

Vision Development: Birth-5 Years & Effects of Screen Time



Presented by:

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THE PROBLEM- An increased incidence of visual and other functional difficulties seen at our Optometry practice:

- **More pre-school children seen with poor postural control/lower & upper body**
- **Poor eye-motor control in following slow moving objects**
- **Children with the inability to sit still**
- **Learners at school reading without fluency and poor eye tracking skills**
- **Poor balance and depth perception**
- **Poor eye-hand coordination**
- **ADD/ADHD behavioural characteristics**
- **An increase in Myopia among younger children**
- **A greater need for Optometric vision therapy intervention**

Parents and teachers are very concerned and are asking?:

- **Can these visual problems be prevented or treated?**
- **Can I, as parent help my child to develop a healthy and functional vision?**
- **Is technology helping with this process or is it impacting negatively on my child's vision development?**
- **Is there a way of knowing whether my child's visual abilities and skill levels are adequate enough to cope with visual demands in preschool and in the formal classroom?**

**Yes, some can be
prevented and some,
treated and yes, you
can help your child !**

Key to resolving visual developmental problems:

1. By understanding aspects of the visual system and their function.
2. The risk factors that could interfere with normal vision development.
3. How environmental and cultural changes are impacting on vision development in the developing child.
4. Understanding how vision develops from birth to 5 years in a young child and how parental involvement could promote a healthy and foundationally sound developing visual system in their child/ children.
5. Understanding the potential impact of digital screen time on vision development and health of their young developing children

1. Lets talk about the Visual System..



Why is good functional vision that important?



**“When vision is working well,
it guides and leads, when it is not,
it interferes”- Dr John Streff**

Relationship between Vision and Movement....it's all about movement!

- Vision is learned; we are not born with vision, it needs to be developed!
- It is created through action and further developed through interactions and meaningful experiences involving vision, auditory, speech and thinking.
- Vision guides action and is created to derive meaning and serve the needs of the individual.
- Vision as an adult is the product of years of maturation and integration of all sensory experiences
- For successful movement, the brain uses information from the vestibular, visual and somatosensory systems to keep the eyes stable

Advances in technology...What can we learn and apply from Neuroscience?

- Advances in medical technologies such as, (fMRI) have allowed us to gather evidence through in vivo neuroimaging that MOVEMENT DEVELOPMENT & COGNITIVE DEVELOPMENT are more closely related than previously thought.

However.....

- Rapid advances in technology provide benefits and advantages across many diverse areas of life,....BUT....these benefits may not extend to the development of good foundations of movement in childhood.

Therefore we need to be asking....

- Has the digital age promoted a physically more active lifestyle among young developing children or rather, a sedentary one?

2. What are the risk actors placing an infant, toddler, or child at a significant risk for visual impairment ?

- Prematurity, low birth weight or prolonged supplemental oxygen
- Family history of retinoblastoma, congenital cataracts, or metabolic or genetic disease
- Infection of mother during pregnancy (e.g., rubella, toxoplasmosis, venereal disease, herpes, cytomegalovirus, or human immunodeficiency virus)
- Difficult or assisted labour, which may be associated with fetal distress or low Apgar scores
- High refractive error
- Strabismus
- Anisometropia
- Known or suspected central nervous system dysfunction evidenced by developmental delay, cerebral palsy, dysmorphic features, seizures, or hydrocephalus.

2(b). Warning signs that could indicate eye conditions requiring medical attention!

- Reddened eyes or lids
- Eyes tear often
- Encrusted eyelids
- Frequent sties on eyelids
- Different sized pupils
- White pupil/s
- Droopy lid/s



WARNING SIGNS!



Droopy lid/s, Squinting, Pupil sizes differ



White pupil/s & squinting

Role of Parents-Ensuring healthy vision in their children:

- Healthy eyes and good vision play a critical role in how infants and children learn to see.
- Eye and vision problems in infants can cause developmental delays. It is important to detect any problems early to ensure babies have the opportunity to develop the visual abilities they need to grow and learn.
- Parents play an important role in helping to assure their child's eyes and vision can develop properly. Steps that any parent should take include:
 - Watching for signs of eye and vision problems.
 - Seeking professional eyecare starting with the first comprehensive vision assessment at about 6 months of age.
 - Helping their child develop his or her vision by engaging in age-appropriate activities.

3. How are Environmental & Cultural factors impacting on the foundations of movement development in a young child?

- Many playgrounds have been stripped of certain styles of play equipment due to safety and litigation fears.
- Shrinking backyards in urban dwellings
- Many families have both parents in full-time work; less parental interaction with their developing infant/s and toddlers.
- Caregivers of infants and toddlers not experienced or trained in facilitating early childhood development
- Infants and toddlers exposed to Television viewing without any adult interaction/supervision or stimulation encouraging a sedentary lifestyle at a critical neurological phase in child development.
- Adults allowing excessive use of digital screen devices that unnecessarily restrict the developing child's natural movement.

