Cerebral Palsy and Visual Impairment in Children: Experience of collaborative practice in Scotland

CPVI Working Group:
Scottish Sensory Centre / Bobath Children’s Therapy Centre Scotland
CEREBRAL PALSY AND VISUAL IMPAIRMENT IN CHILDREN: EXPERIENCE OF COLLABORATIVE PRACTICE IN SCOTLAND

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Edited by
Marianna Buultjens and Heather McLean

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FOREWORD

I am delighted to have been asked to write a foreword for this timely and very significant book on cerebral palsy and visual impairment in children. It will be of enormous practical help to professionals in the field of visual impairment both in education and health and equally important to parents and carers who are seeking to understand their child’s difficulties. The explanations of cognitive visual impairment and cerebral palsy are lucid and accessible and I believe the detailed case studies will assist colleagues to mobilise appropriate support for children and young people in educational and other settings so as to maximise their learning potential.

The team who have contributed to the book have extensive research and clinical experience and their collective skills shine through in the text. As a practising community paediatrician working in the field of neurodisability, I commend this book with great pleasure. I am sure it will make a difference to the lives of many children and their families.

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26th September 2003
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PREFACE

Moving Forward

Marianna Buultjens and Heather McLean

In November 2000, the Scottish Sensory Centre and Bobath Children’s Therapy Centre Scotland organised a workshop on ‘Cerebral Palsy and Visual Impairment’ (CPVI). The aim was to encourage discussion on and sharing of knowledge and strategies on this topic in order to benefit children with CPVI and their families. A group of professionals from many backgrounds volunteered to take forward the aims of the workshop and became known as the ‘Working Group on CPVI’.

How to share knowledge and ‘know-how’ with each other and with parents in a language free of professional ‘jargon’ was one of the challenges. As a result of discussion during the meetings of the group and writing for the group, a structure for a publication emerged. This was shared with a group of professionals and parents at a second workshop, where useful suggestions guided the future direction of the group.

At this point it was decided to invite additional ‘writers’ to join in the process to complement the range of existing members. The result is this publication. In preparing it we all learnt a lot and we hope that by sharing the most up-to-date information on CPVI and collaborative practice in Scotland every child and young person with cerebral palsy and visual impairment in Scotland will benefit.

Acknowledgements

We would like to thank the Scottish Executive Education Department (SEED), who contributed financial support for this publication, including the funding of 500 copies to be distributed free of charge. The SEED are the main funders of the Scottish Sensory Centre, which hosted the meetings of the working group and organised the publishing of the document.

Thanks to Bobath Children’s Therapy Centre Scotland for enabling Heather McLean to give time to this project and to the James & Grace Anderson Trust for contributing financial support for Heather’s time.

We are grateful to the Education Authorities, Schools, Health Boards, Hospital Trusts, which allowed their staff to take part in this worthwhile task and made it possible.

Thank you to Dr Lea Hyvärinen who has given us permission to include illustrations of her tests.
A big ‘thank you’ to those who gave their own time, especially parents and young people. Their collaboration and insights have enriched our document.

We are pleased to acknowledge the ongoing help from Helen Robertson, Sheila Mackenzie and the desktop publishing skills of Ruth Simpson used in preparing the document for publication. Also, thanks to Jean Campbell for proof-reading.

Dedication

‘Cerebral Palsy in Children: Experience of Collaborative Practice in Scotland’ is dedicated to all children with cerebral palsy and visual impairment in Scotland and their families.

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## Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADL</td>
<td>Activities of Daily Living</td>
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<td>AHP</td>
<td>Abnormal Head Posture</td>
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<td>CP</td>
<td>Cerebral Palsy</td>
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<td>CPVI</td>
<td>Cerebral Palsy and Visual Impairment</td>
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<td>CVI</td>
<td>Cerebral Visual Impairment</td>
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<td></td>
<td>Cortical Visual Impairment</td>
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<td>IEP</td>
<td>Individualised Educational Programme</td>
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<td>LVA</td>
<td>Low Vision Aid</td>
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<td>MDVI</td>
<td>Multiple Disability and Visual Impairment</td>
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<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<td>O&amp;M</td>
<td>Orientation and Mobility</td>
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<td>OT</td>
<td>Occupational Therapist</td>
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<td>SEN</td>
<td>Special Educational Needs</td>
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<td>PTVI</td>
<td>Peripatetic Visiting Teacher of the Visually Impaired</td>
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<td>TVI</td>
<td>Teacher of the Visually Impaired</td>
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<tr>
<td>VEP</td>
<td>Visual Evoked Potential</td>
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<td>VI</td>
<td>Visual Impairment</td>
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<td>VTVI</td>
<td>Visiting Teacher of the Visually Impaired</td>
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CHAPTER 1

Introduction to Cerebral Palsy and Visual Impairment

Andrew Blaikie

How common is cerebral palsy?

For every 1000 new births in Scotland it is thought that about 2 to 3 children will have cerebral palsy. This means that in Scotland, where there are about 1 million children under the age of 16 years, there are about 2000 to 3000 children with cerebral palsy.

What is cerebral palsy?

Cerebral palsy (CP) is a condition that affects both movement and sensation. It is caused by damage to different parts of the brain. The damage may occur before birth, at birth or in early childhood. Some children’s movement might be mildly affected while others will be more severely affected. Often at birth it is not possible to identify which type of cerebral palsy the child will have; the movement difficulties will become more obvious as the child grows and develops. Depending on where the damage to the brain has happened, the child may have other associated impairments: epilepsy; visual impairment; hearing impairment; communication; eating and drinking; emotional/behavioural; cognitive.

There are three main types of cerebral palsy which describe the difficulty with the child’s movement:

1. **Spastic cerebral palsy**
   Children with this type may find their muscles becoming very stiff and weak, especially under effort. This can reduce the amount of movement they have and they can be fearful of the movement because they cannot balance easily.

2. **Athetoid cerebral palsy**
   Children with this type of cerebral palsy often lose control of their posture and will make often continuous and unwanted movements that they cannot control.

3. **Ataxic cerebral palsy**
   Children with this type of cerebral palsy have lack of balance and demonstrate jerky movements. This description of their movement includes how they would move a body part, e.g. when reaching for a toy, as well as movement of their whole body for the purpose of moving around their environment.

While movement is described as being mildly to severely affected, ability to participate in everyday life is affected by the combination of the movement impairment and the other
associated impairments. Therefore the child may be described as having a mild movement impairment but have a severe impairment in taking part in everyday activities, e.g. play, eating and drinking, dressing or communicating.

Did you know, up to 70% of children with cerebral palsy also have a visual impairment?

Nobody is too sure exactly how many children with cerebral palsy also have difficulties with vision. However research has shown that up to three-quarters of all children with cerebral palsy have some kind of visual impairment (Sonsken, Petrie & Drew, 1991).

The reason nobody is too sure of the exact figure is because the types of visual impairment that children with cerebral palsy have, vary so greatly. Because damage to the brain is usually the cause of visual impairment in children with cerebral palsy, there are many more kinds of visual difficulties that may develop. It is not simply visual acuity that may be reduced. Children with cerebral palsy may have:

- reduced visual acuity;
- visual field loss;
- difficulty using their vision to move parts of their body or to move around;
- difficulty recognising objects;
- problems focusing for near objects;
- short or long sightedness;
- problems making accurate fast eye movements;
- problems keeping fixation still on an object.

Visual impairment does not just mean having poor visual acuity (sharpness of vision). It is many more things. In children in whom the eye is the cause of visual impairment, usually only visual acuity is affected. This is more straightforward to measure and it is easier to say for sure whether the child is visually impaired or not. The visual difficulties seen in children with cerebral palsy are more complicated to assess and describe. For these reasons nobody is too sure how many children with cerebral palsy also have visual impairment. All these visual difficulties together are often called cerebral visual impairment or CVI for short.

How do we see?

What we see is in fact made in the brain from signals given to it by the eyes.

What is the normal structure of the eye?

The eye is made of three parts:

- a light focusing 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 its 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.

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 worse. As the child develops the visual difficulties may slowly improve along with improvement of motor skills.

How is the diagnosis of visual impairment made?

It is often difficult to tell if a child with cerebral palsy has problems seeing because of other problems with movement, communication or learning difficulties.

Sometimes it is the parents who notice, by the way their child acts, that vision is impaired. If they discuss this with their Family Doctor an assessment can be arranged. Doctors, teachers and other carers should always consider that a child with cerebral palsy might have some kind of visual impairment. If they suspect a child to have visual impairment 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.

However it is important to bear in mind that the child with cerebral palsy may have CVI as well as an eye condition that affects acuity or control of eye movements. A head scan will usually confirm the damage to the brain to confirm a diagnosis of cerebral palsy, but not all children will have had such a test.

There are other special vision tests that can also be done. These tests measure signals from the ‘vision’ parts of the brain when a child is shown patterns on a screen. Sticky patches are placed on the back of the head. The sticky patches are attached to wires.
that lead to a machine. The machine records the electrical signals made by the brain. The record of the signals will help the doctors decide what the matter is. If the signals are reduced in size or slow, then CVI is more likely. This test is called a Visual Evoked Potential (VEP). It is also uncommon for children with CP to have these tests done.

Often the best way to find out if a child has CVI is by asking questions or observing the child during everyday activities. An eye doctor (ophthalmologist) can find out from the parents and other professionals involved with the child what kind of problems he seems to be having. The doctor’s questions are based on their knowledge of the visual difficulties that commonly occur in children with cerebral palsy and CVI and they should be followed up by observations made by all those involved with the child.

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

Most young children with cerebral palsy and CVI 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.

Cerebral visual impairment 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 lots 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 been only a small amount of damage in only one part of the brain, the visual problem can be a lot less of an impairment.

**How does the brain make sense of what the eye sees?**

The many different ‘vision’ parts of the brain combine together to make two visual ‘systems’ or ‘streams’; the ‘dorsal stream’ and the ‘ventral stream’.

**The ‘dorsal stream’ helps the child move in space**

This system helps people to get around safely and quickly. It also helps people pick objects up and avoid bumping into things and falling over. The visual system that tells the body how to move is called the ‘dorsal stream’. 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 (the upper part of the brain).

When the dorsal stream is damaged it is difficult to know precisely where things are in three dimensions. It can be difficult to:

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

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 a child recognise objects

The other system, called the ‘ventral stream’ helps us to recognise faces, objects and places. ‘Ventral’ describes the part of the brain where the system is (the lower part of the brain). 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.

Children with CVI can have difficulty focusing when looking at near objects

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. When this happens many adults need reading glasses. Some children with CVI may also benefit from reading glasses for the same reason.

Children with CVI may have difficulty making fast eye movements

‘Fast’ eye movements are called saccades. We use saccade eye movements to quickly change the direction that our eyes are looking. This helps us look at something that has suddenly changed position. This is so the eyes can follow and fix accurately on a fast moving object. The eyes can then give clear signals to the brain to make clear vision. Fast eye movements are also important for reading. They help us to move our eyes quickly across the page of a reading book. Saccades are important in many other visual tasks.

Children with CVI may have difficulty making fast eye movements. These children may
tend to make quick head turns when looking around a room or reading, rather than making fast eye movements.

By using a few tips described in the ‘What can be done to help?’ section children with this difficulty may find reading a bit easier.

**What is visual field loss?**

Visual field is the medical word 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 relationship between brain damage and visual field loss is the opposite to what you might think.

The right side of the brain is responsible for seeing the left side of the visual world. 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. A child with damage in this area will not see the ground when looking straight ahead. The child may then 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 cerebral palsy and CVI make the most of their vision.

We use our vision to get around, learn new things, and to meet other 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 Vision 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 reading books being hard to see. This often means it takes longer and more effort to do the work. If the size of 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 reading 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 program while reading. The
program only shows one word of a sentence at a time. 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 program is called ACE READER. There are many others. A demonstration can be downloaded from www.acereader.com.

It is also worth watching carefully to find out what the smallest toys are that a child can see and play with. Then try only to play with toys that are the same size or bigger. Placing one toy on a plain background will often help children see it more readily. Placing lots of toys of different sizes and colours close together on a patterned background can make them ‘invisible’ to many children with CVI.

Recognising facial expressions can often be difficult. It is worth trying to find out at what distance facial expressions can be seen and responded to. Then always try 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. This might also involve careful positioning of the child’s whole body which in turn will assist in gaining the best position of his head.

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.

Even if a child has very poor vision many useful and practical things can be done to improve the ability of the child to move, interact with other children and learn.

Reference

CHAPTER 2

A more detailed look at Cerebral Palsy

Heather McLean

The following is intended to provide an introduction to cerebral palsy and is written from a Bobath perspective.

Cerebral Palsy

Cerebral palsy (CP) is the most common physical disability in childhood. The incidence ranges from 2 to 2.6 per 1000 live births in industrialised countries. (Hagberg, Hagberg, Olow, & van Wendt, 1996)

**Definition**: Cerebral palsy is defined as a permanent, though not unchanging disorder of **posture and movement**, due to a non-progressive lesion to the immature brain. (Brett, 1991)

Although this definition describes cerebral palsy, it only provides a brief outline of the disorder, and the impairments that result are only explained in terms of movement. There is much more that needs to be understood about this diagnosis:

- the impairment of movement that the child presents with; and
- the associated impairments that occur concurrently as a result of the brain damage, e.g. visual impairment, hearing impairment, learning difficulties and sensory processing impairment.

All of these impairments may interfere with the child’s ability to move, explore and interact with the environment in terms of play, self-care, dressing, eating and drinking, communication and mobility. The abilities and disabilities of each child (I will use he/his/him when talking about a child as there are more boys than girls affected) will be unique to him, which highlights the need for careful assessment of the child’s skills. The complexity of each child will also be unique and emphasises the importance of the need for teamwork, with sharing of knowledge between the child, family/carers and all professionals involved, to gain as clear a picture as possible of the child's needs and wishes in order to direct services appropriately. This comprehensive assessment and ongoing intervention will help to maintain the child's functional skills at as high a level as possible into adulthood. For some children with severe physical impairment this focus may be one of prevention of development of tight muscles with loss of joint movement (contractures), and prevention of development of permanent joint structure and soft tissue structure changes which result in abnormal joint position (deformity). These changes can affect the child’s level of ability, both of his mobility and potential to access the
environment. It is important to understand the possible future development of these contractures and deformities, which can reduce the functional possibilities for the child. The following descriptions of the types of motor impairments will help to provide a picture of how the children move and the potential for them to develop patterns of movement or changes in their muscles and other soft tissues, which can be detrimental to functional skills. However, it will also help to highlight that it is possible to help the child to learn to move in a more normal way, therefore reducing the risk of development of poor patterns.

**Current causes (aetiology) of cerebral palsy**

Many children with cerebral palsy present with a number of the above listed impairments. In more recent years there has been an increased survival rate of infants who are born prematurely. The time when the damage occurs in the brain is the key factor. This has an impact on the extent of the brain damage; there are particular times during the development of the foetus when the brain is vulnerable. From clinical experience and a review of the literature there appear to be differences in the presentation of infants who are born prematurely or born at term. These are briefly outlined below as they can present with a recognisable picture that is relevant to their responses to the learning environment.

**Pre-term**

- In general the child’s postural tone is such that it is low around his trunk (proximally) and higher in his limbs (distally).
- The increased incidence of cerebral visual impairment.
- The clearer identification of sensory processing deficits involving the child’s response to touch and movement.
- These children often have difficulties being able to self soothe.
- The child often has difficulties learning to filter only the pertinent sensory stimulation from the environment at one time, i.e. not to be reacting to every stimulus in the environment, which results in difficulties maintaining attention to a single task.

**Term**

- Severe brain damage - more likely to be greater global damage to a larger area of the brain. This can result in more of the body being affected by the motor impairment.
- Severe tone problems - disruptive of attention, learning and functional skills.
- Severe visual impairment.
- Severe management problems due to the complex nature of his movement impairment - eating, sleeping, positioning in equipment.

**What are the different types of motor impairment seen in the child with cerebral palsy?**

A number of classification systems have been designed to group different types of motor impairment. One reason for this is that it is important to understand how the child moves
in order to identify the best means of assisting him to develop greater control of his movement. Another reason is to help predict the future difficulties the child may experience due to the movement impairment and again put in place the correct management to minimise deterioration.

In the definition referred to above there is an inherent understanding that *posture and movement* provide a basis for humans to carry out complex functional skills such as dressing, driving a car, writing, etc. Therefore a disorder of movement will result in impairment of function. The children we are considering in this text also have a visual impairment, so we must consider the added impact of the visual impairment on movement and vice versa.

The following words are used to describe the child’s posture and movement. The terms used describe the state of the child’s muscle tone, e.g. high tone = Hypertonus = spasticity (the most common); low tone = hypotonia; changes in tone between high and low = fluctuating tone = Athetosis.

**Postural tone** is used to describe the ‘process’ by which there is an increased activity level in the muscles, which we need to make use of to enable us to stand upright and move our limbs against gravity, to achieve independent movement (Shumway-Cook & Woollacott, 1995). For example, our postural tone will be lower when we are well supported in a comfy chair and relaxing and will be higher if we attempt to walk across a tightrope; to begin with the muscles will have to become more active in order to support us in standing, and then the effort and concentration of the task will cause us to increase the activity in our muscles further, in an attempt to reduce the risk of falling off the tightrope.

**Impact of EFFORT**: within all of the classifications of the motor impairment it is essential that we consider the impact of the child’s own effort on his movement impairment. It is imperative that we consider not only the child’s physical effort but the effort of thinking, speaking, breathing, looking and the effort of anticipating a movement. Effort results in an increase in the child’s level of postural tone which in turn can reduce possibilities for movement, and therefore reduce the child’s functional possibilities - a vicious circle builds.

![Figure 2.1](image-url)
In all of the following examples a general picture is presented. It is important to point out that each child will present differently, and careful assessment by a paediatrician, physiotherapist, occupational therapist and speech and language therapist is necessary to clearly identify the child’s movement patterns, functional abilities and identify areas of concern.

**Spasticity (Hypertonia):** characteristically the child has stiff muscles, which are weak and have limited range of movement, resulting in limitation of functional abilities. The stiffness can affect all muscles of the body, depending on where the damage has occurred in the brain. Spasticity in the muscles of the lower limbs can cause the legs to be held tightly, turning inwards with the child standing up on his toes. As the child attempts to walk, the legs are pulled together more under the effort of movement, and he will tend to trip over his toes, resulting in instability and loss of balance. Spasticity in the muscles of the eyes can cause the eyes to be pulled in one direction away from the midline position our eyes naturally adopt, although not a common cause of squint. Spasticity in the muscles of the throat and the voice box can cause the child to talk with a very strained voice. Spasticity in the muscles of the shoulders and upper limbs can result in the arms being held bent, with the hands held up towards the shoulders and away from the middle of the child’s body. This obviously interferes with the child’s ability to bring the hands together in the middle for play and manipulation of objects. The hands themselves can be held tightly fisted, making it difficult for the child to release his hands to be able to reach and grasp a toy. The stiff muscles can also become weak as they are not used and exercised normally, and the child then finds it difficult to sustain a position or continue a sequence of movement for long periods of time.

The child can be seen to put in a considerable amount of effort to achieve a relatively small movement. With this effort the stiff muscles become stiffer and the movement limitation becomes greater. This is called an associated reaction. This can result in the child’s balance being further compromised as one side of the body becomes stiffer. The child is pulled to one side and there is less opportunity for the child to make use of this part of his body to make a movement to improve his balance and adjust to changes in position. For example, the child cannot reach out to the side with his arm, as he is pulled to the side and he ends up falling as the arm is pulled in towards the trunk.

