

**Significance of Developmental Milestones**  
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As Behavioural Optometrists we undertake responsibility for our patients' total visual well being. Our first priority is, of course, the detection and referral of pathological conditions. To promote maximum quality of life we are next concerned to diagnose and treat dysfunctions of sight that interfere with the achievement and maintenance of clear, comfortable, task appropriate single vision. However, we are equally concerned with establishing that the development of visual perceptual skills has proceeded in such a way that patient and cultural expectations can be satisfied.

A comprehensive history is the first tool in the battery of examination procedures we employ to achieve these aims. It indicates areas that require careful probing throughout the remainder of the examination and perhaps even additional tests that should be performed. The history is considered in conjunction with specific test results when arriving at a diagnosis, expected prognosis and a treatment regimen.

The visual system cannot be considered in isolation. For this reason, details of present and past systemic disease, trauma and medications are an accepted part of routine optometric history taking. Information regarding developmental milestones should also be sought for exactly the same reason. The development of vision in a child is inextricably intertwined with all the other facets of perceptual development.

In order to properly consider the specific significance of developmental milestones in the optometric history it is necessary to first examine what is meant by the term development. I believe it refers to the continuum of changes, both physical and psychological, that take place in a human being from the time of conception until death. It can, in fact, be considered that the purpose of development is to continually prepare us for meeting life's successive challenges.

Development is a spontaneous process involving many interwoven and interdependent parts. Emphasis is commonly placed on the early childhood years and the developmental stages that move us from infancy to young adulthood. Changes are rapid and dramatic in this period so they are more easily observed and catalogued. None the less these early phases are rightly considered highly influential in determining the quality of later adult experience. There is no single theory that can simply and completely explain such a complex process. A main point of contention is the degree to which we play an active or passive role in our own development. However, the fact that certain basic similarities are sequentially observable in children's behaviour as they grow is universally accepted. Developmental milestones are culturally recognised high points in behavioural change.

For ease of understanding, the continuum of development is usually divided into stages. Each new stage is founded in the experience of the one before. Therefore the

sequence of stages is immutable and no stage can be bypassed without permanently influencing progress through all the succeeding levels. The transition between stages is gradual, not step-like. Furthermore, while the overall thrust of development is forward to greater neural organisation the actual behavioral path followed is, in fact, a zig-zag of gains and lapses.

Piagetian theory contends that a child learns by doing or interacting. A child engaged in the high level thinking of true development is constantly modifying his concept of reality as he accommodates new information presented. In order to adapt past experience to encompass the requirements of a new task a child must be able to conceptualise the task presented and perceive pertinent discrepancies in his own performance. Information available ahead of his capacity to assimilate it is useless. New schemata, or patterns of information organisation, can only be developed where appropriate existing schemata already exist to be modified. A child facing a task for which he is not developmentally ready cannot engage in this high level thinking.

For development to occur the nervous system must mature. It has now been shown that appropriately targeted sensory/motor experience actually results in increasing organisation of neural networks. This, in turn facilitates the acquisition of more sophisticated behaviour patterns. Small children will obsessively repeat a single action till automatic mastery is achieved. Yet sometimes the path of development in a child is skewed by avoidance of experience that in some way must not satisfy or even frighten.

Piaget does not consider the role played by emotions in the drive to acquire knowledge. He sees emotions and personality as an outcome not a cause of the developmental process. Yet satisfaction in achievement and enjoyment of the sensory experience would intuitively seem to play an important part.

Arguments rage over the relative importance of genetic potential, emotional satisfaction, physical maturation and environmental opportunities. A baby with an intact neuromotor system does not have to be taught how to roll over. '[The drive comes from within. On the other hand, the ability to successfully intervene when something goes wrong is dependent on the role played by environmental influences. Interaction with the environment is essential to learning but intervention, to be of benefit, must be planned with organisational readiness in mind.

A child must be able to understand the world in concrete terms before being able to think in the abstract. Roughly seven years of play are needed for a child to develop this concrete knowledge of the physical world. Piaget divides these years into four developmental stages. From 0-2 years, children move through the Sensory/Motor period of development. Next comes the Preoperational stage from 2-7 years followed by the period of Concrete Operations from 7-11 years. Finally the stage of Formal Operations from 11 - 16 years ushers in adulthood. Any such divisions is somewhat

artificial but is none the less useful if the limitations it introduces are kept in mind.

