

Difficulties seeing and hemiplegia

Information resources

About this information

Some children and adults with hemiplegia may have difficulties with certain aspects of seeing. This information sheet explains how we see, which aspects of seeing may be affected in people with hemiplegia, and how these issues can be identified and managed.

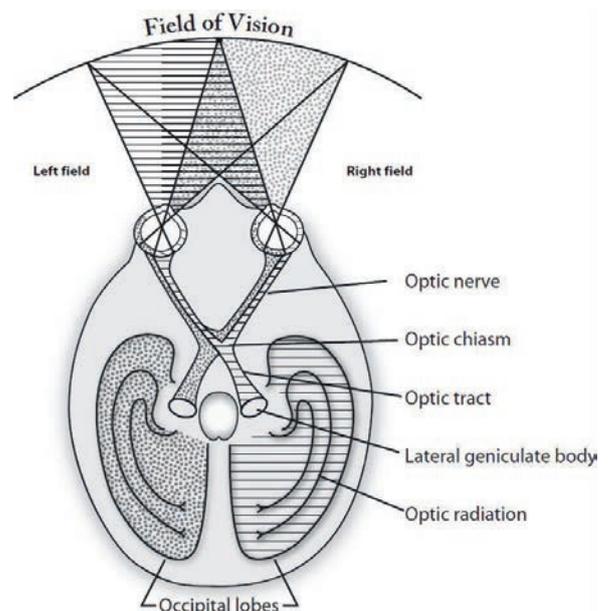
This information sheet has been written with children in mind but it's equally relevant to adults with hemiplegia. Where possible we try to avoid using medical jargon but we have included some complex terms because doctors and other health professionals may use them.

How we see: eyes and brain working together

The eyes work like a pair of cameras to form an image to send to the brain. The cornea is the curved front part of the eye, the iris is the coloured part and the pupil is the hole in the middle. Behind the pupil there is a clear lens. At the back of the eye is the retina.

Together, the cornea and lens bend the light rays entering through the pupil so that they come into focus on the retina. This process of light bending is called refraction. A **refractive error** leads to a loss of focus. The lens can change shape so that objects at different distances can be seen clearly. This process is called **accommodation** (see 'Eye function impairments' section).

The light sensitive cells in the retina are called rods and cones; they convert the picture on the retina into tiny electrical signals which run along the optic nerves, through the brain to the back part, called the occipital lobes.



On their way to the brain, the two optic nerves join in a crossover junction, so that the messages from the two eyes are mingled. In this way, the picture of what we see to our left (with each eye) is created in the right side of the brain, and the picture of what we see to our right (with each eye) is created in the left side of the brain. The brain 'knits together' the images received by each eye and this helps to create 3D vision.

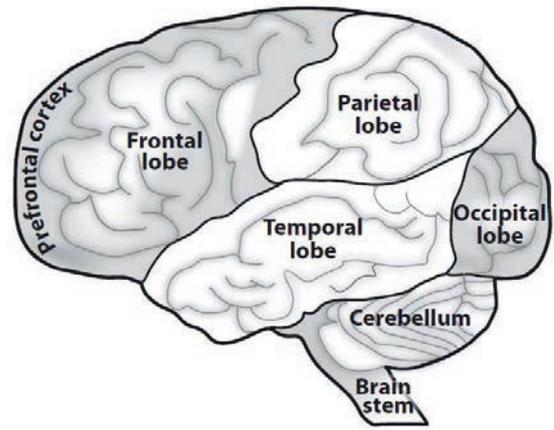
Several parts of the brain work together to create the picture that we see:

The back of the brain (the **occipital lobes**) analyses the picture information from the eyes for clarity, colour, shades of grey, and the extent of the area that can be seen – called the visual fields.

The parts of the brain just behind the ears are called the temporal lobes. These contain a powerful 'search engine'. The information from the occipital lobes is sent here along a pathway called the 'ventral stream'. This information is compared with our own stored picture information: if it matches, the picture is recognised. If it does not, the brain learns to recognise it in the future.

Above the temporal lobes are the **posterior parietal lobes**. They receive the information from the back of the brain along a pathway called the dorsal stream. From this they construct a 3D map of our surroundings.

What we are looking at is seen and interpreted in the temporal lobes. The posterior parietal lobes map the scene, so that we can use our vision to guide our movements. The **frontal lobes** help us to focus our attention on certain items in the overall visual scene. They are closely linked to our conscious recognition vision in the temporal lobes, which tells us what things are, and our non-conscious mapping vision, which tells us where things are.