Spasticity can be classified further into different degrees of stiffness of the muscles; mild, moderate and severe. The stiffness and limited movement that we characteristically see in the child with spasticity is the result of the brain telling too many muscles to work at once and the muscles working too hard. There is a failure of the brain to “calm down” this activity. **The child with severe spasticity** will present with extremely limited movement and his movements can be very predictable as there are little variety of movement patterns available. The child’s posture could be described as having too much stability and insufficient mobility to allow movement. This child can appear to be stuck in one position with extremely limited ability to move his body or limbs out of the position. Careful postural management and change of position is required to assist this child in maintaining comfort and maintaining the movement he has to ease daily management.
The child with moderate spasticity will present with greater movement possibility than the child with severe spasticity. Greater mobility at the joints allows a greater variety of movement patterns, although the child will still present as having limited variety of movement patterns. For example, he will always reach out in the same way perhaps with the elbow, wrist and hand slightly bent, but the fingers will be able to open more to allow the possibility of grasping an object and maybe even moving it around between his hands.

This is the group of children who are most likely to have a visual impairment, which may take the form of only impaired movement of the eyes, visual field loss, or the more complex picture of cerebral visual impairment.

Athetosis: this child presents with continuous, unwanted movements, which are outwith the child’s control. Pure athetosis is rare and a more common picture is seen of a child with a combination of spasticity and athetosis, or hypotonia and athetosis. With this type of cerebral palsy the distribution is usually that the total body is involved (quadriplegia). However some children do present with only one side affected (hemiplegia) although this is extremely rare. Again it is important to highlight that the involuntary movements are influenced by the child’s level of effort, both physical and even thinking about or anticipating a movement/action including speech and looking.

There are different types of involuntary movements that can be described, the most common being:

- ‘writhing’ type movements, sometimes described as ‘mobile spasms’;
- spasms that result in an excessive and extreme movement (dystonic spasms).

With both of these types of movement the impact on the child’s posture is such that it is extremely difficult for him to maintain any stability in his body. This is particularly clear to see when he attempts to move his limbs, e.g. the child may try to reach forward to touch an object, and his hand will fly backwards in the opposite direction to where he wants it to be. This child’s movements are very much influenced by the position of his head. For example, the child may lift his head upwards (extension) and his whole body will straighten, including his arms. The child is using unnecessary muscles, i.e. cannot isolate individual movements. This clearly has an impact on the child’s potential to bring his hands towards his eyes for visual exploration, and it is important to find positions or prepare the child for head movement to increase the potential for the child to experience hand to mouth exploration.

In the child with the dystonic type spasms, the limb can then become ‘stuck’ in this position for a few seconds before the forward movement of the arm can occur. The child understandably often becomes distressed and frustrated that his efforts to reach out are unsuccessful. Often with these children the spasms can occur very asymmetrically in their body, i.e. child turns his eyes to one side and his head is then pulled to that side, with the arm and the leg of the same side stiffly extending and further reducing the child’s
stability in a position. It is important with this child to observe at what point the position of the eyes influences the rest of the body, and work carefully around that range. For example perhaps if a toy is held only slightly off centre the child will be able to visually locate it and begin to be able to reach for the toy. However if the toy is taken too far to the side to encourage greater tracking or scanning skills then the dystonic pattern will be triggered and the whole posture of the child is disrupted. On the other hand a child who has better peripheral vision than central vision will choose to look to the side to explore his world; on looking in this way the child will become more asymmetrical in his posture, reducing his stability and limiting the development of more normal patterns of movement which are important in preventing the development of contractures and deformities. But the lead with this child may need to be his vision, i.e. starting where the child is choosing to look, and using his vision to try and influence his posture towards a position of greater symmetry and stability, which may in turn enhance the possibilities for the use of his arms to reach out. Again, this highlights the need for careful teamwork to identify the child’s thresholds, and gradually try to extend these without detriment to his visual development or postural development.

**Hypotonia (low tone):** characteristically this child has ‘floppy’ muscles, which also results in difficulties in moving his limbs/body. It is unusual for a child with cerebral palsy to have pure hypotonia. It is more common for hypotonia to occur along with hypertonia in other parts of the body. The child’s joints can appear to have excessive movement and can tend to be unstable, as the muscles around the joint are too lax and do not support a stable position of the joint. This child can also lack strength in his muscles, again due to under-use, and as with the child with spasticity he requires to make excessive effort to achieve a movement.

Often this child has a high stimulation threshold and may have a low state of alertness; this child may appear uninterested in his surroundings as it is so difficult for him to gain sufficient activity in his muscles to make a movement, he often needs longer to respond. This child often requires assistance with head control, particularly in upright positions; side-lying may be good for this child as it helps to bring his hands together in the midline, and enables him to see his hands.

**Ataxia:** the type of movement impairment seen is that the child finds it difficult to control the direction of the movement of his limbs and to grade the movement. This will be seen as the child having difficulty holding a steady posture of the whole body or maintaining steadiness in a limb or of his head. For example, when the child reaches for an object, his arm might appear to be jerky in its movements, which may worsen as the child’s hand comes closer to the target (intention tremor). Another example would be that the child has difficulties maintaining his balance when walking, as the movements of the legs are ungraded and jerky. In addition the child may not be able to make use of adjustments to his body, head or arm posture, in order to maintain his balance. For example, the child is not able to produce controlled and co-ordinated movement of his arms away from his body when he is falling over. Instead an excessively large movement may be produced in the wrong direction, which only serves to knock him further off balance. This is
because the child’s body cannot react quickly enough to demands on his balance as he moves around in the environment, negotiating obstacles or changes in floor surface.

As with hypotonia, it is rare that a child with cerebral palsy would have pure ataxia. There are many syndromes that have ataxia as one of their symptoms. Ataxia associated with cerebral palsy is usually seen in combination with spasticity, athetosis or both. Ataxia is most likely to be caused by damage to a specific part of the brain that is responsible for the co-ordination of movement, the cerebellum, which is situated below the two cerebral hemispheres at the back of the brain.

As a result of the picture described above, many of these children are fearful of movement as they know they can easily lose their balance and fall over. Therefore they tend to move slowly. However, there are also those children who try to compensate for their lack of balance by constantly being on the move, and find it difficult to maintain stillness. These children can have difficulty with precise control of their finger movement, making activities that involve selective hand movements difficult for them, e.g. tying laces, writing. They may have a type of uncontrolled movement of the eyes (nystagmus), or they may require to make use of their eyes to fix on an object in the environment to help them to maintain their balance (optical righting). This is seen when the child finds it difficult to bring his eyes down to look in his lower visual field, e.g. to untie his shoelaces, or look down towards the table surface when participating in a table-top activity.

Due to the site of the damage that occurs in this type of cerebral palsy, children may present with difficulties appreciating and organising the relationship in distance of one object to another (spatial relationships). For example, they have difficulty in perceiving the relative distances between objects or between themselves and objects, and this also results in misjudging the amount of movement required to reach or avoid an object.

**Distribution of tone**

In all ‘types’ of cerebral palsy there can be certain parts of the body affected. The following terms are used to describe the distribution of the motor impairment in the body:

- **Diplegia** - all four limbs affected but lower limbs more affected than upper limbs.
- **Hemiplegia** - one side of the body affected, arm and leg may be equally or unequally affected.
- **Quadriplegia** - all four limbs affected but upper limbs more affected than lower limbs, and the child is not able to use his upper limbs efficiently to support himself when moving from one position to another.

**‘Prognosis’ of cerebral palsy**

Although the lesion in the brain is permanent and unchanging, the child does change in his functional abilities due to the influence of sensation and movement on development. There may be changes to the soft tissues of the body, i.e. the muscles and tendons,
which can lose range of movement and strength. This is particularly seen when the child takes a growth spurt when the bones are growing faster than the muscles and tendons, and the child appears to lose abilities and may seem to deteriorate. There is a danger that a child can develop contractures and deformities due to the nature of the changes in the soft tissues. There are external factors, which also influence change, e.g. changing demands on the child like starting school, where more time may be spent in one position, and the nature of the daily routine may require more precise hand function and increased concentration. These both require effort, which will influence the degree of stiffness or involuntary movements in the child’s body. There is also some evidence to support the fact that adolescent children can reach a stage of ‘burnout’. This can be due to years of effort to maintain physical skills and a combination of increased weight, increased height, difficulty in achieving a full range of movement of muscles and a reaction against frequent therapy. This may be a time in their life when they decide to make different choices about their main means of mobility, for example, to make use of a wheelchair for longer distances rather than continuing with independent walking.

Listening to the children and families

The issues raised above highlight the importance of maintaining ongoing discussion with the young person regarding his wishes, concerns and the areas of skill that he wishes to work on. It is important to emphasise here the importance of listening to families and the young person’s own assessment of his abilities and situation within the various environments of home, school and the community. It is important also to consider that the family may experience a feeling of ‘burnout’ following years of providing appropriate therapy and support. This again reinforces the need for teamwork.

Impact of cerebral palsy on the child’s daily activities (functional skills)

*How does the impairment of movement and sensation impact on the child’s general development and functional abilities - more specifically on visual skills?*

Impairment of movement

As we observe a small baby from the first days of dependence on his parents for care, to the baby reaching out for the first time to hold his bottle, or looking at his parents’ faces and responding with a smile, we can be unaware of the complex process that takes place within the child’s brain. In simple terms this is a process of receiving information, organising information and orchestrating the necessary response of moving, looking, touching, smelling, thinking, etc, to then enable the child to reach out and grasp the toy that he is looking at, for example. To help explain this process and understand the impairment of movement seen in the child with cerebral palsy, we will briefly examine how a child with an intact central nervous system develops normal movement and therefore the ability to ‘reach out and grasp a toy’.
Example of child developing normally (refer to Figure 2.2)

A baby around three months begins to practise reaching for a toy when lying on his back. This happens at this stage because the baby has developed enough control and strength in the muscles around the back and tummy to be able to hold a stable position of lying on his back. The baby has also developed enough control and strength in his shoulders and arms to be able to hold his arms out. The baby even has the ability to stay in this position without falling to the side as he reaches out with his arms. The parent tends to use visually interesting and noisy toys that are easy for the baby to hold, as they know that the baby responds to these most easily. The baby is beginning to look at his own hand movements as he approaches the toy, to assist in successfully grasping it. The baby may even look at his hands and then look at the toy as if trying to work out ‘How do I get my hands to touch that thing?’ The baby is therefore beginning to learn about space and distance both as he moves his arms through space but also as he moves his eyes towards and away from the toy. This is when we see the constant interplay between the sensory system (touch and vision) and motor system (movement of body and its parts including eyes); in simple terms, in this instance, the parts of the brain controlling vision and the sense of touch send information to the parts of the brain controlling movement, resulting in the baby’s visual and touch exploration driving the desire to reach and grasp and practise this movement until the baby achieves greater control and accuracy. The brain remembers the feeling of this movement (proprioception) so that the next time he reaches for a toy, the activity of reaching is immediately more accurate and this process of refinement continues throughout life.

This act of looking, reaching and touching also helps to promote use of the head and eyes in midline, which is important both for efficient use of the eyes to scan our environment, but also for balance of our whole body as we move around our environment. At the same time, the strength and control of the muscles of the back, tummy and shoulders also helps to maintain the position of the head such that the sensory system and the motor systems are working in harmony. This is the beginning of head control where the child can move his head while still lying on his back. This developing head control in a supported position on the floor is important to gain movement of the eyes independent of the head. Head control is later important for the child developing the ability to hold his head in the middle when sitting/standing and walking, and in providing the correct position for the eyes to take in the visual information.

If we carefully observe the eye movements of a newborn, we would see that each eye can move independently of the other. For example, the left eye may be turned outward and the right eye may be turned upwards. At this stage this is a completely normal occurrence, although it can be disconcerting to the observer! These ‘random’ eye movements gradually become more organised until the child develops more graded control of the eye movements together in unison (binocular vision) to assist in gaining a clear picture of the toy and the three-dimensional world the baby interacts with.
The baby is also developing the skill of being able to look at a lot of information at one time and to be able to make sense of what is seen, to pick out the relevant information and carry out an action to respond to the busy visual environment. For example, the parent may present several toys and the baby will choose to reach for only one. The parent also plays an important role in orchestrating the environment for the child by choosing toys which interest the baby by varying colours, sounds and textures. The parent will also position toys carefully so the baby can reach them, or may even place the toy into the baby’s hand if he is becoming frustrated when he does not succeed with his own efforts.

Figure 2.2

**SENSORY SYSTEMS**

**Sense of body position (proprioceptive) system**
Position of body/body parts in space.
Position of self in relation to the object.
Movement of arm through space to the position of the toy.

**Visual system**
Visually locate the toy. Distance from hand. Definition of cube from background. Size of the cube. Recognition of the toy.

**Balance (vestibular) system**
Maintain head position. Maintain balance whilst moving forward to reach.

**Touch system**

**MOTOR SYSTEMS**

**Motor system**
Stability and adjustment of the trunk to support arm movement. Movement of the arm. Opening and grasping of the hand.

**Musculo-skeletal system**

**ANALYSIS OF SENSORY – MOTOR INFORMATION**

**CO-ORDINATED SENSORY-MOTOR ACTIVITY. GRASPING THE TOY.**
During motor development, vision provides important feedback to the vestibular and proprioceptive systems; consequently motor development is impeded in cases of early blindness. Our results provide evidence that from the first months onwards blindness does indeed affect early motor development. It is an established fact that sensory systems have a wide range of plasticity and, to a certain degree, early intervention may help to compensate for the lack of vision. (Prechtl, Cioni, Einspieler, Bos & Ferrari, 2001)

Example of developing child with cerebral palsy developing

As diagnosis is almost always not made at the time of birth, diagnosis may not be made until the child is over one year. The type of movement impairment the child demonstrates becomes more apparent over time with the child’s efforts to move and to co-ordinate movement with looking and doing. We will use an example of an 8 month old child who has stiffness of the muscles affecting his whole body; his left side is more involved than the right (spastic quadriplegia).

The muscles around the tummy and the back are stiff. It is difficult for the muscles to work together efficiently to enable the child to maintain balance when lying on his back on the floor. The muscles around the pelvis and hips could be stiff, causing the child’s legs to be bent up slightly at the hips and pulled together with the knees turning inwards. This pattern of movement in the legs interferes with the child’s ability to use his legs for balance; the child’s legs may be pulled up off the floor resulting in the child balancing on his bottom and pushing his weight upwards towards the trunk and head. As the left side is more involved, the muscles of this side will probably be stiffer and the leg may bend up more, and the whole side of the body may be tight, which will tend to force the child’s body over onto that side. This may be seen as the child always rolling over the left side and perhaps predominantly reaching with the right arm as this is the looser arm and the left arm may become caught under his left side as he rolls.

The muscles around the shoulders are likely to be stiff, therefore the child has difficulty reaching his arms away from his body to reach the toy, particularly with the left side which is stiffer. As a result, as this child tries to reach forward, he becomes stiffer on the left side, with the effort of reaching, and may end up falling to the left as that side of the body becomes tighter, pulling the muscles at the side of his body causing him to be pulled over the left side. The lower part of the arm and hand will also be stiff, with the child achieving better opening of the right hand, as this is the side less affected. This stiffness in the arms will limit the distance the child can reach for the toy, and may limit the movement of the individual fingers to explore and move the toy around in his hands. As the child reaches with the right, the left arm and hand will become tighter and the left arm may be pulled in towards the chest, and the opportunity to play with both hands in the middle, which is necessary for greater exploration and manipulation of the toy, is interrupted. This may interfere with the child’s development of use of hands in the sitting position.

This tightness on the left also influences the position of the head, also pulling the head
down on the left, therefore taking the eyes away from the middle. Equally the child may try very hard to maintain the head and eyes in the middle to see the toy presented, and this also causes the rest of the body to stiffen with effort, again causing him to be unstable on the floor. Clearly a vicious cycle builds:

Child attempts to reach → child’s limbs become stiffer → head, eyes, body and arms are pulled away from the toy → child tries harder to reach → child’s limbs become stiffer → the possibility to look, reach, grasp and explore lessens → child becomes frustrated!

As this pattern of limited reach develops the potential for the child to practise looking at his hands may diminish. The child’s hands are held closer to the chest so the child is forced to bring the head and eyes down to look at his hands. This movement brings the neck into a more bent position, which can influence a more bent position throughout the whole body, for example, in the tummy and the hips, which further reduces the child’s stability in this position of lying on the floor. This reduces the opportunity to gain balance skills. As the head is repeatedly taken into this position there is less opportunity for the child to develop head control, and this may result in poor head control when the child is later learning to sit.

Children with severe visual impairment are able to explore their environment and objects/people within it as they have an intact motor system. However the acquisition of movement skills is delayed in these children due to “the poverty of information from the visual system to pass information (feedback) to the proprioceptive and vestibular systems to drive their movements.” (Prechtl et al, 2001)

This reference and the example above highlight the close relationship between all areas of skill development, particularly highlighting visual and movement skills. Considering the child with cerebral palsy who has both movement impairment and a visual impairment presents the challenge of a complex inter-relationship of the impairments affecting each other. It is important to consider two aspects of movement here:

• That we do not make the challenge of a movement too great for the child or do not wait too long for the child’s own movement. This may cause the child to use excessive effort and actually serve to further reduce his movement potential and increase his frustration. Or we may be making too great a demand on the child’s visual skills as he may not be able to ‘see’ into the range of movement that we are demanding from him. Rather we should start where the child is at, from both the motor and the visual aspect, and gradually build on his potential. By assisting the child to achieve more normal movement patterns, we can assist in the development of visual skills, by providing the movement possibility to encourage the child’s motivation for exploration to stimulate visual skills. For example, by making movements of the upper limbs easier to achieve, the child may be able to begin to bring his hands towards his face and eyes to make use of the vision he has to visually explore the object held.
• That we do not make the challenge of movement too limiting so that the child is not encouraged to move away from his stereotypical patterns. This may cause the child to repeat the same movements over and over again and not learn new patterns of movement. This can lead to lack of movement and increasing risk of contractures and deformity. Clearly it is important to work around the child’s ‘thresholds’ of both vision and movement, but there is potential for change and development and we need to grade this carefully. Perhaps the key issue comes up again of ‘teamworking’ to provide a ‘graded sensory environment and movement experience’ for the child. This will help to develop his movement potential and may expand his experience of his environment.

The emphasis of impairment may change from one situation to another and even from one moment to another. Therefore an extremely complex picture is presented which demands careful assessment from anyone who interacts with the child. No one professional can have all the answers, and we must, as professionals, place the child and the carers at the centre of our considerations. How can we meet this challenge to address both the movement needs and the visual needs of these children, and consider other additional impairments?

‘Associated’ impairments

At the time of diagnosis it may also be clear that the child has ‘associated impairments’ dependent on the site of the lesion, which will impact on his development of functional abilities: seizures/epilepsy, visual impairment, hearing impairment, perceptual problems, learning difficulties, tactile processing and communication.

These impairments may not be clear at the time of diagnosis and may become apparent as the child develops. In either case, all of the above impairments should continue to be assessed for until they are ruled out. In labelling these areas as ‘associated impairments’ there is concern that they are somehow then considered to be of secondary importance to the motor impairment. Rather we would like to highlight the strong interplay between the sensory and motor system, and the importance of gaining a balance between all areas of impairment to gain the best outcome for the child. This again highlights the importance of teamwork.