4. Visual Development:

- Babies learn to see over a period of time, much like they learn to walk and talk.
- They are not born with all the visual abilities they need in life.
- The ability to focus their eyes, move them accurately, and use them together as a team must be learned.
- They need to learn how to use the visual information the eyes send to their brain in order to understand the world around them and interact with it appropriately.

Steps in Infant Vision Development: at Birth

*The following are some milestones to watch for in vision and child development. It is important to remember that not every child is the same and some may reach certain milestones at different ages.

- Babies cannot see well as older children and adults, eyes and visual system not fully developed
- Improvements are significant in first six months of life
- At birth poor eyesight, infant will blink in response to bright light or touching the eye
- Eyes are sometimes uncoordinated, may look cross-eyed
- New-borns can only focus or to stare at an object +/-20 cm away
- Initially fixes eyes on a face or light then begins to follow a moving object



At one Month:

- Can follow a slowly moving black and white target to midline
- Will blink at a flash light
- May follow faces and pictures with contrasting black and white images usually with eyes and head moving together/ no dissociation
- Visual acuity is still poor
- Ocular movements may often be uncoordinated
- Watches parent closely
- Tears begin to form



Two Months:

- Infants' eyes are still not well coordinated and may appear to wander or be cross-eyed
- However, if an eye appears to turn in ,out up or down constantly, an evaluation is warranted.
- Begins to be able to see an object as one image
- Brief fixation occurs, although ocular movements are still uncoordinated
- Attention may be possible a little closer now at about 15 cm away
- Beginning to be aware of colours, (primarily red and yellow)
- Baby should be able to bring his or her hands together



Three Months:

- Ocular movements coordinated most of the time
- Attraction to both black and white and coloured targets
- Infant capable of glancing at much smaller targets as small as 2.5 cm
- Interested in faces
- Visual attention and visual searching begins
- Infant able to associate visual stimuli and an event (e.g., the bottle and feeding)
- Babies begin to follow moving objects with their eyes and reach for things



Four Months:

- “Hand regard” occurs i.e. marked interest in the infants on hands
- He/ She reacts (usually smiles) to familiar faces
- Able to follow a visual target past the midline and track horizontally, vertically and in a circle
- Visual acuity estimated to be in the 20/200 to 20/ 300 range
- **Encouraging development at this stage:**
 - Use a nightlight or other dim lamps in your baby’s room.
 - Changes the crib’s position frequently and change your child’s position in it.
 - Keep reach-and-touch toys within your baby’s focus, about eight to twelve inches from their face.
 - Talk to your baby as you walk around the room.
 - Alternate right and left sides with each feeding.
 - **Baby should be able to turn his or her eyes together to focus on near objects**



FIVE MONTHS:

- Able to look at an object in their own hands
- Infant is visually aware of the environment and can shift gaze from near to far easily
- Can “study” or inspect objects visually at the near point i.e. now **able to converge the eyes** to do so
- Able to fixate on objects about 8cm from eyes
- **Depth perception** starting to develop as the eyes are capable of working together- perception of a three -dimensional view of the world!
- **Eye-hand coordination (reaching)** is usually achieved
- Colour vision is believed to good by 5 months not as sensitive as that of an adult

At 5 months:

- Baby should be able to **make the sounds for "P", "B", "T", "D", and "M"**



SIX MONTHS:

- **Eye movements are coordinated and smooth**
 - Vision can be used efficiently at both near and at a distance
 - **Infant recognizes and differentiates faces and can reach for and grasp a visual target**
 - **Hand movements are monitored visually**
 - Child may be interested in watching falling objects and usually fixates on where the object disappears
 - **Schedule your baby's first eye exam around 6 months of age!**
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- **Encouraging development at this stage:**
 - Lots of tummy time
 - Follows faces up, down, sideways, closer, farther
 - Make noises to the side so baby turns toward them
 - Change position frequently so their view of the world changes
 - Let baby bounce on the bed with support for both hands to encourage balancing
 - Lots of toys to touch, grasp, listen to and find with eyes and ears
 - **Encourage crawling and creeping!!**



Further development....

- **At 7 months:**
 - Baby should be able to **roll over independently**
- **At 8 months:**
 - Your baby should be able to **sit up without support**
 - Talk to your baby frequently so they can associate experiences with words.
 - Place objects on a highchair tray that can be pushed off and dropped to the floor.
- **At 9 months:**
 - Your baby should be able to **creep and crawl**
 - Can transfer objects from hand to hand; able to explore visually
 - Do not rush your baby into walking. Creeping on all fours is very important for developing coordination of both the body and the eyes!



