neck reflex can be tested when the child is in the same position.

The examiner first needs to flex the child's neck down fully and hold it for five seconds, then slowly extend the neck and hold it for a further five seconds. The examiner can hold the neck with two hands on either side of the head but there is no specific point to place the hands. This activity should be repeated three times, and the child needs to be observed for any change in position, shifting of weight posteriorly, arching of the back or bending of the arms (Amiel-Tison and Gosselin 2001, Kliegman et al 2007).

Figure 5. Galant reflex in a baby



To check for rooting and sucking reflexes, the examiner needs to use the tip of a finger or a brush to lightly stroke from the outer corners of the nose beyond the corners of the mouth. If mouth or head movement is seen, the rooting reflex is likely to be present. The sucking reflex may be indicated by pursing of the lips while stroking the central part above the upper lip (the philtrum). To test for the palmar reflex (Figure 6), the child is asked to stand with elbows bent and palms facing upwards away from the body. Then the examiner needs to gently stroke the palm with a finger from the web between the thumb and the index finger to the heel of the hand. If the reflex is present, there would be an inward movement of the thumb, fingers or elbows (Amiel-Tinson and Gosselin 2001, Kliegman et al 2016).

The Galant reflex can be tested with the child on all fours and the examiner using a finger to stroke the child's back on one side of the spine towards the sacral area. The reflex may be present if there is an arching of the back or movement of the back away from the stroke. To test for the tonic labyrinthine reflex, the child should lie face down on the ground with the palms facing down and hands in front of the head. Then the child is asked to keep the head off the ground while raising the legs straight. If they are unable to keep the legs straight, it may indicate retention of the reflex (Amiel-Tison and Gosselin 2001, Kliegman et al 2007).

The Moro reflex could be tested by the so-called 'pigeon walk'. The child should be asked to walk in a straight line with toes pointing inwards and holding a stick with palms upward. Any imbalance may indicate the retained reflex.

Home-based exercises

Retained primitive reflexes can be managed in different treatment settings depending on the type of reflex and any co-morbidity the child may have. It is advisable to obtain the guidance

Figure 6. Palmar reflex in a baby



of a paediatric occupational therapist, where such expertise is available. In addition, parents can be educated about these reflexes and their potential effect on children, as well as possible home-based exercises. In resource-limited settings where expert multidisciplinary teams may not be available, health professionals including children's nurses can provide education and support. The aim of the exercises for children with retained primitive reflexes is to reintegrate these movements as close as possible to the typical motor development sequence (Grigg et al 2018). To subdue the retained reflexes, the movements need to be repeated often and improvements would be understandably slow. The period that the exercises need to be continued is variable and differs according to each child.

For the rooting and the sucking reflex, the child's face should be stroked with a brush to induce the reflex. This may need to be repeated several times in a row until the reflex stops happening and then the whole exercise should be repeated during the day. When the Moro reflex is known to be present, the child should sit in a chair in the fetal position, with his or her wrists and ankles crossed. With the fists closed, the child needs to inhale and then swing the arms and legs out as if posing like a starfish. While doing this, the child's head should be extended backwards, and the hands should open. On exhaling, the child is asked to go back to the original position after staying in the starfish-like position for a few seconds. The exercise should then be repeated several times in a session (Blythe and Blythe 2012).

The Galant reflex is managed by training the child to do an activity similar to making 'snow angels'. The child should lie on the floor with his or her legs extended and arms to the sides. While breathing in, the child should spread the legs outwardly and lift the arms along the surface until they touch. Then while exhaling, the child should return to the original position. The arms and legs should move synchronously. This exercise should be repeated several times a day (Berne 2006).

To address a retained palmar grasp reflex, the child should squeeze a rubber ball several times a day. The activities to target the asymmetric tonic neck reflex activities are similar to postures that are used in fencing. The seated child is asked to turn the head and extend the arm and leg on the same side outwardly at the same time. The child needs to look at the hand that is moving out, while the other hand should open. The opposite arm and leg should flex. This needs to be repeated several times until the reflex fatigues (Cheatum

and Hammond 2000). The exercises used to integrate the symmetrical tonic neck reflex, and tonic labyrinthine reflex is the same as the activities used for detection of these retained reflexes described earlier.

Structured programmes

There are emerging studies on more structured programmes to integrate retained primitive reflexes (Grigg et al 2018). These may be recommended in settings where such expertise is available. Rhythmic movement training is an example of a programme that incorporates developmental movements, gentle isometric pressure and self-awareness. A recent study involving a group of parents who have obtained this therapy for their children demonstrated satisfactory results and suggested that this form of therapy is cost-effective, low impact and can be easily incorporated into their daily routine (Grigg et al 2018). However, providing this therapy needs specific training, which may not be available in many settings.

Case examples

Jamal was an eight-year-old boy diagnosed with ADHD and specific learning disorder with impairment in written expression (American Psychiatric Association 2013) and similar to dyslexia. After multidisciplinary assessment and diagnosis by the child and adolescent psychiatrist, he was given stimulant medication for ADHD symptoms. His hyperactivity, attention to academic work and impulsive aggression at home and school improved remarkably. Jamal did not have any visual or hearing impairment. However, he continued to have specific difficulties when doing schoolwork, such as failing to colour inside the lines and writing haphazardly on a page with poor orientation. This was a concern for his parents as his overall behaviour was satisfactory. Further exploration revealed that he was poor at catching a ball when it was thrown to him. Physical examination revealed the presence of the symmetrical tonic neck reflex and he was referred to occupational therapy for an assessment. His learning and hand-eye coordination skills improved with persistent, targeted home-based activities over three months. Improvement was shown in clinical assessments, and parent and teacher feedback. After initial assessment and advice from the occupational therapist, the children's nurse provided advice and support to continue the exercises at home.

Bella was a ten-year-old girl treated for ADHD and post-traumatic stress disorder related to domestic violence. She had been on

stimulant medications and had satisfactory control of her inattentive behaviour. However, she experienced ongoing difficulties in reading and telling the time using an analogue clock. Physical examination revealed that she had retained asymmetrical tonic neck reflex and she was referred for expert paediatric occupational therapy. Bella was unable to attend regular occupational therapy because of family disputes. A nurse clinician provided Bella and her family with individualised instructions in liaison with the occupation therapist. With this support, she continued home-based activities and her skills in reading and telling the time improved remarkably over a few months. The improvement was evident from her school reports.

Conclusion

Retained primitive reflexes are increasingly being recognised as a potential contributing factor to behavioural abnormalities and learning deficits. They are associated with

neurodevelopmental disorders such as ADHD. Children's nurses are becoming more involved in the developmental screening of children and may serve as the most important health provider for children in many resource-limited settings. Increased awareness of retained primitive reflexes, their clinical importance and management would therefore be helpful for children's nurses and other health professionals to be able to provide practical home-based management for these children to obtain better functional outcomes related to their learning and behaviour.

Ideally, in multidisciplinary paediatric settings, a paediatric occupational therapist would provide the initial assessment and management of children with retained primitive reflexes. However, many settings might not have access to this expertise and greater awareness of primitive reflexes among health professionals could improve the detection of retained reflexes and referral for appropriate care.

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