The child’s limited movements restrict the freedom to explore and interact with the environment. In turn, decreased interactions with the environment limit opportunities to derive sensory experiences from the interaction. (Blanche & Burke, 1991)

Impairment of sensation - ‘sensory processing impairment’

Our understanding of how the body learns to carry out movement is progressing with new concepts developing. There is a greater understanding that the sensory systems of the central nervous system have a much larger role than was previously appreciated. This has led therapists to take much greater consideration of the sensory processing
impairments of children with cerebral palsy. As a result we must try to combine therapy to address the motor impairment with therapy to address the sensory processing impairment. An example of this may be a child with a classification of moderate spastic diplegia who is having difficulties making progress with his standing and walking. On assessment it appears that not only does the child have a motor impairment due to the presence of spasticity, which causes the child to walk with his hips and knees always slightly bent and walk up on his toes, but the child also has a sensory impairment. This sensory impairment is seen as the child being unable to identify where he is being touched on his lower legs (poor tactile localisation) and being unable to organise the movement of his legs without looking at his legs (poor proprioceptive awareness). So the question must be asked, “Can the child ‘feel’ his legs?” before we even consider how he is moving his legs. In this occasion it would be helpful to start with activities that help the child to gain greater sensory information about the position of his legs, by perhaps tapping his legs, or brushing different textures over his legs, or assisting him to stamp his feet down onto the floor.

What is a sensory processing disorder?

There are many examples of children with cerebral palsy who demonstrate difficulty with processing information received from the sense of touch, from the sense of position of their limbs/body (proprioception) and from their balance sense (vestibular).

A child with cerebral palsy who has difficulty processing information received from the sense of touch may demonstrate a lack of awareness of the part of his body that is most affected by the movement disorder. For example, a child with hemiplegia can seem unaware of an abnormal position of his hand when he is leaning on the back of his hand with his wrist strongly bent towards the forearm, a position that you and I would find uncomfortable after a short period of time. Another example would be when a child with cerebral palsy places his hand into a texture that the other children in the playgroup are happy to explore and feel, e.g. wet spaghetti or finger paint, and the child with cerebral palsy immediately becomes distressed, quickly withdraws his hands from the texture, turns his eyes away from looking at the texture or may even begin to gag or vomit. This would be termed hypersensitivity to tactile input. The child may demonstrate several behavioural signs that could be indicative of hypersensitivity:

- avoiding touch, toy, texture;
- child pushes back/pulls away;
- child averts eyes from the activity;
- child develops ‘worried expression’;
- increased sucking/swallowing behaviour;
- facial grimace - pulling back (retraction) of lips;
- increased saliva production, increased frequency of swallowing;
- drooling;
- gagging which may lead to vomiting;
- autonomic nervous system (ANS) changes - face flushes, breathing rate increases;
• changes in his arousal and attention levels - child can become over-aroused or under-aroused;
• crying.

What can be done to help when the above signs are observed?

Firstly, it is important to identify the child's level of ability and level of sensitivity to different textures. This helps to identify the child's ‘threshold of tolerance’ for a texture. This needs to be done sensitively and gradually in order to avoid an extreme reaction from the child. It is important to make use of the child’s other senses to help him build his experience of different textures in a positive way.

*Preparation* - it may help to prepare the child’s body for the experience by reducing the level of stiffness in his muscles; children with stiff limbs find it harder to discriminate objects by touch. If they feel more relaxed this can help them to gain greater tactile information as they can then move their limbs/hands/fingers more easily to gain greater information.

*Grade the stimulation* - when the child's threshold of tolerance has been identified it is important to work around that threshold, starting by making the activity easier and always working towards the threshold. It is necessary to work towards the threshold in order to build the child's confidence to be able to adapt to this situation.

*Be inviting in your approach* - it is important to allow the child to come to you and to feel he is in control at all times. We must not impose the experience on the child.

*Maintain firm pressure with your hands on the child* - it is important to think about how you touch and handle the child. If your hands are used lightly against the child's skin this can be worse than being tickled and only serves to produce more unwanted touch experience. Using your hands firmly gives clearer tactile information and also helps to calm the child's sensitivity to touch. Making minimal changes in the position of your hands is also useful.

*Start at the least sensitive area and work towards the most sensitive area* - many children with cerebral palsy have sensitive palms and it is important to avoid placing textures here first. Rather take the texture onto the back of the child's hands or even onto the back of his forearm and gradually move towards the hand area. As the child adapts to the experience he will probably begin to open his hands and then you can gradually take the texture towards the palm. However, be cautious and be observant for the signs of hypersensitivity outlined above. If they occur then move away from the palms onto the back of the hand. If you work gradually the child will generally begin to adapt each time and you will be able to get the texture more into the palm.

*Use firm/hard objects to begin with* - objects that are firm are easier for the child to tolerate and again help to calm his sensitive response. You can also use something hard
in a softer texture, i.e. a plastic Teletubby in some playdough or sand. In this example
the child’s hands do not have to touch the texture, but he may be able to see the texture
or only part of his hand comes into contact with the texture as he is holding the firm
object - this grades the amount of tactile experience and helps the child to adapt.

In all of the above it is important to work towards and around the child’s ‘threshold of
tolerance’ to help the child to build his tolerance, and therefore help him to gain positive
learning experience from a greater variety of tactile experiences.

Yet another example of a tactile processing disorder would be when a child has difficulty
identifying which part of his body is being touched (poor tactile discrimination), e.g. the
child perceives touch to the index finger of the hand as being touch to the whole hand.
This can result in difficulties with the child’s control of hand movement as it is necessary
to feel the parts of your hand to then be able to move the fingers efficiently. For example
you may observe the child attempt to poke at an object with all fingers extended and be
unable to isolate only the movement of the index finger to be straight. Another example
may be when a child is unable to discriminate properties of objects by exploring the
object with his hands. In this situation the child is unable to gather sufficient tactile
information from the touch receptors in his hands, or is unable to process the information
efficiently in the brain to draw conclusions as to, “what am I touching?” This child may
therefore make use of his mouth to explore objects as he may have greater
discriminatory abilities with his lips and tongue (the lips and tongue have twice as many
touch receptors as the hands). Sometimes this can be interpreted by others as a delay in
the child’s level of development, but in some cases it could be an alternative strategy for
the child to overcome the lack of tactile discrimination in his hands.

An example of poor processing of information about body position (proprioception) would
be when the child with cerebral palsy, who has not moved his limbs into external space,
and is limited in his movement due to the influence of postural tone and patterns,
experiences a ‘new movement’. When we change the tone and movement possibilities to
enable him to achieve the movement, it may feel foreign to the child and he may not be
able to perceive this new position of his limb. What does it feel like to the child? Is it
frightening? Is it like moving his limb into the unknown abyss!!!

What causes the sensory processing impairment?

There may be a few factors which impact on this:

- Negative experiences from early days of life in the neonatal intensive care unit.
  For example the child may become sensitive around the mouth and face due to
  the placement of a feeding tube down his nose, which is taped to his face.

- Limitations of movement result in the child missing out on opportunities to touch
  and feel his environment. For example a child with a classification of moderate
  spastic quadriplegia may have hands that have been predominantly held fisted
with thumbs held into his palms and have had little experience of taking weight on his hands which helps to increase the child’s awareness of his hands and reduce any sensitivities. This child’s palms may be extremely sensitive to being touched to the point where the child may find it distressing to touch certain textures in the environment.

- There may be damage to a specific part of the brain that is responsible for interpreting sensory information from the environment. This experience, that occurs automatically, provides the developing child with information about how his body feels to him. This develops his appreciation of his body as a three-dimensional object with moving parts which are in a specific position and can move in a specific and variety of ways to allow precise control of movement to interact successfully with the environment, e.g. to bring two hands together to bang one object against another to create a sound.

**Why is it important to consider these issues with a child with cerebral palsy and visual impairment? What can be done to help?**

When we are working with children with particularly severe visual impairment, it has been found that it is important to give the children many experiences of their environment through their other senses, perhaps most obviously through the sense of touch or the sense of movement. Therefore we need to be aware that some of the children may actually find it difficult to tolerate sensory information being received in this way, or there may be specific aspects about touch that are difficult for the child to tolerate and may even cause quite distressing hypersensitive responses. It is important therefore to choose carefully which textures the child prefers to play with. Research in the past has found that children with both spasticity and athetosis typically prefer objects which are hard and firm rather than objects that have lots of soft moveable parts like ‘tinsel pom-poms’ or soft/slimy textures like playdough, wet pasta, finger paint. This is of importance for the child with a visual impairment also as these objects are difficult to distinguish apart from each other. It is also important that we carefully grade the amount, type, location on their body and duration of tactile input, to enable these children to adjust to the experience and begin to process the information and gain a positive experience. It is important that this is an aspect that is carefully assessed in each child with cerebral palsy to ensure the child remains alert and attending to his environment and therefore gaining as much positive experience from the environment as possible.

**Summary**

The child with cerebral palsy and visual impairment presents an extremely complex picture, which is challenging as the nature of the condition being so individual to each child. It is important to consider the close relationship of the motor impairment and the sensory impairments that the children can present and try to gain a balance in addressing these issues in all of our interventions with the children and their families.
This complex picture demands teamwork, ongoing review and identifying the correct team members at the correct time. Perhaps some key points to highlight would be:

- Careful assessment of all areas to understand the child’s motor and sensory needs. Providing comprehensive functional visual assessment and assessment of functional motor skills to identify the child’s abilities.

- Teamwork - we need to develop effectiveness of teamwork including involving the parents and increasing parent understanding to empower them. This includes early identification.

- Grading the environment both from a motor and a sensory viewpoint. Children cannot be forced into activities; they require their own motivation to learn and explore within an environment that makes learning possible physically, from a sensory aspect and within a functional, meaningful activity.

- Parallel processing - for many children with cerebral palsy they have difficulty combining two or more sensory modalities; identifying whether the child is integrating sound and touch or sound and vision or vision and proprioception can be difficult. We must improve our skills in this area in order to identify the child’s thresholds and then pitch our intervention just around/below his threshold in order to promote learning in a graded environment. We must beware of physical burnout, shutdown and the danger of children being labelled as having behaviour problems and not identifying the root cause of those problems from a motor or sensory viewpoint.

**Case Study: Jenny**

A picture of Jenny as she presented on first meeting - Jenny likes to listen to sounds and has a favourite ‘Monkey’ toy which has a soft body and hard plastic rings which rattle together when shaken. When she hears ‘Monkey’ she will reach her right hand up slightly as if to find him and sometimes she will make a happy vocalisation. She appears to respond to familiar voices (her parents) demonstrating this by smiling and sometimes vocalising back.

She finds it difficult to move any part of her body and even when lying at rest she is disturbed by little pulls at her hips (spasms) that cause her whole body to curl up. This can be distressing for her and will often be accompanied by a pained expression on her face. As a result she is always held in a bundled up position in her parents arms and they find it difficult to find any position that she is happy in other than on her back. When held sitting or lying on her back she can reach out a little with her right arm but as she does so her whole body tends to become stiff either with her legs shooting out straight or her knees pulling towards her tummy. When she reaches with her right arm her left arm becomes stiffer and she is pulled over to her left side as the whole side of her body becomes stiffer. This sometimes pulls her away from the toy, making it difficult for her to
achieve success, and this also takes her head and eyes away from a toy that is presented to her.

Jenny does appear to respond to movement of a person across her field of vision, especially when there is light coming from behind the person to enhance their outline. Her response is seen as a general movement of her head in the direction of the person moving. Her eyes will blink when an object is moved rapidly towards her eyes but she does not attempt to turn her head away from the object. When a moving object with no sound provided is presented to her at the side of her head or in front of her head she does not attempt to turn her eyes or head towards the object or to reach for the object. When a spotlight is used to light up her immediate environment, Jenny will blink in response to the light and at times will turn her head to the light. The light appears to help Jenny to maintain her attention to the toys presented and helps her to orient her head in the direction of the toys.

After some time holding and moving a familiar toy in her hand there are times when Jenny’s eye movements change. Her eyes come down away from the upward and outward position more towards the middle. Small and rapid side-to-side movements can be seen and her eyelids also close down slightly - perhaps she is trying to visually locate the object.

She is generally a contented little girl but has had periods of illness due to fits, and has had problems coping with food in her mouth and processing food through her stomach. A tube was inserted into her tummy to ease her eating difficulties and this has helped to settle her further.

Jenny is frequently placed on her back on the floor and in this position the stiffness in her limbs is clear to see; her arms are pulled in towards her chest with her elbows bent and her hands held tightly fisted. Her legs are always slightly bent with her knees pulled up and together. When lying on her back her head is often turned to her left side and her left eye area then comes into contact with the supporting surface of the pillow. Her head can remain there for several minutes and she can become slightly distressed by this. Relief is seen in her face, and her whole body is seen to relax slightly when her head is repositioned back to the midline or if she is given support over her chest and around her trunk.

Her parents wished for ideas to help her to be able to play more and make more use of her arms and for her to be more comfortable when being positioned in lying or sitting.
How can we help her to move her arms more easily to reach out into her environment?

**Preparation**

Holding her in side-lying with her hips straighter helps her to accommodate to the position of her hips becoming straighter. She is held comfortably against her parent for security and close contact. As her Dad feels that she becomes looser at her hips, he gradually takes her forward onto her tummy bringing her hips into a more straightened position.

Once on her tummy her Dad maintains close contact for comfort and security. He moves his hands only minimally to allow Jenny to adapt to the new position and so she does not have to process too much information at once. His right hand over her bottom helps to maintain her hips straighter, but if he feels she is pulling at her hips he allows this movement and then gradually gives pressure down over her hips to help her gain straighter hips again. If she can be comfortable in this position, the straightness in her spine and the more relaxed posture will provide a better background for her then to make use of her arms. As can be seen in the photograph her arms are falling loosely over her Dad’s knee, indicating that they are less stiff and it will therefore be more possible for her to use them to reach out into her environment.

**Positioning** - the use of a wedge - this brings her head and trunk slightly above her hips so she does not have to work too hard to bring her head forward and her shoulders forward to lead her arm movement to then reach out into the environment. As outlined previously, if she uses too much effort her tone will only further increase and then her arms will become stiffer, making her reach out more difficult. If she continues to use too much effort, the rest of her body will become more stiff and the vicious circle builds. The neck cushion helps her to maintain her head in the midline and enhance the use of any vision she may have.

In side-lying - the use of ‘V’ cushions brings her lower limbs into a more aligned position. This also helps to maintain her in the side-lying position, which is a good position to bring her two hands together in the midline to allow her to feel her hands touching each other, her hand touching the surface or toys placed on the surface.
Environment

What environment can we create that will provide her with the motivation to reach out and will meet her movement possibilities?

Jenny had greater movement possibility with her right arm therefore the toys are placed at her right side. In this picture she has just reached up and out to the right.

Jenny prefers hard objects, so here a choice of either hard or soft was given to see if she would be encouraged to move her left arm to her preferred toy. Her head also has turned to the left to find her preferred toy.

The use of the tent creates an environment where she can feel boundaries around her, giving her security when she reaches out.
The use of lighting can help her to orient her visually to the toy, orient her body towards a more symmetrical position, and help her orient her head towards the midline/away from the side she constantly pulls to.

Selecting/creating toys, which meet her specific interests - pick up on what she responds to - firm, sound, bells.

In this picture we can see she has successfully brought her right arm up off the cushion to ‘hit’ the bells, creating a sound as she sends them flying. Again a hard, firm texture similar to that of her favourite ‘Monkey’ toy was created. This toy is good as she receives the reward of a sound when she touches it, but also her skills are being developed to reach out and explore as the toy hangs silently between hits.

In Conclusion

Children with cerebral palsy present a complex picture. Not only do they have a motor impairment but many of the children we now see present with a mixture of sensory impairments of which a visual impairment may be only one. Although the definition of cerebral palsy describes the condition as one of motor impairment, the increasing understanding of how the motor system of the human body is influenced by the sensory systems is making greater demands on our expertise as clinicians to identify the specific nature of the child’s impairment and the impact on functional abilities. This necessitates a greater awareness of teamworking and a need to always consider that compromise may be necessary in order that we make the best therapeutic and educational provision possible for the child.

Thorough assessment by several professionals may be necessary to best identify a plan of intervention for the child and the family, remembering not to overload the child or the family.

Open and honest communication between professionals is also necessary to establish aims of intervention and a common language, which we can work with to maintain excellence of service to the child and the family.
References


CHAPTER 3

A more detailed look at the Visual System

Professor Gordon Dutton

Introduction

The brain is a very complex structure. When it is damaged a wide range of effects are seen and every child with brain damage shows a combination of features unique to that child. We therefore need to have a system which identifies the full range of limitations caused by such damage, so that we can work within these limitations and capitalise on the abilities which are identified. This chapter outlines how the human visual system works and how spectacles may help to make best use of vision.

We all have limits to what we can see. Visual information is handled in the brain in a number of different ways. Like all sighted animals man has a reflex visual system, which initiates immediate evasive action when necessary, to avoid hazards. This is a subconscious system. At a higher level of processing, visual information is divided into two categories which are handled in different locations in the brain. One system is responsible for knowing where things are, so that we can move our bodies effectively through visual space. The other system is the 'what' system and allows us to recognise what we are looking at. Both of these high level visual systems can be damaged to varying degrees.

The difficulties caused by blurring of vision (due to disturbance of the input to the brain), are not difficult to imagine. One just has to think about what pictures look like when they are out of focus. A lot of the information is missing. However, the real situation can be much more complex. Exploration and play are important ways of gaining knowledge. If impaired vision interferes with exploration and play, then opportunities to learn fundamental information may have been missed. Vision is needed to gain knowledge and information, particularly in areas which are poorly communicated in other ways, such as knowledge of the anatomy of the opposite sex. We gain our ability to understand and express language by facial expression within the first few years of life. If facial expressions cannot be seen, then they can neither be interpreted nor copied. This can lead to permanent impairment in such communication skills, including paucity of facial expression.

It is estimated that over 40% of the brain is devoted to visual function, so it is not surprising that a large proportion of children with damage to the brain have visual problems of one sort or another. These problems may be due to blurring of vision, or they may be due to difficulties making accurate eye movements, or analysing, understanding or moving through the visual world.
Experience during childhood provides the framework for what the child considers to be normality. Just as we have considerable difficulty understanding how a child with visual impairment sees, children with poor vision from an early age ‘know’ their vision to be normal and do not have a concept of how the world is visualised by people without visual disorders. It is only by careful assessment and continued observation of the visual behaviour of such children that we can gain a deeper understanding of how they see. This knowledge can in turn be used to structure communication, information and the environment to enhance the child’s social skills, learning and mobility, by ensuring that each element is designed to fall within the perceptual limitations of each child. Such an approach potentially makes best use of professional time and arguably will help to reap the greatest rewards.

The visual system and how it works

We take our vision for granted. Yet no one truly knows the answer to the question “How do I know how other people see and if they see in the same way as I do?” When you look at an apple, pick it up and eat it, the tasks you perform are extremely complex and nothing short of miraculous! We take such a mundane set of actions for granted, but it is worthwhile thinking about how the visual system is used to help carry out this action.

The eyes

The lens system at the front of the eye works in exactly the same way as the lens of a camera. An upside down and back to front picture of the apple is formed on the lining at the back of the eye (the retina) which, in principle, is very much like the film in a camera or the detection system inside a video camera.

If you look closely at a television screen you will see that it is made up of thousands of triplets of dots which are very closely spaced. The dots are red, green and blue. For seeing in daylight conditions the retina is made up in an analogous way. Millions of cells called cones (which are interspersed among rod cells for seeing in the dark) are arrayed in a single layer in the deep retina. The picture is registered by the cone cells, which detect red, green or blue light and convert this into electrical impulses. These electrical signals are passed to an inner retinal layer of over one million cells in each eye (called ganglion cells), which carry the signal to the brain. The electrical signal to the brain is divided into two parts and is passed along two parallel wiring systems. One part is responsible for detecting motion and the other part is responsible for analysing detail.