9 To 12 Months:

- Watches faces and tries to imitate expressions
- Searches for hidden objects
- Can stare at small objects
- Visually alert to new people, objects and surroundings
- Differentiates between familiar and unfamiliar people
- Babies can now judge distances fairly well and throw things with precision



One Year:

- Both near and distant acuities are good
- Can watch objects that are moving fast
- Can discriminate between simple geometric forms (circle, triangle, square)
- Scribbles with a crayon
- Visually interested in pictures
- Now using both hands and visually steering hand activity (12-14 months)



12 months to 18 months:

- Now using both hands and visually steering hand activity (12-14 months)
- Visually interested in simple pictures (14-16 months)
- Often holds objects very close to eyes to inspect (14-18 months)
- Points to objects or people using words "look" or "see" (14-18 months)
- Looks for and identifies pictures in books (16-18 months)

Encouraging development at this stage:

- Language is developing quickly: use names for actions and objects
- Engage in water and sand play with containers, cups, pails, plastic bottles
- Provide crayons and large sheets of paper for creative scribbling
- Introduce to things to put together and take apart, fit shapes into spaces
- Pretend play: telephone, human and animal dolls

24 months to 36 months:

- Occasionally visually inspects without needing to touch (20-24 months)
- Smiles, facial brightening when views favourite objects and people (20-24 months)
- Likes to watch movement of wheels (24-28 months)
- Watches own hand while scribbling (26-30 months)
- Visually explores and steers own walking and climbing (30-36 months)
- Watches and imitates other children (30-36 months)
- Can now begin to keep colouring on the paper (34-38 months)
- "Reads" pictures in books (34-38 months)

Encouraging development at this stage:

- Running, tumbling & climbing
- Give lots of time to create and draw
- Play make-believe games, dolls, dress-up clothes, stories
- Assist as beginning to classify objects, colours, shapes
- Set up playdates as learning to socialize with one playmate at a time

40 months to 48 months:

- Brings head and eyes close to page of book while inspecting (40-44 months)
- Draws and names circle and cross on paper (40-44 months)
- Can close eyes on request, and may be able to wink one eye (46-50 months)

Encouraging development at this stage:

- Challenge child to dodge, throw, stop/go, turn sharp corners
- Set up times to encourage to play well in small groups
- Encourage manipulatives, puzzles, hidden pictures, likenesses /differences
- Give time for drawing, colouring, activities with clay and play-dough
- Read lots of books and stories together

4 years to 5 years:

- Uses eyes and hands together well and in increasing skill
- Moves and rolls eyes in an expressive way
- Draws and names pictures
- Colours within lines
- Cuts and pastes quite well on simple pictures
- Copies simple forms and some letters
- Can place small objects in small openings
- Visually alert and observant of surroundings
- Tells about places, objects, or people seen elsewhere

Encouraging development at this stage:

- Tells stories, makes up names, Talk and talk and talk...
- Intellectual development moves ahead quickly
- Fine motor development continues
- Provide lots of opportunities to explore these new abilities.

5. Research Findings:

Impact of increased Digital Screen Time on Vision, Attention & Learning and Eye Health in the developing young child:



Summary of References on the Effect of Screen Time on Refractive Error

- **Terasaki et al** : Time spent on computers and smartphones is associated with increased axial length.
- **Guo et al**: Time spent indoors studying and less time spent outdoors is associated with increased axial length.
- **Lin et al** : Time spent on near activities is associated with increased myopia, while time spent outdoors has no effect.
- **Öner et al**: Time spent reading and writing are associated with increased myopia while time spent on computers, watching television, and outdoor activities are not.
- **Wu et al**: Shorter working distance at near and less time spent outside is associated with increased myopia.
- **Pärsinnen et al**: Shorter working distance in childhood and less time spent outside is associated with increased myopia, especially in females. Time spent on near work during childhood affects initial myopia progression, but does not correlate with the degree of myopia in adulthood.
- **Conclusion**:
- **A Positive association exists between Handheld Device Use/at Near and Myopia!**

No Association Between Handheld Device Use/Near Demands and Myopia(Shortsightedness):

- Li et al:

Reading, computer use, video game use, and homework are not associated with an increase in myopia or axial length. Increased time outdoors is associated with decreased myopia presentation in non-myopic patients but not in patients who are already myopic.

- Jones-Jordan et al:

Little to no correlation is present between time spent on near work and myopia progression. Outdoor activities/sports also have no association to myopia progression.

- Lin et al:

Time spent on near activities is not associated with myopia. Increased outdoor activity is associated with decreased myopia.