The Denver Developmental Screening Test groups the accomplishments expected in a developing child into the areas: Personal/Social, Fine Motor Adaptive, Language and Gross Motor. Such divisions are again artificial in that many basic schemata such as attention control, the ability to discriminate pertinent differences and the ability to sequence are common to them all. However the normative data provided, including the age spread over which each of the specific behaviours listed first appears, is a useful assessment tool.

It must always be remembered that it is the sequence of growth that is important not the age at which a child moves into each successive stage.... Norms, based on observed consistencies in behaviour among children at different ages, are useful in determining if a child is progressing fairly equally in all areas of development. However, it must be remembered that each child is an individual. Children move from one stage to another at different rates. It is often more appropriate to compare a child with his former self rather than with others

Our culture, however, expects a child to have attained certain perceptual skills in order to begin the process of accountable learning between the ages of 4 and 6. Children need to have established visual and auditory dominance in sensory processing by the time they start school. As optometrists we are concerned that children are visually ready for learning in a classroom.

Initially the development of each sensory system requires consensual reinforcement. Therefore visual development cannot be considered without reference to development in the other sensory systems. Sensory /motor is the sorting, organising and putting together of messages received by the brain from all five senses. The drive to sensory/motor is innate. Initially the rate of development is so rapid that gains are readily observable to even an inexperienced observer.

Even before birth activities such as kicking, blinking and swallowing give testimony to the growth of neural organisation. Hence the significance of history information relating to maternal health and medication prior to birth as well as ante natal and birth complications. The APGAR test performed one minute after birth is an index of 5 vital signs: heart rate, respiratory effort, muscle tone, reflex irritability and colour. It is an indicator of potential ante natal and birth trauma influences on later development.

At birth a baby possesses a number of reflexes that form the movement basis for all further sensory/motor experience. Reflexes are innate, automatic responses to specific stimuli. All the reflexes available to a newborn infant have survival value in at least an evolutionary sense. These reflexes disappear as the need for them fades with the arrival of voluntarily controlled movement over the first 6 months.

At birth certain reflex visual behaviours should, in fact, be present. Pupil constriction in response to light, blinking, eye position in the tonic neck reflex and the Doll's Head

reflex together with eye opening on raising the head or sucking are all visual reflex behaviours that should be present if the birth is not too premature. However most parents are unlikely to have noticed, let alone remembered, these signs of early development.

We therefore need to seek information about more widely publicised reflexes that parents will have been exposed to in childcare literature. The Moro or startle reflex, grasp reflex, step reflex, feeding reflex, sucking reflex and tonic reflex should also all be present. The disappearance of these reflexes over the succeeding months is as important to establish as their initial presence. Retained, they inhibit later development of voluntarily controlled movement.

A newborn baby has yet to develop a percept of his own body or the world around him. Touch and movement provide the necessary interactions by which his knowledge is gained. Random movements provide, by accident, the beginnings of voluntary motor control. This motor control proceeds downwards from head to toe. The pressure sensation experienced by a baby lying on its back probably begins this process of self awareness. The vestibular and proprioceptive messages of movement play a key role in its growth. Vestibular input from the inner ear is particularly important as it also affects the muscle tone required for proprioception. The pleasurable pressure sensation of parental touching also plays a significant part.

All voluntary motor function grows from self awareness. A mental map of the body is needed for the development of bilateral coordination where both sides of the body act together. This in turn precedes the development of lateralisation which allows independent, opposite actions to be performed by right and left limbs simultaneously.

Concepts of time as well as space have their start in movement. An understanding of time takes longer to develop than an understanding of space. A four year old child correctly interprets bigger but not older. The start of spatial awareness in movement is not difficult to comprehend. Less obvious is the start of temporal awareness in motor delay. The child learns to respond to 'soon' with motor inhibition.