The visual information about ‘what’ the apple is, is passed to the brain by the detail analysis cells and nerve fibres, while the information about the moving hand is relayed to the appropriate parts of the brain by the movement detection cells and nerve fibres.

The optic nerves and visual pathways

While the eye functions in a way similar to a video camera, the optic nerves and visual pathways are analogous to the cable which runs between the video camera and the
video recorder. Figure 3.1 (diagram of the visual pathways) shows how the visual system is wired up. The electrical signal which is formed at the back of the eye by the two different types of ganglion cells is passed to the brain along over a million fine threads which are layered like transparent silk over the back of the eye. They then exit the eye through a circular channel to become the optic nerve, which runs from the eye to the brain. The picture formed by each of the two eyes is slightly different, and the two pictures are passed as electrical signals along both nerves into the brain.

The two nerves combine together in a cross (called the chiasm) in such a way that the picture seen on the right side by both eyes is passed to the left side of the brain, and the picture seen on the left side is passed to the right side of the brain.

The electrical signals are then relayed to two locations. Most of the information is passed to the back of the brain, called the occipital lobes, but some of the information is passed to a lower central part of the brain called the brain stem. This can be thought of as the primitive visual brain.

![Diagram of the visual pathways](image)

The diagram shows that the right side of a visual scene is seen by the left side of the brain and the left side is seen by the right side of the brain.

**Figure 3.1**

**The primitive visual brain**

The primitive visual brain is an important structure which is present in most animals. It is the part of the brain responsible for protecting us from danger. We are not truly aware of
this visual system until after it has worked, because it functions subconsciously. If you dodge a missile or you have a near miss when driving, it is your primitive visual brain which protects you. It detects a peripheral movement, and initiates movement of your body for you before you have a chance to be truly aware of what you are doing. It appears that this part of the brain is most sensitive to movement at the side and is less sensitive to movement detection straight ahead.

In children who have profound brain damage affecting vision, there can be peripheral motion detection present which appears to be functioning at a subconscious level. In such children, if they are mobile they may be able to walk around objects in their path despite apparently having little if any detectable vision. Children who cannot move their four limbs may detect a moving spoon if it is at the side, and open their mouths more readily, than if the spoon comes from straight ahead. It appears that it is the primitive visual system which is functioning in these circumstances. In some such cases the system appears to be fatiguable because it may appear to work initially and then it doesn’t work, but will work again after a rest.

The occipital lobes

The occipital lobes are at the back of the brain and they are analogous to the video recorder. They receive the electrical signals from the visual pathways and break the information up into its component parts. The detail of the visual scene is broken down and is analysed by tens of millions of cells which are responsible for independently handling colour, detail, orientation and movement. The left occipital lobe sees the right side of the visual scene and the right occipital lobe sees the left side of the visual scene. Moreover, the bottom of the occipital lobes sees the upper part of the scene and the top of the occipital lobes sees the bottom part of the scene.

Children with damage to the occipital lobes can therefore have a range of different visual field defects depending on which parts have been damaged. Damage to the right occipital lobe causes loss of vision on the left side (for both eyes), and damage to the upper part of the occipital lobes (or the incoming pathways to the occipital lobes) results in the lower visual field being impaired, so that an affected child is unable to see the ground when looking straight ahead and tends to trip over things.

(Loss of vision on one side is called homonymous hemianopia. This means loss of half vision in the same distribution in both eyes. It is very different to loss of vision of one eye. When vision is lost in one eye the whole visual scene can be observed with the remaining eye. Hemianopia on the other hand means that half the visual scene is missing for both eyes.)

The dorsal stream and the ventral stream

It takes about one-tenth of a second for information about the visual scene to reach the back of the brain or the occipital lobes. During the next tenth of a second, the visual
information is analysed in two separate ways. Figure 3.2 shows the two pathways of the dorsal stream and the ventral stream. The dorsal stream runs from the occipital lobes to three locations: the back of the brain at the top (called the posterior parietal lobes); a vertical strip of brain in the centre (called the motor cortex); and the front of the brain (called the frontal cortex).

The ventral stream runs from the occipital lobes to the back of the brain at the bottom (called the temporal lobes).

**Figure 3.2**

**The dorsal stream**

The back of the brain at the top (or posterior parietal cortex), is responsible for handling a lot of information at the same time. It works in the same way as the RAM in a computer. It allows us to hold open lots of computer programs at the same time. If you look at a complicated visual scene such as a group of school children, while looking at one child in the middle, you are able to select out another child and immediately change your gaze and attention to that second child. In order to do that, you have to maintain an awareness of the whole class. This is an enormously complex computing task. To make matters worse, you had to make this choice while all the children were trying to attract your attention and there was a lot of background noise. The posterior parietal lobes are responsible for achieving this for you. (But the choice of which child to look at is probably made by the frontal lobes.)

If there is damage to the dorsal stream, or to the posterior parietal lobes, the ability to handle a lot of information at the one time is decreased and a child with such damage probably sees the world in a way similar to a baby. Babies tend to do one thing at a time and that is why baby books present single large pictures, because it is known that infants respond to one or two pictures but not more. It is also known that babies are “one thing at a time” children. For example, when they are listening to music, they are less aware of other things happening.
The motor cortex is responsible for bringing about movement of the body. In an adult who has had a stroke and who cannot move the right side of the body, it is the left motor cortex or the pathways from the left motor cortex which have been damaged. The top of the motor cortex is responsible for moving the foot and the side of the motor cortex is responsible for moving the hand.

The task of picking up an apple involves both the visual system and the motor cortex. First, the apple has to be recognised, then has to be mapped along with everything else in 3-dimensional space by the posterior parietal cortex. This information is passed to the frontal cortex which is responsible for making the executive choice of attending to and picking up the apple. The information about where it is, is then passed to the motor cortex responsible for moving the hand, which reaches out accurately in three-dimensions using the co-ordinates given to it by the parietal cortex, in order to pick up the apple. At the same time, the hand is being shaped so that the fingers are separated far enough to encompass the apple. Once the hand has reached the right position, the fingers grasp the apple and pick it up. Throughout this task, the visual system and the movement system are working in perfect harmony. The action of picking up the apple has been brought about by the interconnecting pathways of the dorsal stream. The picture was formed in the occipital lobes. It was mapped by the parietal lobes. The choice of the apple was made by the frontal lobes. The action was executed by the motor cortex and the whole system was interconnected by the dorsal stream.

When we cross a road and step up onto a kerb, a similar instruction has to be given to the feet. Children with damage to the dorsal stream may have difficulty accurately reaching for things and/or difficulty moving their feet to a correct location in visual space. This can mean that they have difficulty interpreting whether a line on the floor is a step and difficulty working out how far the foot has to be lifted up in order to navigate over a kerb. It is possible that dorsal stream fibres responsible for moving the feet through visual space are damaged while the dorsal stream fibres responsible for moving the hands are not. In this case reaching is accurate but movement of the legs is not.

The frontal cortex has many functions. One of these functions is to move the head and the eyes to look at a chosen new location. When the dorsal stream is damaged, the ability to accurately move the head and eyes to a new target location is decreased and such movements can be either inaccurate or it may not be possible to bring them about at all. This means that it can be difficult to follow and track moving objects because the dorsal stream pathway, which gives the head and eyes the new location to look at, is not functioning properly. Another function is to scan the information about the visual scene presented by the posterior parietal lobes and to make executive choices about what to look at, and what to reach for.

One can now imagine how difficult it must be to read when there is damage to the dorsal stream. Not only can a lot of printed information on the same page not all be seen and appreciated at the same time, but it is not possible to move the head and eyes accurately to a new location in order to access the information. The obvious educational approach is to present small numbers of words at the same time, to enlarge them and to show them
sequentially, for example on a computer screen. The amount of information which can be handled at any one time varies considerably and has to be determined for each child.

The ventral stream

The ventral stream runs from the occipital lobes into the temporal lobes on each side. The temporal lobes contain the visual library. This library contains a general store of objects and shapes which enables us to recognise one object from another. There is also a special store of people’s faces and a library of route finding methods both of which are usually located in the right side of the brain. When you walk down a busy street and recognise someone, your brain has accomplished a fantastic computing task for you. First, you probably know where you are going. Then, for every person you do not recognise, you compare the facial appearance of that person with your personal store of hundreds if not thousands of faces. When it does not match, you walk past that person. When you meet the person you recognise, you have a matching comparison which allows you to greet your friend. You were then able to recognise the facial expressions of your friend and to communicate accordingly. Children who have damage to the ventral stream can have difficulty differentiating one object from another, and in particular may have great difficulty recognising people’s faces and differentiating different types of animals, one from another. They may be unable to recognise the language within facial expressions. In addition, route finding can be particularly difficult. This applies on a large scale when out and about and on a small scale within the home where, for example, it can be particularly difficult to know which drawer items are kept in.

It is clear that the dorsal stream and ventral stream pathways work in harmony with one another because we see and recognise, with our temporal lobes, what we choose to reach out and pick up using the dorsal stream, posterior parietal lobes and motor and frontal cortex. However, when brain damage takes place, specific parts of these tasks are deficient and it can be difficult to understand why a child with such damage is able to see one thing but not another.

Conscious and subconscious vision

The conscious visual system allows us to see and understand the world around us. Incoming visual information is processed, analysed, understood and acted upon. As a young child grows and develops the visual system is being programmed. New experiences are being progressively stored and the visual system is being built up. At birth the visual brain is rather like an empty library with different sections reserved for different sets of books. Face recognition is a good example. The back of the brain at the bottom on the right (the temporal lobe) is the principal storage area for people’s faces. If this area is damaged in an adult, that person loses the ability to recognise faces. Equally, it has been shown that children with brain damage in this territory may have very similar problems of varying degree.

“Look where you’re going!” How often have you heard this expression? The fact is we do not look where we are going. Like all other sighted animals, we move through the
visual world without giving it a thought, by using our subconscious visual systems. Most people, when they first learn how to drive a car, find steering difficult until they look into the distance. It then becomes much easier. Although we check the view ahead to choose where we are going, we use our peripheral vision in a subconscious way to drive the car, to move through a crowd or to walk over uneven ground.

We often need to take evasive action. Whether one is ducking one’s head to avoid hitting a kitchen cupboard door or whether one has to dodge an assailant, it is our subconscious safety system which is coming into play. We probably use a similar system for catching balls.

Progressive improvement in driving skill shows that certain aspects of our subconscious visual system can be trained, whereas the remarkable systems that we and other animals have for self protection are reflex and develop spontaneously. From a practical point of view there are two subconscious visual systems; a high level system mediated by the dorsal stream which allows us to move effortlessly through the visual world while talking or thinking about something else, and an intermittently used subconscious visual system which makes us brake suddenly when a child runs out in front of the car. This second system recruits our adrenalin and makes us feel drained because of the amount of effort which goes into bringing about such subconscious action. It is only after the event that we recognise what our visual system and reflex evasive action has done for us.

The significance of these observations is that a child with brain damage may appear to have no vision but may respond (either reproducibly or intermittently) to a moving target, particularly if it is in the peripheral field of vision.

**Spectacles – what are they for and when are they needed?**

Many children with cerebral visual impairment wear glasses. Glasses are worn for different reasons.

Short sightedness is common in children born prematurely. A short sighted eye is a large eye and the picture is brought into focus in front of the retina. Glasses with concave lenses are used to move the image backwards onto the retina. The glasses make the eyes look smaller and one can see that the side of the face viewed through the glasses appears to be displaced inwards. Without glasses the child is in focus for near but distant objects are out of focus, hence the term short sight. For some children with reduced clarity of vision this means that the printed page can be seen better without glasses. The short sight means that the child can see the page when held close to the eyes. The magnification gained by proximity gives the same effect as a magnifying glass.

Long sightedness occurs when the eye is small. The picture is blurred because it reaches the retina before it has been brought into focus. In the majority of children the focusing system of the eye compensates for this and brings the picture into focus. However, in children with brain damage long sightedness can cause problems which are alleviated with glasses. The focusing system may not work well so that even a very small amount of long sightedness is not corrected for. This problem can affect over half of such
children in special schools, and a small correction for what would otherwise be a ‘normal’ amount of long sightedness can make a significant difference to the child’s ability to see, and academic performance. Long sightedness can also be responsible for making the eyes squint by turning in and when glasses are worn the squint is reduced or eliminated. In children who are long sighted the spectacles magnify the eyes and ideally they need to be worn most of the time.

Astigmatism occurs when the front of the eye has a very slight rugby ball shape. The lens of the glass is shaped in a reciprocal way to compensate for this shaped anomaly.

Children with reduced vision due to brain damage commonly remove their glasses even when they definitely improve vision. One possible reason is visual fatigue. The clear picture requires more processing power than the blurred picture so it is more comfortable to have a blurred picture because it is less complicated and easier to handle. This is of course only a working hypothesis, but when children remove their glasses after working hard for a while they may be giving their visual systems a well deserved rest.

In summary, short sightedness is corrected by glasses which make the eyes look smaller and children may remove their glasses to gain magnification by holding things up close. Long sightedness is corrected by glasses which make the eyes look bigger and children may remove their glasses to get a more comfortable blurry picture for a while.

Visual thresholds

We are all limited by our vision but because we ‘know’ our vision to be normal we are not aware of these limitations. Telescopes and magnifying glasses allow us to see things which are otherwise too small to visualise. This highlights the limitations of the clarity of our vision. Society then chooses to present information in a way which the majority of people can see because it falls within these limitations. People with reduced vision are not able to always see within these limitations, and just like the picture which is only revealed by magnification, the information is not there to see and is not known about.

Children with poor vision from an early age also ‘know’ their vision to be normal and just like fully sighted people, they do not know what it is they do not see and they are not aware of their visual limitations. Unless we know in detail what these limitations are for each child, information which is not seen will be presented to the child. The failure of the child to respond to this information can easily be misinterpreted as either lack of ability or even stubbornness. It is very expensive to teach children with brain damage, and the cost implications alone of using educational material and approaches, which are not actually seen by the children, are considerable. It is therefore important to try to get inside the mind of the child, and to understand as fully as possible what is seen, and what is not seen and then to work inside all of these limitations or thresholds.
Clarity of vision

Look at this printed page and move it back until you can only just read it. You are now looking at the smallest text you can see when it is printed in black against a white background. This is your visual acuity or the limit of your clarity of vision.

Now try and read the text as fast as you can when held at this distance (and don’t cheat by getting closer to it). You will find that it is something of a strain and that you quickly fatigue and get fed up with the task. Compare the time it took you to read a passage, with the time it takes you to read the same text when held at your normal reading distance. It is much quicker to read at the normal reading distance and much less tiring. This is because the text is now big enough to be seen clearly and comfortably.

The letter charts used to measure clarity of vision measure visual acuity. This is the main test used by doctors to make a diagnosis of reduced central vision and is a measure of the smallest clear black target which can be seen against a white background. However, this is not a measure of functional vision (which is recorded with both eyes open), it is a measurement for medical reasons in order to help make a diagnosis or to provide information required for follow up.

For a child who has reduced vision, what one wants to know is the size of target which can be seen with ease at maximum speed. The visual acuity, which is a measure of the smallest target which can be seen, is useful to know, as this is the limit of what can be seen, but neither children nor adults can work at the limit of their vision for very long.

Educational information therefore needs to be well within the limit set by the visual acuity so that it can be easily seen throughout the day even when the child is tired.

Colour and contrast

Imagine the rainbow. Red, orange, yellow, green, blue and purple all blending into one another. Purple can also blend into red. These colours can be arrayed in a circle in such a way that they blend into one another. This is known as the colour circle. If you take a can of grey paint and add red colouring little by little, the paint will gradually become redder until it can get no more red because it is fully saturated. One can now imagine a central grey circle with surrounding colour circles which become progressively more colourful with the primary colours on the outside. Imagine now that the grey centre becomes progressively whiter vertically upwards and progressively blacker vertically downwards. This is what is known as the grey scale. Finally imagine the red becoming a progressively lighter shade of pink until it blends into the apex of white at the top and becoming progressively more brown as it blends into a black apex at the bottom. This imaginary concept is known as the colour solid made up of two circular cones base to base. Black and white are the furthest apart and show the greatest contrast, while, for example, blue and slightly lighter blue are close together and show very little contrast.
In relative darkness it is easy to mix up such colours as green and brown, but black and white can still be differentiated from each other, as can very light blue and navy blue. Many causes of visual impairment cause difficulties in differentiating contrast and colour. This of course imposes limitations on what can and what cannot be seen. As a rule of thumb, the further apart colours are from each other across the colour solid, the more likely they are to be differentiated from one another.

The degree to which brain damage impairs colour vision and contrast perception in children with damage to the brain is not known. As a general rule, colour perception is maintained remarkably well in such children, but from a practical point of view it is worth ensuring that pictures and toys are bright and clear, and that there are few colour boundaries in pictures which are very similar. For example a picture of a dark green frog against lighter green grass may not be seen because of the low colour contrast, but the same frog portrayed on yellow sand would be much more obvious. Information is often photocopied and re-photocopied. This results in grey text against a grey background. The contrast is therefore reduced so that someone with reduced vision may not be able to see it even if the size of the text falls within the visual acuity limits.

The visual world is made up of myriad colours in all sorts of juxtapositions. Visual impairment can degrade colour boundaries of low contrast, while not affecting boundaries with more contrasting colours and shades. This means that some things are seen and others are not, and it is important to be vigilant to look out for what is seen when not expected and what is not seen when expected. It is by making mental notes about these observations while working or just being with the child that one can build up a mental picture of the colour boundaries which are seen and the ones which are not.

Visual fields

The visual field is the area over which one can see at any one time. The nerve fibres which run from the eyes to the brain are arranged in a very organised manner. This means that, when damage takes place, well recognised patterns of visual field loss can occur, and different patterns of loss have different functional consequences.

Hemianopia

The wiring diagram of the brain is such that the back of the brain on the right is responsible for seeing on the left side of the visual scene (for both eyes), and the back of the brain on the left is responsible for seeing the right side of the visual scene. Brain damage can affect one side or the other and gives rise to left or right sided loss of vision.

The lack of vision in hemianopia can be thought of in the same way as the world behind you. It is not seen. Occasionally, however, some visual function may be retained such as the subconscious perception of movement so that an affected child may not appear to see on one side but is able to walk through a crowd without bumping into anyone.
From a practical point of view there are a number of issues which need to be considered when looking after a child with hemianopia.

*Eating food* can be a problem because food can be left on the side of the plate on the same side as the hemianopia. When this is recognised, turning the plate round so that the remaining food comes into view can be very effective. A policy of putting the favourite food on the hemianopic side of the plate can help a child to develop strategies of exploration because one never knows what pleasant surprises may be waiting round the corner.

*Communication* with a child with hemianopia needs to take into account that someone sitting or approaching from the visually impaired side may not be seen.

*Mobility* can be impaired due to hemianopia, with the child bumping into things and people on the affected side.

*Crossing roads* is an important issue. Oncoming traffic can easily be missed, particularly if it is small and silent like a bicycle. When looking to the affected side the head and eyes need to be turned fully. This is perhaps best taught by example, particularly with the young child.

*The position in the classroom* needs to be selected so that the subject of interest is either straight ahead or on the unaffected side. If the child is sitting so that the teacher, for example, is on the affected side, it can be difficult to attract the child’s attention.

*Access to information* can be restricted by hemianopia because data presented on the affected side may be missed.