Visual impairments and hemiplegia

Children with hemiplegia can have difficulties with many aspects of eye function and vision. As hemiplegia results from an injury that affects one side of the brain more than the other, this may result in visual field defects (see below). A hemi-field defect is the type of visual impairment that doctors may most commonly suspect in your child. However, it is important to be aware of the other eye and other potential visual difficulties.

Eye function impairments

Refractive errors: these are focusing issues and can be corrected through wearing spectacles. An eye test called Refraction, which will identify this problem, is carried out by an optometrist or ophthalmologist.

- Myopia or short-sightedness: when looking at distant objects, the image falls in front of the retina and so vision is blurred. Near objects can be seen clearly. Glasses to correct the issue appear to suck the edge of the face inwards.
- Hypermetropia or long-sightedness: when looking at near objects, the image falls behind the retina and so vision is blurred. Distant objects are usually seen clearly. Glasses to correct the issue make the eye look bigger.



- Astigmatism: the curvature of the eye is uneven, causing uneven image placement. Glasses can correct the issue.

Squint: the eyes are not straight. If the brain receives very different images from each eye it cannot knit them together and may start to 'switch off' the vision from one eye, causing vision in it to be reduced. This is called amblyopia, and can be treated by patching the unaffected eye. This type of treatment is usually undertaken by an orthoptist working in an eye clinic.

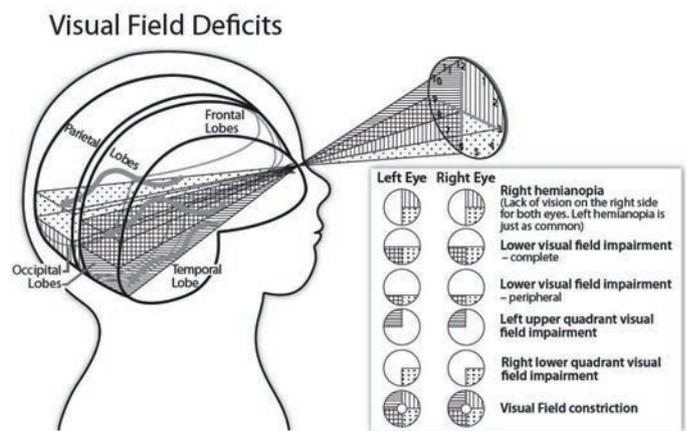
Accommodative difficulties (when the lens fails to adjust its shape): near objects may not be seen clearly. An optometrist or ophthalmologist can test for this and glasses can help.

Eye movement difficulties: these can affect the movements needed to follow a moving object, or when shifting gaze from one thing to another. Eye movement issues can usually be overcome by moving head and eyes together.



Visual field defects

In hemiplegia, if the brain injury affects the back part of the brain, vision can be lost or disturbed on the opposite side of the injury. Because some of the information from each eye is sent to both sides of the brain, half of the field provided by each eye may be affected. This is usually called a hemi-field defect or a **hemianopia**.



If the left side of the brain has been injured, causing a right hemiplegia, then there may be loss or impairment of vision to the right side of the body, and vice versa. Lack of vision to the right in each eye is called right hemianopia and lack of vision to the left in each eye is called left hemianopia. Sometimes the word homonymous hemianopia is used: this means that the vision on the same side in each eye is lost.

There are other patterns of field defect depending on the exact location of the brain injury, but hemi-field defects are most likely in hemiplegia.

How do we know if visual field defects are present? Children and young people may not be able to report what they can't do or see and may not be aware that their experience is different from that of other children. Field defects may be 'suspected' either because a health professional considers it a likely issue, or because of what can be observed. Remember however, that there can often be more than one explanation for some observations.

What can be observed? If you are a parent, observe what your child does and doesn't notice in a variety of situations. Does your child often seem to turn his/her face in one direction? Notice what your child sees when seated at the meal table, or on the floor with toys all around. Does s/he seem to 'miss' anything to either side? How does s/he react when something appears on one side from behind? When your child is walking or moving, notice whether s/he bumps into things on one side.

Visual fields can be tested by a method known as 'confrontation testing'. The tester asks the person to look straight at them, and then introduces an object into different parts of the visual field. The person being tested reports when they can see the object. This test can be carried out in young children but it can be difficult as it depends on a child understanding the instructions and cooperating. In very young children useful information can still be obtained by observing when a child turns to look at something introduced from behind. This is sometimes called modified distraction testing.

Very detailed visual field testing can be carried out using specialised equipment called a perimeter, available in an eye clinic. Many children from about the age of eight years can do this type of test.

Continued observations over time are very important: sometimes a visual field defect may be suspected or assumed and described in medical letters, but this should always be clarified by testing as far as is possible. As limb movements are also limited, this can also affect your child's ability to reach or move on one side.

What can be done to help?