The ability to grasp and release that forms the starting point of attention control must be learnt first in such fundamental areas as walking and sleeping. It can also be seen in more complex concept development such as counting and number. At 6 months a baby can attend to only one block. By 9 months he can hold two and attend to a third. At 12 months several blocks can be manipulated at once. Counting to two is eventually achieved by 3 years of age.

Visual input is integral to all these developmental processes. Information gained by movement and touch is increasingly integrated with sensory input from the eyes as knowledge of the world begins to be assembled. Eventually vision and/or audition alone can provide information regarding the world beyond arm's reach. Furthermore, basic schemata such as attention control are vital to all sensory processing. They are equally evident in the emerging visual skills as in other sensory system organisation.

Rising up, visual search and grasping are signs of development to be looked for in the first few months. Awareness of hands, bringing hands together in the midline, sitting alone, wrist rotation, apposition of thumb and forefinger, rolling front to back, improved head control and the ability to hold the 'airplane position' are all significant accomplishments by roughly 6 months of age.

Crawling, creeping, a pincer grip, babbling recognition of familiar words and evidence of motor planning in actions such as bell ringing should be observable by 9 months. The concept of object permanence should also be arising at around this time. To the small baby objects only exist as they are experienced. The understanding that an object continues to exist apart from one's self requires the ability to hold a mental image of the object. When combined with the ability to search, the concept of object permanence is established.

The first birthday usually sees the ability to respond to simple instructions, instances of crossing the midline, standing alone and the ability to say a few simple words. Over the following 12 months walking is succeeded by running, vocabulary increases to around fifty words, a mental body map is constructed and vertical space is explored by climbing. Piaget's sensory/motor child becomes a preoperational child.

During the years leading up to school, language acquisition continues with its increasing ability to represent the world through symbols. Gross motor mastery also continues to grow. Jumping, balancing on one foot and kicking are examples of the type of skills observable. Increasing fine motor control is demonstrated in a number of ways. Pencil grip and the ability to copy increasingly advanced shapes is significant. Using such tools as zips and scissors is another pointer to improving fine motor control.

The Concrete Operational child begins to perform actions in the mind. Reversibility, classification, seriation and conservation are important concepts acquired during this period. Their appearance leads to the final Piagetian stage of Formal Operations with its developing ability to 'think about thoughts'. It is important to remember that it is the sequence of development that is important not the speed. Adequate time should be spent exploring possibilities and perfecting understanding at each level for the hierarchy of development to be sound.

In conclusion, it is our duty to thoroughly seek out all the information pertinent to a complete analysis of our patients' visual status. Therefore, the optometric history should, when indicated, include questions relating to the achievement of satisfactory early sensory motor development and the development of adequate visual perceptual skills.

Consideration of disruptive environmental influences such as disease, trauma, exposure to medication, poor nutrition and early deprivation of sensory stimulation are both significant to diagnosis and to the planning of an intervention programme. For the

same reasons, it is important to identify and trace early skews that have arisen without an attributable cause in the hierarchy of development.

An available indicator of satisfactory development is the successful attainment of memorable, culturally celebrated developmental milestones. Most parents can supply details of the age at which their child first crawled, walked and said a recognisable word. Some may be able to supply more detailed information.

Our aim is to decide whether current difficulties are simply the result of a mismatch between culturally determined expectations and an individual child's rate of development. The alternative is that they are the result of a skew in the path of development that has arisen when difficulty has been experienced in establishing particular schemata. This distinction is important to formulating our advice on treatment options.

When searching the answer to this question I came across the following quotation from 'The Little Prince' Antoine De Saint-Exupéry. I found it to be food for considerable thought.

"If I have told you these details about the asteroid and made a note of its number for you, it is on account of grown-ups and their ways. Grown-ups love figures. When you tell them that you have made a few friends they never ask you any questions about essential matters. They never say to you: "What does his voice sound like? What game does he love best? Does he collect butterflies?" Instead, they demand: - How old is he? How many brothers has he? How much does he weigh? How much money does his father make only from these figures do they think they have learned anything about him."

The gains of development are cumulative. Not only do the skills of a later stage build on those of an earlier one but the more basic skills should remain available for use as part of the adult's intellectual armoury. We want to know if those early skills are available to our patients. It is also interesting to reflect on whether we, as Optometrists, know how to ask pertinent questions.

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