*Reading* in particular requires special attention with left and right hemianopia having different implications. As the eyes scan across the text the hemianopia moves with the eyes. For loss of vision on the right side each new word jumps into view and may not be anticipated because it cannot be seen when looking straight ahead, but once the end of the line has been reached the left hand end of the next line down is seen and the eyes can jump to the beginning. For a left hemianopia, on the other hand, as the text is read from left to right the text on the left progressively disappears so that it can be difficult to find the beginning of the next line. It can be helpful to have a system of progressively moving a finger down the left hand margin. Alternative approaches of reading text either vertically or obliquely can prove very helpful for some children, particularly those who have developed their visual impairment after having learned to read.

*Quadrantic visual field loss*. Brain damage can cause loss of vision in any of the four quadrants of the visual field affecting both eyes equally. While quadrantic visual field loss of this nature is less of a problem than hemianopia, it can still cause significant problems in any of the areas outlined above.
Associated cognitive visual problems. Problems of recognition and orientation are quite frequently associated with hemianopia. This subject is discussed later in the chapter.

Lower visual field loss

The visual pathways, which lead from the eyes to the brain, run very close to the water spaces in the brain. In particular, it is the fibres which serve the lower field of vision in both eyes which run over the top of the water spaces and lie closest to them which are most likely to be damaged. The commonest scenario is the child who has difficulty moving his legs due to spastic diplegia who has lower visual field impairment. When looking straight ahead he is unable to see the ground in front of him and when walking over irregular ground he has to walk with the head turned down to check whether there are any obstacles or pot holes. On top of all that there may also be problems in knowing exactly where the feet are.

Lower visual field defects can be very variable and range from being complete so that none of the ground ahead is visible, to being relatively minor so that only the ground one to two metres ahead is not seen. It is worth simulating a lower visual field defect for oneself by holding a piece of card below one’s eyes so that the ground immediately ahead is not seen when looking straight ahead. It is remarkable how much we take for granted. When one can’t see where one’s feet are treading it is quite disabling. An approach which encourages the child to regularly look at the ground ahead to check for safety can prove helpful.

Children with impaired walking due to spastic diplegia and lower visual field impairment can particularly enjoy horse or pony riding. The horse provides mobility over rough ground; it can see where it is going and the training in balance is also helpful. Horse riding can provide a new found freedom for such children.

Visual field constriction

There is a range of disorders of vision due to damage to the brain which are accompanied by constriction of the visual field. A central island of vision is present but peripheral vision is restricted. Visual field constriction is, however, unusual. The commonest cause of apparent constriction of the visual field is difficulty in attending to a lot of information at the same time. This gives the impression that the visual field is narrow, but when the visual scene is made less complicated, the apparent lack of attention to a target in the peripheral visual field is no longer present.

Central visual field loss

If the visual acuity is reduced then there is a reduction in central visual function overall, which in turn represents a central visual field impairment. In such children the more peripheral visual field may provide more useful vision, and the child appears to look past what he is looking at, when in fact the child has chosen the head and eye position which gives the clearest picture.
Combinations of visual field disorders

Poor central vision commonly accompanies hemianopia, and lower visual field impairment can also accompany hemianopia so that vision is only present in one upper outer quadrant of the visual field for both eyes. Under these circumstances all of the difficulties outlined above can be compounded because of the greater restriction of vision.

Seeing movement

We take for granted the fact that we can see moving targets. Not only are we able to see the moving object and to work out the speed and direction of the movement, but we can also see and interpret detail on the object as it is moving. We all, however, recognise that when objects move quickly we are first unable to see the detail, and as the object moves faster it becomes so blurred that it may not even be possible to see it at all. As the blades of a propeller rotate they eventually cannot be seen as the propeller speeds up, and we take it for granted that one cannot see a bullet as it emerges from a gun barrel. In both cases the moving object is not seen because it is moving faster than the detection system in our brains is able to cope with.

The ‘computing system’ in the brain, which enables us to cope with perception of movement, is complex, and it is perhaps not surprising that it may not work so well in some children with brain damage. There are two types of condition which impair movement perception, namely impaired tracking and impaired movement perception.

In children in whom there is damage to the eye movement systems, there can be difficulty in tracking moving objects. Careful observation shows that such children may be able to compensate by moving the head to follow a moving target if it is slow enough, but if the target moves quickly it may be missed, both because the eyes are unable to lock on to, and follow, the moving target.

Impaired movement perception due to brain damage is rare. There is a small sector of the brain, which is at the back of the brain on both sides, which is responsible for seeing movement. In the majority of children with brain damage this part of the brain is preserved, and they are able to see moving targets even if brain damage is severe. However, in a small minority it is this sector of brain tissue which is selectively damaged and although an affected individual can see static targets, objects which move may be invisible unless they are moving very slowly. This problem tends to remain permanent and it is clearly very important to recognise it.

Children with impaired movement perception often choose to watch television programmes in which there is limited movement, such as the weather man or the news reader, but they have little or no interest in fast moving programmes such as cartoons.

A teaching approach which recognises impaired tracking, involves slow movement and gesture, and avoids educational material such as videos or DVDs in which there is a lot of movement would be appropriate.
**Moving through the 3D world**

The picture of what we see is first processed at the back of the brain. It is then broken down into two components: vision for recognition, which takes place at the bottom of the brain at the back, the temporal lobes; and vision for action, in which the picture of the visual world is passed to the part of the brain responsible for moving the body through the picture of what we see. In many children with brain damage and visual impairment, there are profound problems in bringing about accurate movements through visual space, because the pathways in the brain which pass the details of the picture to the part of the brain responsible for motion, the dorsal stream, has been damaged.

In some children it can be the movement of the legs through visual space which is impaired, and in others it can be the movement of the arms and the hands, or both can be impaired. These problems can compound the problems of weakness and stiffness or spasticity, or they may simply be visual, but the outcome of inaccurate movement of the body through visual space is the common outcome.

One situation which is common is the child who has difficulty knowing whether a line in the floor is a step or not. When the child comes to a boundary between linoleum and carpet for example, the boundary has to be carefully explored before it can be crossed. Another typical problem is difficulty negotiating steps and kerbs. Going up stairs is often easier but going down stairs is a particular problem because it is particularly difficult to estimate the depth of each step. The same applies to kerbs. Typically the foot is lifted too high and it may be lifted before coming to the step.

Other children can have problems accurately reaching for things and manipulating them. It can of course be difficult to work out whether the problem is due to weakness, or to poor co-ordination, or for visual reasons, but the typical picture is one in which the reach is intermittently accurate. The hand is not accurately pre-configured to the shape or to the orientation of what is about to be picked up.

Practical approaches to these problems require practice, practice and more practice. Soft play areas which are quiet with not many children around and which provide a stimulating opportunity to learn to move through 3D space without injury can be very helpful, both in providing the opportunity to learn skills and in helping confidence to develop.

**Crowding and complexity**

If one opens too many programs in a computer to run at the same time the computer gets slower, and if one more program is opened the computer stops working. This is because there isn’t enough active memory to cope with all the tasks which need to be done at the same time. Our minds function in a similar way. Watching television whilst doing homework usually means that it takes longer to do the homework. If there is a conversation going on in the room at the same time, the homework may never get done because all the ‘programs’ cannot be held open at the same time.
The visual system has to handle a very large amount of information at the same time, and it succeeds in doing this by using a double system which is located at the top of the brain at the back, the posterior parietal lobes. All the incoming information is processed simultaneously, but the conscious mind cannot cope with this, so there is a second selection system, probably located in the frontal lobes, which selects out which information to attend to at any one time, and allows the rest to be ignored until it is chosen for attention.

Damage to the posterior parietal lobes or to the pathways which link them to the visual system, the dorsal stream, means that the mind can’t cope with a lot of information at the same time. Children with such problems show a number of different features related to the complexity of the visual scene. Both the background and the foreground can be detailed and difficult to appreciate fully. Young children can find it difficult to locate a toy when it is on a patterned carpet but have much less difficulty finding the same toy on a plain carpet. If the same toy is in amongst other toys on a plain carpet it may not be possible to find it. The practical approach is to regularly investigate how clear the background and the foreground have to be in order to allow the child to function optimally. Older children who are learning to read may only be able to access a small number of words at the same time. The approach to take in this situation is analogous to reading Braille in which the information is broken down and presented sequentially. For example, when learning to read, a computer can be used to show one word at a time. When the condition is less severe, enlargement of text reduces crowding and can help significantly. Magnifying aids can also help because they too diminish crowding. A spectacle correction which corrects long sightedness may not normally be given because of the ability of the brain to compensate for the long sightedness by focusing. However such a correction can have the advantage of magnification which also reduces crowding.

Impaired simultaneous perception can give the impression that the child has tunnel vision because it is not possible to attend to a visual stimulus at the side at the same time as attending to something of interest in the centre of the field of vision. The visual acuity can be normal for single letters but reduced for words. This is called crowding and is brought about because the more information is present, the bigger it has to be to create less crowding of the central visual scene so that less is being presented for analysis at any one time.

Gradual spontaneous improvement over a number of years takes place in the majority of children, and the ability to handle increasing amounts of visual information gradually improves. This means that the condition needs to be kept under regular review so that the educational approaches employed are matched to ability.

**Limitations imposed by disorders of eye movement**

Disorders of eye movement which can impair vision can be divided into squint, impaired tracking, and to and fro oscillation of the eyes or nystagmus.

Squint is a condition in which the eyes are not aligned correctly and one of the eyes is
turned in, out, up or down. The brain adapts to squint in children by ignoring the image formed by the squinting eye. Our ability to see in three dimensions relies on the differences between the two pictures presented by the eyes. These differences are interpreted as a sense of depth. If you close one eye as you reach for something you will find that your reach becomes slightly less accurate. If you play a racket sport with one eye closed you will find it more difficult to hit the ball because the two eyes act in harmony to allow you to judge speed and distance in real time. If one eye is squinting the facility of such 3D vision is absent.

Many children with cerebral palsy have difficulty controlling the movement of their eyes. Our eye movements can be divided into two types, fast and slow. Fast eye movements are used to look from one object of interest to another, while slow eye movements are used to track a moving target. Either or both can be impaired. In addition to degrading the ability to see detail on moving targets, there can be difficulty in accessing information on static targets as well. In order to read we have to move our eyes in a very regular way. The eyes make four or five jerking movements to the right as we read a line and at the end of the line they jump back to the beginning of the next line. In children with impaired tracking these movements are inaccurate and reading is difficult. It is not surprising that some children appear to miss words out or jump to the wrong line when reading. An approach which recognises this is to enlarge the text. This means that even if the successive eye movements are irregular, the next word is seen because the enlarged words compensate for the inaccuracy of the eye movements.

To and fro movements of the eyes sometimes accompany cerebral palsy and may be seen in children with cerebral visual impairment without movement difficulties. One might expect that the children would see everything oscillating to and fro, but they do not because the brain smooths out the picture. The outcome is that the visual acuity is diminished because of ‘camera shake’. Many children discover that they get clearer vision if they hold their eyes in the position in which the eye movements are least. This results in the child adopting a head posture, particularly when concentrating on small print, for example. Head posturing can be diminished in many children by enlarging the print so that there is no longer a need to enhance vision in this way.

Visual fatigue

There are many jobs which entail detailed inspection. For example, looking down microscopes, reading X-rays and quality control. It is well recognised that because these tasks involve a lot of mental effort the workers become tired and inaccuracies creep in. Regular well earned breaks are therefore scheduled in order to enhance performance. Children with visual impairment due to brain damage become fatigued in like manner and their performance drops off when they have worked hard. In particular the visual system can be fatigued especially in children who have very limited vision. In these children there can be periods of remarkable lucidity when the visual system appears to be working well, interspersed with periods during which the child does not appear to see. The exact reasons for this behaviour are unknown.
On a lesser scale, children get tired much more easily if what they are being shown is a struggle to see because it is at the limit of their perception, for any of the reasons already described. For all children who fatigue quickly the first thing to do is to simplify the visual information by enlargement and removing clutter. This can often give gratifying results, which can often be enhanced by ensuring that all forms of communication are clear and paced at the speed at which attention is maintained. By diminishing the amount of information a child has to handle, both in space and in time, and ensuring that everyone working with the child is aware of the limits of detail, complexity and speed of communication which the child can cope with, the periods during which the child becomes inattentive can be diminished.

Recognition

The human brain is designed so that we can rapidly see, know and understand what we are looking at. When a baby is born and looks around for the first time, the brain, which is a remarkably active self-programming computer, is turned on. The brain of the newborn infant is rather like a brand new library without many books in it. There are, however, a number of rooms in the library which are destined for book collections about different subjects. The room for face recognition already has one or two books in it. The infant will spend more time looking at a face than a jumbled pattern of the same complexity. As each new face is seen, the picture is stored for subsequent recognition. Seeing the same face many times means that the young child begins to recognise close family members. As time goes by and the baby explores, the information about what is experienced is given meaning and is progressively stored. If there is an impaired visual input then the visual information which is stored can only be as good as the quality of the input which is provided. The mind can only learn to see as well as the information it is provided with. In most cases in which there is simply impaired clarity of visual input, the young child compensates by getting much closer to see things. The magnification which is obtained by proximity compensates for the impairment in the anterior visual pathways. In contrast, when there is brain damage present, the ‘computing units’ which are responsible for knowing and understanding what is seen may be dysfunctional. It is therefore important to be able to identify visual disorders due to brain damage so that the problems can be both circumvented and dealt with directly.

Recognition of people

When you walk down a busy street and recognise and greet a friend, the amount of computing being done by your brain is phenomenal. The act of not recognising someone needs a lot of processing. Each person is compared with the whole stored image bank of the hundreds of people you already know and an almost instant conclusion is reached that you haven’t met that person before. When you come to the person you do know, a match is made and you are able to greet your friend.

When you then have a conversation, you are able to respond to a wide range of nuances of facial expression and reciprocate with appropriate facial expressions of your own.
Although we take facial expression for granted, this too needs a lot of computing power in the brain.

Children who have poor vision due to brain damage can have impairment of both face recognition and the ability to interpret facial expression. It is very important to recognise these disabilities, for obvious reasons. An inability or disability in recognising one’s friends is socially disabling. If this is compounded by not being able to react to facial expressions, a significant degree of alienation can result. When teaching a child with these problems one has to be aware that one is recognised by the tone of the voice, and that the language component of facial expression may not be apparent. The voice therefore needs to convey all the language.

Recognition of shape and form

In order to recognise the differences between different types of car the brain has to do the same job as it does for faces, but a different part of the brain is used. This means that brain damage can result in problems in differentiating shapes from one another, but with an intact ability to recognise faces. This can be relevant to maths, for example, where such a child may have numeric skills but be unable to comprehend geometry.

Damage to the temporal lobes can impair the ability to read text, resulting in alexia (inability to read) or dyslexia (selective impairment in reading in the context of normal intelligence in other aspects of intellectual function). The part of the brain responsible for interpreting the written word into language comprises the language centre, which is on the left side in most people. If there is damage to the back of the brain on the left combined with damage to the pathway between the back of the brain on the right and the language centre, alexia is the result. The damage on the left causes inability to see on the right side or hemianopia. There is intact visual function in the right brain, but because the pathway (the posterior corpus callosum) which conveys this information to the reading centre is damaged, text information cannot be interpreted linguistically. There is some evidence that phonetic reading is particularly impaired in these individuals and that the ‘look and say’ method of reading may be the best way of teaching individuals with this rare disorder.

Orientation

Orientation is not truly a visual skill because people with no vision can be fully orientated by virtue of their other senses. However, in general, vision and visual memory play a large part. We need to be orientated to find our way about from one place to another, and within buildings. The same skills are needed to know where to find things in cupboards and drawers, both at home and at school, and orientation is needed to know where one has put things down. If the part of the brain which is used for orientation is not functioning well, there may be problems and difficulties both on the large scale of finding one’s way around and on the small scale within the home and at school.
Like the skill of face recognition, orientation requires an ability to retain a store of information which is compared with the current scene. If there is a match one is orientated. If not, the new scene needs to be learnt and memorised for future reference.

The part of the brain which is used for finding one’s way around is close to the part for recognising faces and close to the part for seeing on the left hand side. This means that children with impaired orientation may or may not have problems recognising people and seeing on the left hand side as well.

**Orientation when outside**

It can be difficult to know whether a child with brain damage has difficulty finding his way around outside because such children rarely have the opportunity to get out and about on their own. There can therefore be two factors which lead to problems with route finding: an intrinsic disability; and lack of opportunity to learn the strategies which come naturally to children who are given their independence. When possible the child should be asked to be the guide and take the lead.

There are a number of approaches which can be very helpful for people who have difficulties finding their way about.

- Talking about where one is going in a consistent way for all important routes helps each route to be remembered.
- Looking out for landmarks and talking about them.
- Learning where the sun is at different times of day, and learning how to use the sun as a reference point so that one doesn’t lose one’s sense of direction.
- Writing short songs or poems about important routes can prove very helpful to some.
- Playing hide and seek.
- Getting out and about regularly.

**Orientation when inside**

Have you ever had difficulty remembering which drawer or cupboard something is in? Imagine what it is like to have this as a permanent problem, but you know that you are normal because you have always had the problem and you do not know what it is to have the skill. You develop a system of leaving things in specific locations which you have spent ages remembering. Then someone moves them! Imagine how frustrating this is. It takes ages to find them despite a huge amount of effort and then you are told that you’re stupid if you can’t find things. Not surprisingly your frustration boils over. You then develop a system of marking each drawer and each cupboard and your mum comes into the room, gets angry that the furniture has been defaced and removes all your carefully designed labels. Your rage boils over and you are thought to have behavioural problems! This is a true story of a child with problems due to previously undiagnosed problems with orientation. As soon as the problem was recognised and everyone was informed of the
cause and nature of the problem, the drawers were re-labelled, the position of everything was respected and all the ‘behavioural problems’ disappeared.

The same children have tremendous problems when they change schools and need intensive orientation training in such new environments. The degree of the problem can vary from occasionally getting lost in school to never being able to find the classroom without help. Identifiers which are ideally designed and put up by the child can be very helpful.

Younger children need to be given every opportunity to act as the messenger in the school, while children in secondary school may need intensive training about the school, ideally in advance. Parents may need help in developing methods of teaching, particularly when visiting hotels and other large public buildings. Some children can be taught to develop a discipline of making up alternative ways of remembering, such as mnemonics.

Knowing where things are

Children with profound problems with orientation can have difficulty knowing where they have put things. To the observer it is obvious that the felt tip pen is just on the right hand side but to the child someone may have stolen the pen because it is nowhere to be found. Children with this degree of orientational difficulty need to have a dedicated work station in which the location for the pen is clearly shown. To begin with, a place mat with the patterns of the cutlery can help at meal times. With a lot of hard work these difficulties can be overcome and it is then only when the child is rushed or stressed that the problems become evident.

Visual memory

Our ability to remember what we have seen is very important. The initial part of the process is carried out by the inner parts of the temporal lobes of the brain. If visual memory is impaired due to damage to the temporal lobes and adjacent areas where visual memories are formed, it is not surprising that such tasks as copying are difficult. One strategy which is worth considering is to encourage the child with a poor visual memory to speak out loud (initially and then to speak in memory) what has been seen, so that auditory memories are formed instead, which can in turn help such activities as copying down information.

