Cerebral palsy and visual impairment

Although cerebral palsy mainly causes difficulty with movement, other conditions may also occur. This is because other parts of the brain may also be affected and this can lead to visual impairment because the brain makes sight from signals given to it by the eyes so what we see is in fact made in the brain.

What is the normal structure of the eye?

The eye consists of three parts:

- A light focussing bit at the front (cornea and lens)
- A light sensitive film at the back of the eye (retina)
- A large collection of communication wires to the brain (optic nerve)

A curved window called the cornea first focuses the light. The light then passes through a hole called the pupil. A circle of muscle called the iris surrounds the pupil. The iris is the coloured part of the eye. The light is then focused onto the back of the eye by a lens. Tiny light sensitive patches (photoreceptors) cover the back of the eye. These photoreceptors collect information about the visual world. The covering of photoreceptors at the back of the eye forms a thin film known as the retina. Each photoreceptor sends signals down very fine wires to the brain. The wires joining each eye to the brain are called the optic nerves. The information then travels to many different special ‘vision’ parts of the brain. All parts of the brain and eye need to be present and working for us to see normally.

The visual impairment that occurs in Cerebral Palsy is called Cerebral Visual Impairment (CVI).

What is Cerebral Visual Impairment?

Cerebral Visual Impairment (CVI) is a condition where some of the special ‘vision’ parts of the brain and its connections are damaged. This causes visual impairment even though the eyes are normal. Often children with CVI actually have good visual acuity but cannot ‘make sense’ of what they see. In most cases, once the damage has happened it does not get any worse. As the child gets older the visual difficulties may slowly improve.
How is the diagnosis made?

Many children with cerebral palsy will have visual impairment. It is often difficult to tell if a child has problems seeing because of other problems with communication, movement or learning difficulties. Sometimes it is the parent who notices that vision is impaired because of the way their child acts. If they discuss this with their family doctor an assessment can be arranged. Professionals and carers should always consider that a child with cerebral palsy might have some kind of visual impairment. If they suspect this an assessment should be organised.

CVI can be diagnosed in a child who has:
• visual difficulty
• damage to the ‘vision’ parts of the brain
• but apparently normal eyes

A head scan will usually confirm the damage to the brain. There are other special tests that can also be done which measure signals from the ‘vision’ parts of the brain when a child is shown patterns on a screen. This test is called a Visual Evoked Potential (VEP). Sticky patches are placed on the back of the head and attached to wires that lead to a machine. The machine records the electrical signals made by the brain. If the signals are reduced in size or slow then CVI is more likely.

Often the best way to find out if a child has Cerebral Visual Impairment is by an eye doctor asking questions to find out what kind of problems the child seems to be having. The questions are based on the visual difficulties that commonly occur in children with CVI. If a child has difficulties that are typical of the condition then they are very likely to have CVI.

What kind of visual difficulties is a child with CVI likely to have?

Most young children with Cerebral Visual Impairment feel their vision to be ‘normal’ as they have never known anything else but their own visual world. At first they assume that everyone else has vision the same as their own and do not realise that other people see things differently.

CVI can affect vision in many ways. All, or only one, of the special ‘vision’ parts of the brain can be damaged to different degrees. If there has been a lot of damage to many parts of the brain the vision can be very poor. However, the child may still see movement and bright lights. Complete blindness due to brain damage is rare. If there has only been a small amount of damage in only one part of the brain, the visual problem can be a lot less impairing. Children with CVI can have problems with:
• getting around
• recognising objects
• focusing for near objects
• fast eye movements
• visual field loss
What are the visual systems?

The many different elements that make sense of vision within the brain combine together to make two visual ‘systems’: the dorsal stream and the ventral stream.

The ‘dorsal stream’ helps the child to get around safely and quickly; pick up objects; avoid bumping into things and falling over. It is called a ‘stream’ because it is a flow of information about the visual world from one place to another like water flowing in a stream. ‘Dorsal’ describes the part of the brain where the system is. When the dorsal stream is damaged it is difficult to know precisely where things are in three dimensions. It can be difficult to:

- use stairs without falling
- step onto pavements without tripping
- reach forward and grab a cup or handle

Damage to the dorsal stream can also make it difficult to see a lot of different things at the same time. This means it can be difficult to find a toy on a patterned carpet or to see something that is pointed out in the distance amongst other things.

The ‘ventral stream’ helps us to recognise faces, objects and places. Damage to this system leads to problems:

- recognising familiar faces
- knowing what common everyday objects are
- losing the way in places that should be well known to the child

There are a number of other problems that can occur in children with CVI who still appear to have good vision. These include:

- difficulty remembering things they have seen
- difficulty imagining ‘seeing’ things in their minds
- some children’s vision can become ‘tired’ more quickly than others. This means that their ability to see can vary from one time to another
- difficulty reading: this can be due to lots of different reasons

Why is there difficulty with focusing?