Summary of References on the Effect of Screen Time on Attention and Learning

Increased Television viewing effects:

- **Simonato et al:**
- Increased time spent watching television in the toddler years is **associated with increased risk of poor eating habits, decreased student engagement and increased screen time in adolescence.**
- **Nathanson et al:**
- Increased time watching television and initiating television use earlier in life are associated with **decreased executive functioning in pre-schoolers. Higher quality shows and those lacking commercials are associated with improved executive functioning.**
- **Sharif et al:**
- Increased television watching on weekdays and access to cable movie channels is associated with **decreased academic performance.** Weekend television/video game use has no effect on academic performance.
- **Lingenini et al:**
- Increased television and/or computer use **is associated with ADHD** along with several other factors such as **depression, anxiety, and family status** among others.

- **Pagani et al:**
- Increased television watching in the toddler years is associated with **decreased kindergarten readiness measured through poorer number knowledge, decreased classroom engagement/attention, as well as social and emotional deficiencies.**
- **Duch et al:**
- Increased daily television viewing is associated with **poor language development/communication.**
- **Lillard et al:**
- Television viewing, particularly fantasy shows, are associated with **decreased executive functioning in 4-6 year olds.**
- **Nikkelen et al:**
- A meta-analysis of multiple studies finding that increased use of television and video games is associated with **ADHD-related behaviours.**
- **Suchert et al:**
- Television watching, video games, and computer/mobile phone use are all **associated with ADHD symptoms, while other inactive but not screen-based activities such as doing homework, reading, or listening to music are not.**
- **Anderson et al:**
- **Educational television programming is associated with improved academic performance while violent programming can have a negative effect.**

Computer/Handheld Device Use:

- Tong et al:
- **ADHD is associated with increased computer use on school days as well as increased use of computer or smartphone use near bedtime.** Also discussed differences in eating habits associated with ADHD.
- Huber et al:
- **Educational, interactive applications can positively affect executive functioning in preschool-age children while non-interactive media (video) does not.**
- Holton et al:
- **ADHD is associated with increased unhealthy lifestyle habits/behaviours in children such as increased screen time, consuming artificially sweetened beverages, and decreased reading at home among others.**
- Suchert et al:
- **Television watching, video games, and computer/mobile phone use are all associated with ADHD symptoms, while other inactive but not screen-based activities such as doing homework, reading, or listening to music are not.**

Summary of References on the Effect of Screen Time on Eye Health:

Blue Light/Retinal Health

- Chassiakos et al:
- The irradiance **of blue light from electronic devices with LED screens is below documented exposure limits even with extended use.** Blue blocking lenses are not clinically beneficial in improving vision, improving sleep, decreasing eye strain/fatigue, or preventing retinal disease.

- Simonato et al:
- The **blue light in LED displays can cause retinal cell damage.** This could be improved by using displays that irradiate lower levels of blue light.

- Nathanson et al: **Blue light can cause retinal cell damage,** though light in the 470-490 nm range is less detrimental than that of shorter wavelengths.

- Sharif et al:
- **Spectral irradiance of several lamps and electronic devices** (computer screens, tablets, laptops, smartphones) was measured and **found to be less than that of natural light irradiance even with extended viewing.**

Ocular Surface Effects:

- Lee et al:
- Short wavelength blue light can cause corneal **cell damage which may lead to corneal inflammation and dry eye.**
- Chu et al:
- Blink rate is not reduced during computer screen viewing, while the **rate of incomplete blinks is increased during computer use.**
- Moon, Lee et:
- Smartphones and general screen use are associated with an **increase in dry eye risk, while computer and television use are not.**
- Moon, Kim et al:
- Screen use such as that in smartphone, computer, and television use is **associated with increased dry eye.**
- Alves et al:
- An overview of dry eye in the paediatric population. Regarding screens, it suggests that increased time spent on computers/television may be associated with **an increase in dry eye incidence in paediatric patients.**

The American Academy of Pediatrics (AAP) (1999) has recommended that children younger than 24 months of age not be exposed to electronic screens!

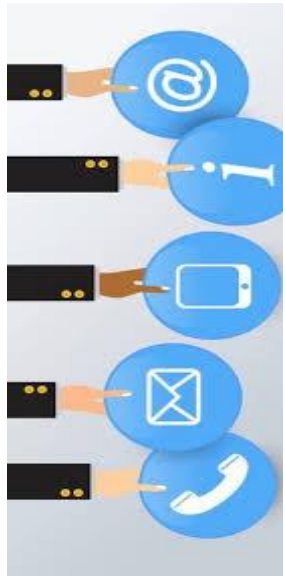


Thank You!





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Sources:

- ❖ Vision Development & Rehabilitation Volume 4, Issue 3
- ❖ September 2018
- ❖ American Optometric Association
- ❖ American Academy of Pediatrics (AAP)
- ❖ Infantsee
- ❖ COVD
- ❖ ACBO