Conclusion

Cerebral visual impairment is complex. The input to the brain can be impaired due to damage to the visual pathways. The information processing can be disturbed in such a way that recognition is impaired (damage to the ‘what’ pathway or ventral stream) or in such a way that analysis of the complexity of the visual scene and movement through 3D space is impaired (damage to the ‘where’ pathway or dorsal stream). The pathways
serving eye movements can be damaged and this means that rapidly moving information may not be seen. The control of focusing by the eye can also be deficient so that an affected child has difficulty bringing things into focus, particularly if long sighted. This can lead to significant blurring of vision. Children known to have poor vision associated with known damage to the brain need to be evaluated in a structured way which identifies all the problems. The educational approach which is adopted must ensure that all information which is presented can be seen, appreciated and understood. The information therefore needs to be designed to fall within the perceptual limitations of each child.
CHAPTER 4

The Roles of the Professionals

4.1 The Community Paediatrician

Aisla Sinclair

A community paediatrician is a doctor who specialises in looking after children with chronic illness and disability in a community setting. He/she works out of clinics, health centres, nurseries and schools and in close co-operation with other agencies - education, social work and the hospital-based services - to help children, within the constraints of their disability, to make the most of their education and achieve their maximum potential.

A community paediatrician with a special interest in visual impairment will have experience and skills in neurodevelopmental assessment which will have been extended to cover visual function in greater depth and detail. They will seek all background information there is about a child, with a detailed medical history, a thorough medical and developmental examination, a view of investigation results plus a collation of information from health visitors, GPs, paediatricians, ophthalmologists, orthoptists and other medical and non-medical professionals who have been involved with the child, in order to establish or confirm a diagnosis. Diagnosis is usually related to cause.

Assessment tools

Assessment tools used by the paediatrician will be a mix of medical examination and functional assessment which will include both observation and task setting. The Reynell-Zinkin Scales (Reynell & Zinkin, 1979) can be used. They are a graded series of those observations and tasks which have been designed as a measure of development in a child with visual impairment.

Diagnosis leads on to treatment which may be medical but more often harnesses the expertise of other agencies - teacher of children with visual impairment (TVI), teachers, speech and language therapists, occupational therapists and physiotherapists, educational psychologists. This diagnosis-treatment process parallels the assessment-intervention system of other agencies. While all agencies may have the same goals, they tend to use different terminology. The community paediatrician is at the interface between the acute services and the community. It should be their role to convert the information passing between the various agencies into a common language, which can then be used in communication between parents and professionals and to plan strategies for the support, education and development of the child.

An example of collaborative working between agencies and across the acute/community services divide is in joint assessment.
This has been found to be very useful, for example, where an orthoptist has been able to observe a child during a teaching session with a TVI, that is, in a real setting, rather than in a clinic, with real everyday objects. The paediatrician and the TVI have collaborated to assess development and functional vision at the same time - particularly important for a child with CPVI.

Each professional brings a different perspective. Assessment from different angles gives a more complete picture which is important in a child with CPVI where it is often very difficult to tease out primary, and secondary causes (e.g. is a child’s head drooping because of weak musculature or poor vision), and where visual function might vary in quality and timing from day-to-day.

The community paediatrician slots well into the multi-disciplinary team caring for the child with CPVI:

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<th>Communication</th>
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<tr>
<td>Medical information</td>
<td>Important contribution of medical and neurodevelopmental information.</td>
</tr>
<tr>
<td>Co-ordinating</td>
<td>Practised in interagency working so that easily takes on a co-ordinating role.</td>
</tr>
<tr>
<td>Overview</td>
<td>In collating information and drawing the team of parents and professionals together, the community paediatrician is in a prime position to overview the whole child so that all needs are identified and gaps in provision bridged.</td>
</tr>
</tbody>
</table>

Figure 4.1

4.2 The Peripatetic Teacher of the Visually Impaired

Louise France

A peripatetic teacher of visual impairment (TVI) visits children at home, in the nursery, mainstream or special school. The teacher is a visitor supporting both the child and the people who deliver the child’s education. Their role can vary between authorities but involvement begins with a referral which is usually followed up by a functional vision assessment. This is likely to comprise of the following:
• Gathering of background information from those who know the child, such as the parents, class teacher and other specialists already involved. Joint visits are made if possible. Reports from the ophthalmologist are requested.

• Observation of the child in everyday situations in the home, nursery or classroom.

• Identification of an appropriate vision assessment tool. For the child with cerebral palsy, in particular, this will involve assessing more than acuity, including also contrast sensitivity and visual field. Approaches used will range from those recommended in ‘Vision for Doing’ (Aitken & Buultjens, 1992) and Lea Test materials (Hyvärinen, 1995-96) for those with additional difficulties, to the standard Snellen Chart and Maclure Reading Type Test.

A report will follow which summarises the results of the assessment and it will make a number of recommendations concerning classroom practice. The TVI begins to visit the child to help implement these recommendations. The frequency of the visits will vary depending on the degree of visual impairment and whether the child is in a special or mainstream school/nursery or at home. The TVI can offer advice and support in some of the following ways:

• Raise awareness of visual impairment in the school and help other people develop an understanding of the child’s needs and the effect of cerebral palsy on the child’s use of vision: in-service training will be offered to the school.

• Suggest any necessary physical changes to the child’s environment and position in the classroom; this will require discussion with the child’s physiotherapist.

• Advise upon adaptation of reading materials or alternative communication aids. When applicable a print size is recommended, or alternatively the size of symbols or types of signs may be discussed with the speech and language therapist.

• Give training in how to use specialist equipment and monitor its use, for example, low vision aids, specialist technology, or Lilli Nielsen’s ‘Little Room’ (Nielsen, 1992).

• Teach the child strategies such as making use of a reading marker.

• Discuss with the teacher targets for the child’s IEP.

• Negotiate on behalf of the child, for example if a reduced amount of classwork is necessary.

• Offer individual teaching of skills that the child with CPVI may find particularly difficult, such as scanning, tracking, or handwriting.
• Continue to observe the child’s vision so that changes can be detected early.

• Develop a relationship with the child’s parents as soon as possible. This is best when a referral is made immediately after diagnosis, and the TVI can begin by visiting at home and maintain contact when the child starts school, or ensure introductions are made between parents and a new TVI. The TVI provides support for the parents as well as the child and can liaise between home and school.

• Suggest any other agencies that could be involved.

Case study of peripatetic teacher’s involvement with a child with cerebral palsy and visual impairment in a special school

Richard has cerebral palsy, is registered blind and has profound learning difficulties. He was referred by a multi-disciplinary pre-5 assessment team for support from a peripatetic teacher of visual impairment at the age of one year. Weekly home visits began. His vision was assessed using ‘Vision for Doing’. He was attentive to stimuli to the other senses but it was uncertain whether he had light perception. He started nursery at a school for children with complex needs at age two and visits from a VI teacher continued. Staff were encouraged to keep an open mind about his vision and to continue to observe his response to light. There were joint observation sessions which staff have continued in between visits.

The VI teacher recommended that Lilli Nielsen’s ‘Little Room’ was introduced when Richard started at the nursery. The VI teacher suggested some appropriate real objects to begin with and made the initial structured observations.

The ‘Movement Gesture and Sign’ approach described by Lee and MacWilliam in ‘Learning Together’ (2002) was recommended then discussed with Richard’s speech and language therapist and class teacher. The VI teacher helped staff to identify initial movements that Richard made that could be interpreted as gestures and nurtured into his unique signs.

Richard was referred to Bobath Children’s Therapy Centre Scotland and the VI teacher has been able to join in therapy sessions with their physiotherapist and OT. Bobath Scotland also liaises with school staff. Richard is now five years old and is able to sit with minimal support. This has improved his possibilities for play.

Richard’s case highlights the value of early involvement from a teacher of visual impairment for a child with cerebral palsy, visual impairment and other difficulties. Severe visual impairment is not just another disability. In cases where the home visiting teacher is from another specialism, regular joint visits could produce similar benefits.
4.3 The VI Teacher in the Special School/Unit for Children with Multiple Disability and Visual Impairment (MDVI)

Liz Colquhoun

The VI teacher in a school for MDVI is responsible for a small group of children, some of whom may have cerebral palsy and a visual impairment (CPVI). The teacher’s role would come under the following headings:

Visual assessment using a number of methods

- Ongoing observation.
- Ongoing assessment.
- Ongoing evaluation of assessment.

The VI teacher within the special school for those children with more complex needs may use materials to assess the child’s functional vision, e.g. ‘Vision for Doing’ and those of Lea Hyvärinen, rather than the standard tests used for mainstream children. This, together with ongoing observation of a child in everyday situations, gives a better picture of how well they use their residual vision. Ongoing evaluation and assessment is extremely important if the teacher is able to monitor any changes and plan appropriately for the child’s educational needs.

Individualised Educational Programme (IEP)

- Assess the target needs of the child - short term/experiential/long term.
- On site collaboration with other professionals:
speech and language therapists; 
physiotherapists; 
occupational therapists; 
mobility specialists; 
visiting specialist subject teachers, home link, hearing impairment.

• Co-ordinating information from other professionals. 
• Recording targets - to draw up IEP. 
• Carrying out IEP. 
• Ongoing assessment of achievement level of child - recording. 
• Ongoing assessment of delivery method of IEP - evaluation.

Every child has his/her own specific needs so a plan is necessary to meet these needs. Depending on the child, targets may be short (experiential) or long term. Meeting with other professionals is important at the planning stage so that they can have input in their particular area. The teacher can then co-ordinate the information and record the targets within the programme. It is then the duty of the teacher and her classroom team to carry out the programme daily. There must be ongoing assessment of the achievement level of the child and method of delivery of the IEP to make sure the child is meeting his/her potential.

Parents

• Communication at review meeting and parents nights. 
• Input to IEP. 
• Two-way communication through home/school diary. 
• Reinforcement of work at home.

It is essential that the parents have an input at the planning stage and also that there be ongoing communication to ensure continuity in targets set.

Team co-ordinator

• Responsibility for classroom team. 
• Organise and communicate method of carrying out IEP. 
• Oversee ongoing work.

The teacher has responsibility for the classroom team. It is his/her duty to organise and communicate the method of carrying out the IEP and to oversee the ongoing work.

Case Study

Ed was a 5 year old boy who, after routine surgery, developed complications and was brain damaged, blind, with severe cerebral palsy and a speech impediment. It was decided at a meeting of the Visual Impairment Assessment Team that he should attend a school for multiply disabled and visually impaired children.
A review was attended by the class teacher, parents and a number of other professionals. Each had assessed the needs of the child and reported to the meeting. The class teacher then met on a one-to-one basis with the physiotherapist, speech and language therapist and mobility education officer to establish what their input would be to the IEP.

The teacher then gathered all the information and produced the IEP. Since the child had an SEN auxiliary it was important that the teacher established with her exactly what was required and monitor the child’s progress to assess whether any adjustments to the IEP or approaches to delivery were required. The other professionals also met regularly with the teacher to assess the progress and give advice if required. The classroom team used ongoing observation between visits to the ophthalmologist, to look for any sign that Ed’s sight could be returning. The parents were kept informed by home/school diary, noted any developments and how they were progressing with work at home.

They had asked to have Ed referred to Bobath Children’s Therapy Centre Scotland for an assessment and possible treatment sessions. The class teacher supplied a report initially and then at the start of each block of treatment sessions. She also attended sessions in the first block and thereafter the SEN auxiliary attended at least twice in each block. This ensured continuity between all those working with Ed, giving the best possible movement and positioning opportunities to enable him to access his education programme and reach his full potential.

4.4 The Social Worker

Isobel Thomson

Emotional support

Social workers assess the needs of the child within the context of the family, supporting parents through the emotional impact of the grief, sorrow and loss they feel when told their child has a disability. Support is also provided to the wider family, e.g. siblings and grandparents, if required.

Information

Information regarding welfare benefits and concessions is made available. Claims by families in need can be supported if required. Information is provided about voluntary agencies on both local and national level where parents can access additional information and services.

Resources

The social worker can offer support to a family to care for their child by arranging appropriate respite care either in the family home or in another environment, if required, either for parents or siblings, to give them a break from caring. Summer Play schemes are arranged during the summer school holidays that families can access. In conjunction
with other professionals, for example teachers of the visually impaired, an assessment of need for provision of specialised equipment, toys, etc, for home use to maximise the child’s development and education can be made. Provision can be on a permanent loan basis or by application to appropriate statutory or charitable funding sources.

**Transition from children’s services to adult services**

The social worker supports the family and young person at the transition from education to adult services. The Future Needs Assessment, involving joint working with health and education colleagues, identifies the young person’s needs and makes arrangements for any continuing or higher educational training and assessment of the young person’s need for support, to assist their transition to adulthood.

**Protection**

Where there are concerns that a child may be abused, the locally agreed procedures for child protection need to be activated and addressed in the same way as for any other child in this situation. In this situation the partnership between the various agencies is invaluable, especially where a worker knows the communication system used by the child/young person and is able to help with informing and participating in the process of assessment.

**4.5 The Speech and Language Therapist**

*Gillian Callander and Shona Gillespie*

**Introduction to speech and language therapy**

Children with a visual impairment and cerebral palsy often have difficulty with talking, listening, interacting and understanding. This may create problems in communicating with and understanding the outside world. A speech and language therapist helps these children to achieve their communication potential.

**Referral system**

Anyone, with the parents’ consent, can refer a child to Speech and Language Therapy. Parents of the child can also make a direct referral to the service. Very young children are usually referred by a doctor or health visitor. As the child gets older, teachers at nursery or school may feel it would be helpful to make a referral.

**The role of the speech and language therapist**

A speech and language therapist will work with the child, the parents and other important people in the child’s environment to assess how the child:

- interacts and plays with others;
- understands spoken language;
• understands the environment;
• uses gestures, sounds or words to communicate;
• eats, drinks and swallows.

The child will be seen in one or more of the following places:
• Health Centre/Clinic/Child Development Centre;
• Home;
• Nursery/School.

After all the information has been collected the speech and language therapist will work with the parents and other professionals. This may involve:

1. **Support and advice** for the people who work with the child through encouraging useful communication at home and in the nursery/school environment. Parents and carers are helped to use communication which is appropriate to the child’s level of ability. Training may be provided through workshops in any aspect of communication and/or eating and drinking skills.

2. **Individual or group work** with the child to support development of:
   
   • **Interaction skills**: children with visual difficulties and cerebral palsy may have problems in the areas of listening, taking turns, shared attention, and may not be able to make eye contact, see facial expressions or understand body language. These difficulties can cause problems in forming social relationships and in taking part appropriately in conversation. For example, if a child is unable to see facial expressions then they will not know if the person they are interacting with is happy/sad, enjoying the interaction or bored. If they are unable to make eye contact then their conversational partners may feel that the child is uninterested or not listening.

   • **Information gathering**: information gathered by children with visual difficulties and cerebral palsy will require to be gained through the use of senses other than vision and may be limited in the area of touch. This will affect how language develops as the way in which they explore and learn about their environment will be different from that of a child without difficulties. Communication skills may be delayed and sometimes will not follow the normal pattern of development. For example, there can be difficulties in using the correct personal pronouns, keeping to the current topic of conversation, and developing appropriate vocabulary.

   • **Speech sounds**: it is common for children with cerebral palsy and visual impairment to have difficulty in producing the correct sounds required to produce clear speech.
• **Eating, drinking and swallowing skills**: there may be a physical or behavioural difficulty in this area due to visual impairment and/or motor problems.

• **Augmentative communication** (using gesture, signing, symbols, technology): this can be useful in developing additional communication skills for these children.

3. **Written information** to the relevant people involved in the child’s care. This may be in the form of advice sheets or more formal reports.

At all times the speech and language therapist works in partnership with parents, education staff and other relevant professionals, e.g. physiotherapists, occupational therapists, social workers, and medical staff. Every child is an individual and as a result, therapy is planned to suit differing needs. These needs may change as the child grows and develops. Therapy input must therefore be flexible to meet these changes.

4.6 **Optometrists, Opticians, Orthoptists and Ophthalmologists**

**Andrew Blaikie**

It is often very confusing for parents to understand what all the different eye professionals do whose names begin with ‘O’. The names all sound the same. They all do quite similar things but with some very important differences. It is useful for parents to know what they do, so they know which professional is responsible for providing what service for their child. That way they can turn to the right professional at the right time to meet their child’s needs.

**Optometrist**

An optometrist is a person who examines eyes to see if spectacles will improve vision. He or she can measure visual acuity and pressure within the eye. By using specialised equipment an optometrist can also perform a full examination of all the different parts of the eye. Some optometrists may also recommend and prescribe drops to treat eye conditions. Optometrists write a spectacle prescription that is given to the patient and passed on to an optician.

Many optometrists will only rarely see children with cerebral palsy and visual impairment. It is worth finding out in your area if any optometrists have a special interest in examining and prescribing for children with cerebral palsy. There is increasing evidence that children with cerebral palsy have difficulty focusing on near objects (accommodation). It is useful to have your child’s distance (about 6 metres away) and near (within 30cm) visual acuity assessed. If a child’s distance vision at 6 metres is better than their near vision the child may be very long sighted and/or have weak accommodation. Often a
reading prescription, either as bifocals or a single focus pair of reading glasses will make the visual world within a child’s arm reach clearer and more interesting.

**Optician**

An optician is a person who makes spectacles based on a prescription. He or she can decide on the best type of lens and spectacle frame to suit the individual. Optometrists and opticians often work together.

Again many opticians will only rarely see children with cerebral palsy and visual impairment. It is challenging fitting a comfortable spectacle frame that a child with cerebral palsy will tolerate. Children who are developmentally under the age of 2 years do not usually enjoy wearing glasses, even if they see better with them. Children who are developmentally between the ages of 2 and 4 years are more likely to tolerate wearing glasses but may still try to pull them off, even if they are seeing better with them. It is important to persevere with children of these developmental ages as once they are used to their glasses they will benefit from seeing more clearly.

It is also important that the frame sits correctly on the face so that the child is looking through the correct part of the lens. By using a soft silicone nose piece, light plastic lenses and frame and well fitting curled ear pieces, children with cerebral palsy are more likely to wear glasses and benefit from better vision.

**Orthoptist**

An orthoptist is a person who assesses vision and eye movements. They use methods of assessing vision that are most suitable for young children. They can assess squints and patients complaining of double vision. They usually work in eye clinics with ophthalmologists.

It is often more difficult to accurately and confidently assess vision in children with cerebral palsy. Orthoptists can use observation skills, forced choice preferential looking tests and matching symbol and letter tests to try to say what level of vision a child may have. The different types of test are better for assessing children of different developmental ages and abilities.

Children with cerebral palsy may have special difficulties with vision that other children are less likely to have. Often children will be able to see a very small single symbol when presented in isolation but be unable to see the same symbol when crowded together amongst others. Instead the child may only be able to see crowded symbols when they are much larger. This is known as ‘crowding’. This can sometimes be a reason why children have unexpectedly poor reading speeds for their visual acuity and age.

Children with cerebral palsy and visual impairment can also have limitation of smooth following and fast position changing eye movements. Difficulties with eye movements can also lead to unexpectedly poor reading speeds.
It is important that when your child is examined by an orthoptist a suitable test is used and that crowding and eye movement difficulties are specifically examined for.

**Ophthalmologist**

An ophthalmologist is a person who has qualified as a doctor and specialised in the diagnosis and treatment of eye conditions. They can prescribe spectacles and drugs. Most ophthalmologists will perform surgery although they may specialise in different types of surgery.

Children with cerebral palsy are at risk of suffering from visual field loss and complicated forms of brain related visual impairment (agnosias and apraxias). It is important that your ophthalmologist asks about these and examines for them. Ophthalmologists can also check to see if a child needs glasses, just like an optometrist. If a prescription is to be made, tell the ophthalmologist which optician you intend to use so a copy of the clinic letter can also be copied and sent to your optician. That way the optician will understand more clearly the needs of your child.

An ophthalmologist should oversee and co-ordinate all the vision aspects of the care of a child with cerebral palsy. It is their responsibility to disseminate information to the cross-discipline team concerned with all other aspects of the child’s health. It is helpful to ask your ophthalmologist to copy clinic letters to all members of the cross-discipline team on your behalf. It is also worth asking for a copy of any clinic letters or other written correspondence for yourself to keep in a file at home. Making photocopies of these letters for teachers, occupational therapists, physiotherapists, social workers or optometrists can be very useful when they wish to work with your child.