Children with CVI can have difficulty focusing when looking at objects near to them. The focusing power of the eye needs to increase when looking at a close object. In children with CVI the focusing power can be reduced. It can also become tired more easily. This is the usual situation for most adults when they become 40 or 50 years old and they may need reading glasses. Some children with CVI may also benefit from reading glasses for the same reason.
Why is there difficulty with fast eye movements?

Children with CVI may have difficulty making fast eye movements or saccades. Saccade eye movements are used to quickly change the direction that our eyes are looking. This helps us look at something that has suddenly changed position. This is necessary so that the eyes can follow and fix accurately on a fast moving object, which then give clear signals to the brain to make clear vision. Fast eye movements are also important for reading. They help us to quickly move our eyes across the page of a text book. Saccades are important in many other visual tasks. Children with CVI may have difficulty making fast eye movements and may make quick head turns when looking round a room or reading rather than making fast eye movements.

What is visual field loss?

Visual field is the medical term for the full area that we can see: our visual world. If an area of our visual world is blurred or missing with the rest clear, then visual field loss is present. It is due to damage to some of the special vision parts of the brain. The right side of the brain is responsible for seeing the left side of the visual world, whilst the left side of the brain sees the right side of the visual world. If the right side of the brain is damaged the left side of the visual world may not be seen. In the same way the upper part of the back of the brain is responsible for seeing the lower part of the visual world. Therefore a child with damage in this area will not see the ground when looking straight ahead and may tend to trip over things.

What can be done to help?

There are no medicines or surgical treatments that will fix or improve brain damage. There are however lots of things that can be done to help children with CVI make the most of their vision.

We use our vision to get around, learn new things, meet people and make friends. It is important to consider what your child’s particular problems with vision might be now and in the future. If your child has been prescribed spectacles, contact lenses or a Low Visual Aid (LVA) it is important that they are encouraged to wear and use them. This will help your child see more clearly and ensure the vision parts of the brain grow and develop.

Problems at school may be due to some of the text books being hard to see. This often means it takes longer and more effort to do the work. If the size of the print is increased and letters and words spaced more widely most children will find schoolwork easier. Good bright lighting and crisp black print on a clean white background will also make things easier. Sometimes placing books on a slope, which tilts the print towards the child, will improve reading speed as well. When reading it can be helpful to read one line at a time through a ‘letter box’ placed over the page. Placing a piece of blue tack below the line they are reading, at the beginning of the next sentence, can help some children find their way back to the start of the next line more quickly.
Some children may also benefit from using a computer programme while reading. The programme only shows one word of a sentence at a time and the word is in the middle of the computer screen. This reduces the need for fast eye movements. It can increase reading speed and reduce tiredness. One programme is called ACE READER, but there are many others. A demonstration can be downloaded from www.acereader.com

It is also worth watching carefully to find out what are the smallest toys that a child can see and play with and when playing together trying only to use toys that are the same size or bigger. Placing one toy on a plain background will often help children see it more easily. Whereas, placing lots of toys of different size and colour close together on a patterned background can make them ‘invisible’ to many children with CVI.

Recognising facial expressions can often be difficult. It is worthwhile trying to find out at what distance facial expressions can be seen and responded to and then always trying to talk and smile from within this distance. This helps a child to learn what facial expressions mean and to copy them. There is a special part of the brain that helps children ‘make sense’ of faces. Sometimes this part is also damaged. These children may have difficulty responding to smiling even if their vision is clear enough. If the child has visual field loss, try to place objects in the part of the child’s vision that is working.

Cerebral Visual Impairment commonly occurs in children who have difficulty controlling both head and eye movements. Careful positioning of the head to prevent it falling to the side or falling forward can help a lot.

Infants and young children need to learn about the world around them. Home visiting teachers, physiotherapists and occupational and speech therapists may all add to the child’s care and education. It is important to continue the programmes that they recommend. If the child is involved in family activities, vision can improve and new skills can develop.

This document is not a substitute for a consultation with a Health Professional and should not be used as a means of diagnosing a condition.

Further Reading

This is a book about cerebral palsy and visual impairment in children, which gives explanations of cognitive visual impairment and cerebral palsy and offers detailed case studies.

This resource can be borrowed from our library or viewed or downloaded from: http://www.ssc.education.ed.ac.uk/resources/vi&multi/cpvi/SSreport.pdf
Our Advice Service
Advice Service Capability Scotland is a national disability advice and information service. We specialise in information on cerebral palsy.

We offer:
- information on Capability Scotland services
- advice on cerebral palsy
- general advice on disability issues

We also have a small lending library with resources about cerebral palsy and children's books about disability.

You can get in touch with us by calling, e-mailing, dropping in or writing a letter.