- When playing with your child, seat yourself on your child's unaffected side so that s/he is aware that you are there.
- Position your child so that his/her unaffected side is facing towards the room rather than the wall.
- From time to time place objects on your child's affected side to encourage turning and looking at the affected side.
- Be aware of likely obstacles that your child may not see when moving around independently.
- Do not discourage any body or head movements that your child may make spontaneously when searching or reaching.

Of course, guidance from therapists treating your child's hemiplegia must also be considered, depending on his/her current treatment goals.



Hemi-inattention Sometimes there may be a relative lack of awareness in part of the visual field, rather than an actual lack of visual field – this is hemi-inattention. Your child may not notice things placed in the affected area when they are attracted by an object in the unaffected area. However, if that object is removed, they have more attention available to ‘notice’ objects in the affected part of their visual field.

Reduced visual acuity

Visual acuity means clarity of vision or how sharply focused something appears. Reduced visual acuity means that things appear less clear than they should. Things will look blurred or ‘out of focus’. Visual acuity can be affected by a refractive error (see previous section) and correction by glasses can restore normal visual acuity. However, any injury affecting the brain can reduce visual acuity and this will not be correctable with glasses.

Visual acuity can be measured by specialists using cards which show pictures or letters. Your child does not have to be able to talk to have this type of test. If visual acuity is reduced, then your child may have difficulty in seeing small detail.



Visual perceptual impairment

Vision begins with visual detection (seeing that something is there). Visual perceptual skills are those skills which support a rich interpretation of what is seen, and include the ability to recognise shape, form and size despite circumstances which might limit the capacity to do so. For example, visual perceptual skills underlie the ability to see shapes as distinct even when they are overlapping, or to see the whole of something despite parts being missing.

Visual perceptual skills are useful in a variety of everyday tasks, and support the development of academic skills such as reading, writing and mathematics. Visual perceptual difficulties are found in a small proportion of children with all types of cerebral palsy. Children with this type of impairment may have difficulties with putting puzzle pieces together, or with copying or drawing. They may also have difficulties coordinating vision and movement, sometimes called visuo-motor integration.

Identifying visual perceptual and visuo-motor impairments

Formal testing can be carried out in children from the age of four. These tests should ideally be considered alongside what else is known about your child’s learning and academic achievements.

What can be done to help?

Specific tasks may be recommended to see if your child’s skills can improve. However, these skills cannot always be ‘learnt’ and may not improve with practice; a more practical approach is often to help your child use their strengths or other strategies to achieve a given goal.

Will any of these eye or visual impairments cause my child to have difficulties learning to read or write?

You and your child's teacher will work together to introduce her/him to letters and early reading activities at the right time. Many issues already mentioned could have some impact on your child's ability to make steady progress with reading and writing. And there are also other difficulties relating to hemiplegia that can affect some children's progress with these skills. Your child's teacher and therapists should be able to work together to find out why your child might be having difficulty and the best way to help.

Other difficulties seeing

Sometimes other difficulties with vision may occur in children with hemiplegia. When brain injury, rather than eye abnormality, causes vision difficulties this is called cerebral visual impairment. Visual field defects and eye movement issues are part of the cerebral visual impairment 'spectrum'.

Many other types of visual difficulty have been reported in children with brain injury and some of these are described below. It is important to remember that these issues do not occur in all children with hemiplegia or other forms of cerebral palsy.

- Difficulty recognising faces or facial expressions. Face recognition difficulty is called prosopagnosia.
- Difficulty finding things in cluttered environments or when things are not in their usual position.
- Difficulty route finding.
- Difficulties with aspects of depth perception: a change in floor covering may be seen as a step even where there is none present.
- Difficulties with visual attention – this can include getting tired more quickly than another child during activities that require sustained visual effort, or finding it hard to look at a given object in a sustained way.

Acknowledgement

The illustrations used in this resource were designed by Professor Gordon Dutton, who holds copyright for them, and created by Angela Dowd, for the book *Vision and the Brain*.



How can HemiHelp help you?

HemiHelp:

- has a Helpline staffed by professionals who have personal experience of hemiplegia (**0345 123 2372**) – **helpline@hemihelp.org.uk**
- runs a UK-wide home visiting service
- has an extensive website with free information downloads
- has a Facebook group and Twitter feed (**@hemihelp**)
- puts members in touch with others who have faced similar issues
- produces a magazine where members can share information and experience
- runs regular conferences around the UK for parents and professionals
- has a transition support service for young adults including employment workshops, 1:1 support, and work placements
- membership is from £10 a year and benefits include HemiHelp's quarterly magazine, access to our services and schemes and priority booking at HemiHelp events

We can provide references for this information resource. Please contact us at **support@hemihelp.org.uk**

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