4.7 **The Physiotherapist**

*Anne Harnden*

The role of the physiotherapist is to enable the child to move as smoothly and effortlessly as possible to access his environment, both in terms of moving safely about the environment, including transfers involving self care activities, and also in terms of finding suitable positions where the child can explore play materials.

Children are heavily dependent on sensory information to guide and adapt movement skills. We learn to refine movement by feeling how we move, using feedback from various sensory receptors in our bodies which tell us, for example, where our head and limbs are in space, how fast we are moving, and using our eyes for visual monitoring. We use this information to guide and adapt movement patterns in order to function efficiently according to the demands of the environment and the task. The developing child thus acquires a large repertoire of movement patterns. Head and trunk control are vital to support movements of our bodies through space, to help us to balance, and to provide a base from which to develop refined use of vision and hand movements.
Whatever the type (classification) of cerebral palsy, the possibilities for efficient use of sensory feedback will be limited. This will influence the child’s motor abilities to move and explore his environment. The child with cerebral palsy thus develops a somewhat limited repertoire of movement patterns. Balance will become compromised and movements will tend to be awkward in gross and fine motor terms. Where the child has hypertonia/spasticity (stiffness of muscles), for example, repetition of these patterns tends to result in the child becoming stiffer, with patterns becoming even more limited. This stiffness will result in permanent loss of range of movement in the joints in the child’s body (contractures). Difficulties in adapting and adjusting are characteristic of the child with cerebral palsy and therefore this child has to work hard at maintaining a position in space. Effort also unfortunately results in increasing stiffness. Extra effort is imposed when the child is expected to maintain a position and attend to a learning task.

The child with athetosis has abnormally wide ranging movements and will tend to hold himself somewhat stiffly in order to achieve function. Again this limits the repertoire of movement patterns available to him, and he also has difficulties with adapting and adjusting.

Difficulties in using visual information can result in the child being fearful to move, which will limit movement patterns. These patterns will also be influenced by the amount of effort the child employs to use his degree of visual skills. Visual field loss may result in the child orienting his head in a particular direction. As head movements strongly influence body postures, movement patterns will obviously be affected.

Optimum learning comes about through our own active learning. The physiotherapist will provide a treatment programme to promote head and trunk control to support the child’s movements and balance and give him the confidence to explore. This often includes ways of improving mobility and strength. Handling techniques will be used where and when necessary, to encourage movement within more normal patterns. The child will be encouraged to develop his own repertoire of movement patterns thus enhancing sensory feedback. This will give the child more possibilities to refine his movement patterns, to be more able to adapt and adjust, and therefore more able to move and function, or to maintain a position and function. Equipment such as seating and standing frames are used to reduce the effort a child employs and to maintain appropriate alignment. Orthoses/splints may also be provided to support joints of the body in alignment.

The physiotherapist recognises the implications of visual field loss but also the importance of maintaining alignment and joint range of movement. Therefore close liaison with the occupational therapist and VI teacher is vital to enhance visual training working towards a realistic position for the child that will enable the child to develop and use his visual skills.

The importance of gaining a working balance between all areas of impairment is emphasised to gain the best outcome for the child. (See Appendix 1 for report on study of working relationships between physiotherapists and teachers.)
4.8 Role of Support Staff/VI Teacher in supporting mobility programmes

Linda Bain, Angie Bisson and Mary Pullen

Mobility support staff work under the guidance of a qualified orientation and mobility (O&M) specialist to ensure the visually impaired person gains confidence and independence. This work involves:

- awareness of the need for independence;
- introduction of sighted guide technique;
- introduction and reinforcement of necessary skills before introduction of use of long cane;
- room familiarisation;
- simple indoor route familiarisation;
- reinforcement of sensory awareness development;
- participation in the delivery and reinforcement of environmental awareness programmes;
- participation in the delivery and reinforcement of programmes aimed at improving communication skills including increasing awareness of body language, age appropriate social interaction and ‘stranger danger’;
- reinforcement of shopping skills;
- experiential exercises involving public transport;
- monitoring of good practice with regard to cane skills and an awareness that individuals may have been taught adapted techniques depending on their own individual special needs;
- knowing what constitutes good practice but referring bad practice or the introduction of new skills to the O&M specialist. Good communication between ALL those involved in delivering the mobility programme is essential;
- keeping up-to-date with educational developments relating to mobility, VI and special educational needs in general.

Role of Qualified Orientation and Mobility Specialist

In terms of devising a comprehensive programme of orientation and mobility a qualified specialist is essential. Their role is to:

- assess the orientation and mobility level and identify needs of the visually impaired person;
- devise a programme of training and implement it;
- advise, support and train others working with the visually impaired person, including mobility support staff;
- identify key areas and skills for trained mobility support staff to implement or reinforce with the visually impaired person;
- to emphasise the importance of cross-curricular mobility education;
- monitor the delivery of all orientation and mobility programmes being implemented by mobility support;
• deliver any outdoor route familiarisation;
• deliver all long cane skills training;
• implement and deliver training in all technological mobility aids;
• implement and deliver all independent travel skills including use of public transport;
• to keep up-to-date with educational developments relating to mobility, VI and special educational needs in general.

4.9 The Educational Psychologist

Ruth Walker

An educational psychologist may be involved from the early years of a child’s life in working with families and other professionals to assess the needs, and advise on the child’s programme in nursery or school. An educational psychologist is employed by the local authority and may be based within administrative offices or schools.

Psychologists work with a wide range of children between the age of birth and 19 years who may have additional support needs. They often work closely with teachers and other professionals as a team to help ensure that the child is able to learn effectively in school and achieve their all round potential. Where possible children with additional needs are educated within mainstream schools. Additional resources can be provided and adaptations made to buildings to allow pupils with physical needs to be as independent as possible. If a child’s support needs are more complex, placement within a special school may be considered.

For the family, an educational psychologist may become involved from an early age, visiting home to discuss the child’s developmental needs and consider the range of possible nursery and school places available. A nursery or school might need extra resources or adaptations and together with other professionals the psychologist may advise the authority on these, as well as contributing to the child’s teaching programme once there. Some local authorities have multi-disciplinary assessment teams such as a School Advisory Team which provide a framework for people to work together closely and this can be helpful to parents. Whether a more formal system such as this exists or not, it is important for all those involved to meet regularly and monitor the progress of the child.

Psychological assessment of children with complex needs is usually done in an informal way. Working with a child who has both visual impairment and cerebral palsy requires time and careful attention to the implications of both conditions and the way in which together they can affect the child’s learning. Assessment requires getting to know the child informally, for example through observations of play and learning at home and in school, detailed discussion with those who know the child well and linking with other professionals who may employ special assessment tools.

A Record of Needs is a document which draws from the information and views of all those involved, including parents. With older children their own thoughts and opinions are important. At present a Record can be opened from the age of two years but is more
usually opened at a transition stage such as when the child moves to school. The Record of Needs may be replaced in the future by a Co-ordinated Support Plan for pupils who are thought to be encountering complex multiple barriers to learning and who need a diversity of services.

The psychologist may help in considering possible schools with parents and children at transition times, working with them and others to come to a decision about the most appropriate educational support and provision.

4.10 The Occupational Therapist and the child with CPVI

Gillian McDaid

Physical

To facilitate the development of gross and fine motor skills to promote the child’s level of function with regard to Activities of Daily Living (ADL), e.g. dressing, feeding, playing, etc.

Use of selected, purposeful activities to develop hand skills within the home, at school and during therapy sessions.

Visual/cognitive

Assessment of visual-spatial and visual-perceptual skills in relation to their functional impact on ADL.

Specific activities to develop visual perceptual skills with provision of home/school programmes to support them.

Specialised equipment

Assessment, advice and referral for provision of specialised seating and other equipment to provide appropriate postural support and access to necessary materials, e.g. adjustable height seating/tables for home/school, etc.

Assessment advice on small aids to assist fine motor skills, e.g. pencil grips, non-slip mats, tilted boards, etc.

Methods of assessment

Through observation and detailed analysis of the child’s performance during selected activities.

Use of specific standardised tests for Motor and Perceptual function
Methods of intervention

Working with parents/carers to assist their understanding of the child’s needs and aims of occupational therapy. Provision of Therapy programmes and opportunity to work within the home, school and nursery environments when necessary.

Joint working with other professionals, sharing of information at home, school, etc.

Case study: David 4 years old, diagnosis of asymmetric spastic diplegia affecting the right side more than left. Low visual acuity, glasses for table work.

David had been known to many members of the multi-disciplinary team through his attendance at a child development centre. He was due to start primary school the following year and his parents were very anxious that he attended his local mainstream primary school. With this in mind, his educational psychologist requested an up-to-date assessment of his pre-school abilities, e.g. fine motor skills, grapho-motor ability (pre-writing skills), etc.

David was assessed by the occupational therapist and a special educational needs (SEN) teacher. The assessment indicated that David was significantly behind in terms of visual-spatial concepts and pre-writing skills.

Further assessments from the ophthalmologist, orthoptist and physiotherapist contributed additional information. David’s glasses prescription was changed and the orthoptist detected a lower visual field defect. The physiotherapist concluded that David’s diplegia affected his posture and position for activities. He tended to rotate and fix his physical and visual attention to his immediate left side and ignore the upper, middle and right areas of space around him. The occupational therapy assessment of his fine motor skills also revealed a neglect of his right hand and a lack of integrating it with his left. This also caused David to be very focused on his left side.

The following year David started on a physiotherapy programme to help him move more freely to both sides and improve his gross motor spatial awareness. The occupational therapist’s programme addressed bilateral hand function, hand/eye targeting and visual-spatial concepts at a table top level, and the SEN teacher provided a pre-writing skills programme.

Following a Liaison school meeting prior to his commencement at primary, the following supports were implemented.

The occupational therapist assessed David for a height adjustable school chair, toilet alterations and non-slip table top mats, which were purchased by the Education Service. The school obtained a special needs auxiliary who was able to support David’s physical access around school following advice from the physiotherapist. David also received support from a VI support teacher who helped modify his materials and provided a sloping board for reading and writing.
David's needs were reviewed at a yearly meeting by the team and educational psychologist and any changes made. The integration to primary has been successful and he is coping well with the curriculum.
CHAPTER 5

Working Collaboratively

Janis Sugden

Children with a disability often have a multitude of professionals involved with themselves and their family throughout their childhood. In Chapter 4 you read about the roles of many of these professionals. Many parents can give examples of times when they have been overwhelmed by the number of professionals visiting them in their home. Parents can also relate to situations when they have been unclear as to why so many professionals are involved and what is the job of each person they see.

Within this section we would like to emphasise the importance of collaborative team working and suggest the need for a more defined key worker system to clarify the roles of those who might be involved with a child with a visual impairment and cerebral palsy. In the past the quality of this service has depended on the personnel involved and the area in which the child lives.

We would also like to propose a system (protocol) to clarify this process of professional involvement in an attempt to reduce demands on the child and the family whilst maintaining excellence of service provision to meet the child’s identified needs.

“Quality provision for meeting special educational needs is best achieved within the context of a positive ethos of partnership between parents and schools, local authorities, education support services, and other agencies working with children and young persons.

The effective provision of services requires an inclusive strategy which is understood by all concerned, is operated collaboratively and commands the confidence of children, young persons and their parents.

Professionals in local authorities, schools and support services work with relevant voluntary and health sector organisations in a spirit of inclusion, partnership and collaboration. The contribution which each makes is valued equally and regarded complimentary.” (SOEID, 1998)

A plan of action is necessary in order to provide a comprehensive support system for children with cerebral palsy to assess their level of functional vision throughout their educational careers. The following flow chart (Figure 5.1) identifies the relevant stages of assessment and intervention.
Flowchart to Identify Stages of Routine Assessment and Intervention

At diagnosis

At entry to pre-school/nursery

Transition to primary school

At primary 3/4 stage

Transition to secondary school

**NB:** The above stages should be dealt with routinely. However, the team may meet in addition to these times, for example if a child moves area, or if there is a marked change in the child’s educational progress.

**Figure 5.1**

The child’s special needs can be addressed by collaborative interagency working. Team working has often been practised informally in many areas. The team should consist of all adults who will work with the child, including parents or guardians. In our model the core team consists of a team co-ordinator, who is a community paediatrician, the visiting teacher of the visually impaired (if the child is not in a unit which specialises in this field), the child’s teacher and an orthoptist. This core team will be assisted and advised by other specialists when required. Additional team members may include an educational
psychologist, social worker, an occupational therapist, a physiotherapist, a speech and language therapist, health visitor, and an ophthalmologist. It is extremely unlikely that all of these professionals will be involved at any one time.

The following diagram (Figure 5.2) suggests a protocol to ensure a uniform procedure when the needs of the child are being addressed. Collaborative interagency working is achieved by relevant members, who have been selected from this team, meeting regularly, contributing joint aims and knowledge and planning together.

<table>
<thead>
<tr>
<th>Sources of Referrals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents</td>
</tr>
<tr>
<td>Paediatricians</td>
</tr>
<tr>
<td>Ophthalmologists</td>
</tr>
<tr>
<td>Educational and Health Professionals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Core Group Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referrals received by the co-ordinator of the multi-disciplinary team and distributed to appropriate core-team members.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planning Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary meeting to discuss referral to pool existing information to arrange necessary assessment(s) and who is to be responsible for them.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual (or joint) professional assessment(s).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>An invitation to parents to meet with the team to discuss assessments and plan strategies for support.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Review Meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>This meeting to be held with parents and relevant professionals at the appropriate stages indicated in the flow chart in Figure 5.1.</td>
</tr>
</tbody>
</table>

**Figure 5.2**

**Multi-disciplinary assessment team**

The benefits of multi-disciplinary working are improved communication and understanding between all those involved, whether professionals, parents or carers.

- For professionals it provides an opportunity to share skills and knowledge in order to establish an effective process of assessment, intervention, planning and review.
- For parents it allows their views to be taken into consideration and raises awareness of how their child's needs can be met within their local community.
For education authorities it can provide a good working structure to facilitate inclusion in schools and communities.

To be effective, this method of working requires a co-ordinated approach that involves clear task setting for appropriate core members of the team, clarity of workers’ roles and responsibilities and regular communication and liaison patterns. The assessments can be completed either jointly or on an individual basis. A team meeting, including parents, will agree future involvement of all concerned.

Framework

A framework with practice guidelines to plan and provide for the child with cerebral palsy and visual impairment is essential. This framework must be transferable to individual team environments. A successful framework must have the following:

Agreed joint aims

- Joint Practice guidelines.
- Regular consultation and liaison meetings.
- Informal contact.
- Varied forums.

The aims of the team need to be clear to all involved, including the community.

The team aims to:
- provide specialist advice;
- provide ongoing assessment of a child’s functional vision;
- evaluate a child’s educational needs;
- offer support to families;
- link with other professionals who are not already members of the core team.

Joint practice guidelines/referral criteria

- There is a need for clear referral criteria.
- Any child from birth to school leaving age whose learning may be affected by impaired cerebral/cognitive processing of visual information, including cerebral palsy, may be referred.
- An effective process of assessment planning and review should be established.

Regular consultation and liaison meetings

- A continuity of practice within and between services, which is open, honest and understandable to all, is a priority. The trust, respect and tolerance of others is essential - especially parents. Professional roles can be made clearer by
shadowing each other at work, in-service delivery and joint assessments of children.

• The team must have a co-ordinator who has responsibility for organising appropriate meetings, assessments and responding to referrals.
• Meetings should have an established agenda. The least intrusive, but effective assessment and intervention should be used.
• Regular feedback from users should be collated and responded to. This enables the team to evaluate the service provision and if necessary to make changes to improve the service.

Informal contact

• When a child with cerebral palsy and visual impairment is referred to the team, the co-ordinator will contact the family and introduce herself and the team to the family. This may be done very informally, initially by telephone, followed by a home visit from a team worker. It is a good idea at this stage to give the parents a written list of professionals who will be involved.
• Professionals also benefit from informal discussion between meetings.

Varied forums

• It is not always necessary for every member of the team to be present at all meetings. A large group of professionals can be very intimidating for parents and children.
• Meetings should, whenever possible, be held in the child's local environment.
• The professional team can travel rather than the child and his family.

Reference

CHAPTER 6

Assessment of Visual Function

Andrew Blaikie

There are many different aspects of visual function that can be assessed in a child. The main aspects of visual function that may be impaired and that are possible to assess in children with cerebral palsy include:

• refractive errors and near focusing skills;
• visual acuity;
• contrast sensitivity;
• visual field;
• fast and slow eye movements.

The visual function of children with cerebral palsy can vary from one day to another. A child’s visual function may be poorer if they are tired or feeling ill. They may only cooperate with formal assessment for short periods of time and may tire quickly. Often only segments of a full assessment can be performed at one time. It is probably most meaningful to assess a child in a place familiar to them (school or home) when they are in a good mood, in the morning and not ill. Assessment is not a brief single event. It is a careful regular process of observation and formal testing over a long period of time involving many people. To gain an accurate and realistic idea of a child’s visual function requires careful listening and observation, time and patience.

Asking questions is the best way to start an assessment

Before ‘testing’ visual function it is usually very helpful to ask parents, teachers and other carers about a child’s vision. This may identify more complex types of cerebral visual impairment that might not be revealed by formal ‘testing’. Professor Gordon Dutton has developed a useful structured strategy for questioning parents and carers. This is described in an abridged version below.

A structured clinical history taking strategy

These questions were published in a research paper (Houliston, Taguri, Dutton, Hajivassiliou & Young, 1999). Some questions have been altered and shortened for clarity and sake of space. For the following questions, which number best describes how your child responds in the following situations?

Never 1
Occasionally 2
Most of the Time 3
Always 4
1. Does your child recognise you before you speak?
2. Does your child recognise other family members?
3. Does your child recognise friends?
4. Does your child recognise people from photographs?
5. Can your child identify him/herself from photographs?
6. Can your child recognise shapes?
7. Can your child recognise objects?
8. Can your child name colours?
9. Can your child match colours?
10. Can your child find his/her way around the house?
11. How often does he/she ask for directions around the home?
12. Does he/she lose objects around the house?
13. Can your child find his/her way around new surroundings?
14. How often does he/she ask for directions in new surroundings?
15. Does he/she have difficulty reaching out for and grasping objects?
16. Does your child have difficulty distinguishing a line from a step?
17. Is your child able to see moving objects or are they seen only when they are stationary? (e.g. pets, traffic, rolling ball)
18. Does your child have difficulty seeing objects when he/she is moving quickly him/herself?
19. Can your child find objects on a patterned carpet?
20. Can your child find objects in complex pictures?
21. Does your child eat food from only one part of the plate and ignore the rest?
22. Does he/she misjudge going through doorways or along corridors?

Using this strategy an idea for a child’s strengths and weaknesses can be created. Once a ‘feel’ for a child’s visual function has been formed, more formal observation and testing can be pursued. It is important that any assessment is performed with the child wearing his usual glasses if they have been prescribed.

**Refractive error and near focusing skills**

**Refractive errors**

When most children are born their eyes tend to be either short or long sighted. Short and long sight are both types of ‘refractive error’. Children with refractive error usually need glasses to see clearly and comfortably. Over the first few years of life these refractive errors become less and less until by the age of 5 years very few children continue to have any refractive error. Refractive errors ‘disappear’ by an active process called emmetropisation. Emmetropisation depends on otherwise normal eyes and brain. If there is a problem with either the eyes or brain then this process is interrupted leading to more short and long sight refractive errors in childhood. In children with cerebral palsy emmetropisation (and ‘loss’ of refractive errors) is less likely to be successful. This means that most children with cerebral palsy have a refractive error and are likely to benefit from wearing glasses. Any child with cerebral palsy should be tested by an
optometrist or ophthalmologist to see if they have a refractive error and then prescribed
glasses if it is thought appropriate.

Many children with cerebral palsy may not initially tolerate wearing glasses. This is likely
to be because their visual system is not able to comfortably cope with a clear and ‘in
focus’ visual world. They are likely to be overwhelmed by the initial experience. Through
a structured programme of progressive wear many children can learn to benefit from and
enjoy wearing glasses.

![Happy wearing glasses](image)

**Figure 6.1**

**Near focusing skills**

The eye’s ability to dynamically increase focusing power to allow clear viewing of near
objects is called ‘Accommodation’. This ability to focus for near objects declines
throughout life and consequently most people of middle age need ‘reading glasses’ to
maintain near focusing. Many children with cerebral palsy similarly ‘under accommodate’.
It is recognised that up to 80% of children with cerebral palsy (and also Down’s
syndrome) have difficulty with focusing for near objects even in childhood. This leads to
a blurred retinal image. This will inevitably negatively impact upon learning potential
during structured lessons in school but also incidental learning at home and at play.

![A clear image with normal accommodation](image) ![A blurred image with impaired accommodation](image)

A great deal of detail can be lost from a picture and text if ‘near focusing’ (accommodation) is
impaired. This can make an important impact upon a child’s ability to learn.

**Figure 6.2**
Many eye-care practitioners in North America and Scandinavia routinely prescribe bifocals for children with impairment of accommodation. It is recommended that children with cerebral palsy are tested for near focusing by ‘dynamic’ retinoscopy. If impaired accommodation is noted then children should be prescribed bi or multifocal glasses to help with ‘near’ focusing. Glasses like these are likely to make a positive impact upon a child’s ability to learn and improve their quality of life.

Visual acuity

This is the most commonly measured aspect of vision. There are many definitions. Visual acuity is often described as the ‘threshold for recognition of high contrast materials’. This means the smallest black object on a white background (or vice versa) that a child can see, and actually say what it is (recognise), when presented in good lighting. There are three main ways of assessing visual acuity:

- observation of a child playing and asking questions (taking a history);
- preferential looking tests;
- object recognition and matching.

Different means of assessment are used depending on a child’s developmental age, level of vision and ability to co-operate and communicate.

Observation of a child playing and asking questions

By carefully watching a child at play it is possible to make a reasonably accurate estimate of their visual acuity. It is often possible to make an assessment of many other aspects of visual function as well. The size of toys that a child locates and handles can give clues to their visual function. By introducing small objects of known size such as Smarties, sweeteners or 100s and 1000s cake toppings it is possible to make more confident assessments of visual function. Useful information can also be gained by asking parents, main carers and teachers about a child’s behaviour when playing. This can be just as valuable as spending time observing a child.

Preferential looking tests

Other tests are more formal such as forced choice preferential looking tests. These tests are based on the idea that a child, when presented with two different patterns, will fixate on a pattern that is coarse enough for them to see rather than an equivalently bright but plain pattern.

The ‘Cardiff Card’ test uses outlines of objects such as a house, car or duck that will interest a child. The pictures are positioned either at the top or the bottom of a plain grey card. There are eleven visual acuity levels, with three different cards with different images at each level.
The examiner presents the cards, beginning with the largest picture, at a distance of either 1 metre or 50cm. The first card is presented at the patient's eye level and the examiner watches the child's eye movement, whether up or down, to estimate the direction of gaze. A mental note is made of this direction and then the second card is presented. Again the eye movement is observed. The examiner then checks the cards to see if both estimations are correct. If so, the next set of cards is presented in the same manner. If a wrong estimation of picture position is made or no definite fixation is observed, then the previous set of cards is again presented, using all three cards. The end point is found when two of the three cards are consistently seen correctly. This test is suitable for children of developmental age of 1 to 3 years.

Some children, especially those with cerebral palsy, have difficulty making accurate voluntary eye movements. This can sometimes make interpretation of ‘preferential looking tests’ very difficult. Some children with cerebral palsy may also find it difficult to make sense of pictures so find it difficult to visually fix on a picture.

Other tests simply use black and white stripes called ‘gratings’. These tests are suitable for even younger children. These tests however really only assess whether a child can ‘detect’ the pattern rather than necessarily ‘recognise’ anything. Grating tests may not predict functional ‘recognition’ visual acuity when a child is older. Examples of such tests include the Teller cards, Keeler Cards and Precision Vision grating paddles which are shown below.

![Precision Vision grating paddles](image)

**Figure 6.3**

*Object recognition and matching*

There are many Object recognition and matching tests. Some of the more common ones include:

- Kay’s pictures
- Lea Symbols
- Illiterate Es test
- Sheridan-Gardner test
- Snellen test type.

All these tests require a means of communication with the child even if this is only ‘pointing’ with his eyes. Useful recognition and matching tests are the Lea Symbols,
examples of which are shown below.

Figure 6.4

Lea Symbols are suitable for most developmental age ranges and are available in many formats. Matching card games can be played with different sized symbols to interest and engage children. As the symbols become smaller they ‘resolve’ into each other: this means they begin to look like each other. Because of this children are more likely to try to make guesses as they reach their ‘threshold’ visual acuity rather than just give up and lose confidence and interest. The symbols are also available in a 3-dimensional format which can be easier for some children to make sense of.

Contrast Sensitivity

This is a measure of how well a child can see different levels of grey against a white background. Contrast sensitivity is important in:

- communication, such as recognising facial expressions;
- orientation and mobility, such as identifying kerbs and steps;
- accessing information, such as reading letters and numbers;
- activities of daily living, such as eating food from a plate.
There are many different ways to assess contrast sensitivity. A useful way to do so in children with cerebral palsy is by using ‘Hiding Heidi’.

Figure 6.5

‘Hiding Heidi’ Contrast Sensitivity Test

This test is also based on the idea that a child, when presented with two different patterns, will look at a pattern that he can see rather than a plain white card. A simple line diagram of Heidi’s face is presented at the same time as a white card. Gradually paler faces are shown to the child until he no longer has a preference as to which card he looks at. By sequentially presenting increasingly paler faces and observing the child’s responses, an idea of a child’s ability to detect subtle shades of grey is gained.

Visual field

This is the area over which a child can see and then notice and attend to an object when holding his head and eyes still. The visual field is oval in shape. It is wider (180 degrees) than it is high (140 degrees). It extends further downwards (80 degrees) from the centre (fixation) than it does upwards (60 degrees) from fixation. This is because the brow above the eye tends to be more prominent than the cheek below.

Figure 6.6

A normal ‘full’ visual field with the four ‘quadrants’ named and the approximate size of each quadrant described. The large black dot represents the centre of the field or ‘fixation’.
It is possible to get an idea of the size of your own visual field by stretching your arms out and waggling your fingers at the sides while looking straight ahead. Most people can actually see a little ‘behind’ themselves horizontally but will notice that their field is more restricted above by their brow than below by their cheeks. Visual acuity is poor at the edges (the periphery) of the visual field. It is much more difficult to tell how many fingers are being held up at the edges of your own visual field than in the centre. It is however very easy to notice something moving at the edges of your visual field: try waggling your fingers.

Doctors think of the visual field, and examine it, as four quarters or ‘quadrants’. This is because a different part of the brain ‘sees’ each different quadrant. Different parts of the brain see different parts of the visual field from what you might think. For example: the left side of the visual field is seen by the right side of the brain, the right side of the visual field is seen by the left side of the brain, the lower part of the visual field is seen by the upper parts of the brain and the upper parts of the visual field are seen by the lower parts of the brain.

Many children with cerebral palsy may have difficulty seeing in some part of their visual field, e.g. children with hemiplegia affecting the right side of their body may have difficulty seeing objects in their right visual field. This is known as visual field loss. Knowledge of the presence of visual field loss may help explain:

- **Problems with mobility**: e.g. tripping over things on the floor or always bumping into things on only one side
- **Abnormal head posture (AHP)**: e.g. a child may tilt or turn their head to move the ‘seeing’ part of their visual field into a more useful position. Children may also angle books in the opposite direction to their head tilt to make best use of their vision.
- **Poor reading skills despite good visual acuity**: Children with visual field loss on the right side will be forced to read into their poorly seeing field. This will make finding the next word on a line very difficult. A child with mainly left sided visual field loss will have difficulty finding the start of the next line below after finishing the end of the line above. Because of these difficulties a child with good visual acuity but visual field loss may have difficulty reading.
- **Problems locating objects**: children with right sided hemiplegia consistently pick up objects in one area in front of them, e.g. on their left side and ‘ignore’ objects on the right side.

Knowledge of the presence of visual field loss in a child will also help a teacher decide the best place for a child to sit in the classroom.
Assessment of visual field loss

As with other aspects of visual function watching a child playing and asking parents, main carers and teachers questions will often help identify whether a child might be suffering from visual field loss or not. A head turn to the right can suggest visual field loss to the same side. If a child has a movement impairment down one side of their body then visual field loss, if it is present, is likely to also be on the same side as the movement impairment. Clearly if a child always bumps into things on one side, or consistently fails to notice toys placed to one side, then this is likely to be due to visual field loss affecting that side.

Children with spastic diplegia and quadriplegia can characteristically suffer from lower visual field loss. Children with lower field loss may not notice things near to them on table tops. They may trip unexpectedly over toys that have not been tidied away. Lower field loss can also make going down stairs difficult.

Formally trying to assess visual field function is challenging and possibly unnecessary if a good history of symptoms consistent with visual field loss is given. If there is uncertainty from the history, or a child has a condition where visual field loss is especially likely, then testing can be helpful.

There is no single definitive way to assess a child’s visual field. Familiarity and experience of the responses of lots of children with a full and normal visual field is useful when trying to assess and interpret the responses of a child with an abnormal field of vision. The task is made more challenging with children who may have physical and intellectual impairment with additional communication difficulties.

One way of assessing visual fields is by ‘confrontation’. This usually requires two examiners although a third can be helpful. Examiner 1 sits directly in front of the child and engages their attention by talking to them and showing them an object of interest. Examiner 2 quietly begins to move a target in from behind the child. Examiner 1 then removes the central target of interest and observes the child’s eye and head movements. At the same time Examiner 2 continues to slowly and progressively move the target in towards the centre of the child’s field (fixation) along a diagonal line through each of the child’s four ‘quadrants’.
The set up for examining a child’s visual field to confrontation using two examiners

**Figure 6.7**

Examiner 1 carefully observes when the child first notices the target. The child’s responses in the four quadrants are compared. Examiner 2 tries to make sure the target is moved at an even speed along a diagonal path through the middle of each quadrant.

The direction and angle of movement of a target through each ‘quadrant’ of the visual field towards fixation (the central black dot)

**Figure 6.8**

If a child consistently notices the target later on one side than the other then a visual field defect is likely to be present in that area. The findings are more credible if they are also consistent with information gained from the history and from other physical findings such as an impaired movement on the same side.
Fast and slow eye movements

It is very difficult to assess eye movements. It is particularly challenging in children with cerebral palsy. It can be difficult to be confident about interpreting observations, as many children may be unable to make voluntary eye movements. This challenge can be compounded by limitations in communication.

Two important types of eye movement include:

- slow ‘smooth pursuit’;
- fast ‘saccades’.

Slow ‘smooth pursuit’ movements let the eye and brain steadily and constantly fixate an object moving at less than 30 degrees per second. If an object moves more quickly than this then the eye will try to maintain fixation by making fast eye movement (saccadic) jumps. Fast eye movements are also used to change attention from one object to another. For instance if something is noticed in the peripheral visual field a fast eye movement is used by the eye and brain to quickly move the object of interest into the central visual field.

By using these two types of eye movements the eye can find and then keep an object of interest within the central visual field. This is where highest visual acuity and best colour vision is found. Normal vision is therefore dependent on both kinds of eye movements working normally. Without normal eye movements even if a child has good visual acuity, full visual fields and normal contrast sensitivity he will not be able to see well and enjoy normal visual function. Importantly reading is also likely to be difficult.

Children with cerebral palsy can have difficulty making accurate voluntary movements. They can in particular often have difficulty making fast saccadic eye movements. This is most common if the child has spastic diplegia or quadriplegia or athetosis.

Assessment of eye movements

As already discussed taking a history as part of the assessment is crucial. If a child gives a history of making ‘head thrusts’ or other fast unusual head movements while reading or shifting attention from widely spaced objects, then an impairment of fast eye movements may be present.

As with other methods of assessing visual function there is no single definitive way to test eye movements.

Some general rules are however worth following:

- Any target must be big enough for the child to see.
- Usually it is helpful if the target is of some interest to the child (such as an
internally lit toy) and not just a plain white target.

- Try to assess with a plain uncluttered background behind the examiner.
- Try to test movements to all nine cardinal positions of gaze (Figure 6.9).
- Try to test movements from central fixation outwards and then back in again to fixation.
- Try to avoid testing eye movements across the vertical or horizontal midlines.
- Try to provide the child with the best support required to enable him to gain the best head control and/or compare results in different positions, i.e. lying supported as opposed to sitting up.

![The nine ‘cardinal’ positions of gaze](image)

**Figure 6.9**

*Assessment of slow ‘smooth pursuit’ eye movements*

To test ‘slow’ eye movements a target must move slower than 30 degrees per second. This means that any target must take more than 3 seconds to travel across one half (90 degrees) of a child’s visual field. If a target moves more quickly than this then the eye and brain will try to use fast saccadic movements to catch up with the target.

*Assessment of fast ‘saccadic’ eye movements*

To test fast eye movements it is important to try to force a child to quickly move fixation between two widely spaced targets. Try to use two different targets that are large enough for the child to see and that are also likely to interest him. Movements can be assessed horizontally or vertically.

*Optokinetic nystagmus drum*

This simple device can be used as a screening tool to quickly assess fast and slow eye movements. The drum is spun so as the stripes move less than 30 degrees per second. If the child’s visual acuity is not too low then he will ‘follow’ the stripes using slow smooth
pursuit eye movements. When the stripes ‘disappear’ off one side of the drum then fast saccadic eye movements are used to ‘find’ newly appearing stripes on the other side of the drum. By carefully observing eye movements while spinning the drum a quick impression of a child’s ability to move his eyes can be developed.

Figure 6.10

Assessment of fast and slow eye movements using an Optokinetic Nystagmus (OKN) drum

Conclusion

It can initially be very intimidating trying to assess vision in a child with cerebral palsy. At times it can seem as though no useful information is being gained. Through persistence and practice, skills in interpreting subtle clues and characteristic patterns of behaviour can be developed. By ‘segmenting’ assessments and listening carefully, an overall ‘picture’ of visual function can be gained. Once information on different aspects of visual function has been determined it should all be put together into a report. This report should be written in plain language and distributed to the multi-disciplinary team. This way a child can benefit from the assessment as all professionals who care for the child are better informed.

Reference

CHAPTER 7

Learning from Observation

Eleanor Douglas, Mary Lee and Lindi MacWilliam

Assessing the functional vision of children with cerebral palsy and complex associated disabilities

The visual development of children with cerebral visual impairment (CVI), who have cerebral palsy and additional disabilities, (sometimes referred to as children with multiple disabilities), will be inextricably linked with their understanding and ability to make sense of their environment. Seeing for many of these children does not happen easily and effortlessly, but is likely to be a complex learning process, and one in which they can benefit from skilled input and guidance.

Children with CVI do not fit neatly into categories, and one off assessments will not always be sufficient to give a properly detailed picture of a child's visual functioning. Ongoing observation within everyday routines at home and at school can give us a fuller picture and should form the basis of each child's individual programme. One of the extra benefits of this kind of observation is discovering how much the children can teach us about themselves, and it is a continually fascinating process.

A multi-disciplinary approach

For this kind of assessment to be genuinely useful it must involve all those who come into contact with the child during the course of the day, as they will be viewing the child in different contexts and perhaps from different perspectives. This is particularly so in the case of parents, whose input will be vital, since their child spends far more time at home with them than in school.

It is important that any multi-disciplinary assessment team should include the child's teacher. He or she has the advantage of daily contact with the child and can co-ordinate regular observation of the child's use of vision during everyday tasks. All staff and therapists can be involved through the use of a readily available record sheet. This information can then be passed to the multi-disciplinary team. In the same way, any questions that arise during more formal visual assessment can be passed to the classroom team as points to look out for during everyday activities. Parents should always be involved in this process, either by being present during multi-disciplinary assessment or through the use of a questionnaire that invites them to give their observations in a number of areas of the child's development. Multi-disciplinary assessment must look at all areas of a child's sensory development. For different children, vision will play a greater or smaller part in their ability to understand and function within their environment.
Problem-solving through detailed observation

1. **Know your child**

Before starting detailed observations, it is important to ascertain some information about the child. Try to gain:

- a knowledge of the nature of the child’s visual impairment and, if possible, a knowledge of the extent and type of brain damage;
- a knowledge of the child’s approximate developmental level;
- how the child communicates pleasure, excitement, interest, distress, etc;
- what motivates the child?
- physical considerations:
  - type of cerebral palsy;
  - is one side affected more than another;
  - in which position is the child most comfortable or appears most visually aware?
- an indication of the child’s hearing;
- an awareness of seizure activity and how this might affect responses;
- an awareness of the length of time the child takes to process sensory input;
- an awareness of child's 'good' times of day, e.g. is he/she more alert in the morning?
- an awareness of the child’s state of health, mood, etc;
- the child’s level of distractibility and ability to concentrate;
- where does the child appear most responsive, e.g. in quiet area?
- does the child respond differently with different people?

2. **On-going observation of the child’s visual responses**

The following situations can be particularly useful for observation.

**Meal and snack times**

- mouth opening to spoon;
  - orientation, distance, route to mouth;
- does mouth open:
  - to hand without spoon?
  - with other object?
  - outside the eating situation?
- reaching for food;
- note distance, position of hand or spoon - moving or still?
- size, background contrast, of food on plate, e.g. crisps, fruit, bread, etc;
- visual field can be tested by spreading finger food out;
- note head position during reaching or searching.

**General play**

Corners with hanging objects:

- note signs of visual attention, e.g. stilling, focusing, tracking;
what kind of objects are involved?
• is it better if they are moving or still?
• observe optimum distance, size;
• observe several times in the area and compare.

Positioning:
• does the child appear more visually aware when sitting up, on their back/front, over a wedge, well supported, etc?
• is there more response to objects hanging or on a surface in front?
• note the child's ability to reach accurately to object.

Play styles:
• what is the child's favourite type of play/activity, e.g. moving around, lying on floor, play involving moving objects - rolling balls, carrying particular objects around, etc?
• what are the child's favourite types of objects, e.g. tubes, string and threads, bricks, sound making objects, switches, real objects, books, etc?
• does the child appear to see better in a quiet room?

Moving around
Object recognition:
• does the child recognise an object and then reach or move towards it?
• does the child move to a particular area to find a specific object?
• does the child recognise a familiar object in an unfamiliar place?
• does the child appear to recognise objects more when moving around?

Visual field:
• note the child's head position when looking;
• at what point does the child bump into objects?
• does the child experience difficulty with changes of floor surface?
• how does the child negotiate steps or height changes?
• is the child aware of the adult moving? At what distance? Note tracking abilities.

Interactions with an adult:
• observe during 1:1 interaction sessions, massage sessions, changing times, physiotherapy and passive exercise sessions, etc;
• what is child’s preferred position at these times?

Note: • eye contact and focusing;
• awareness and imitation of mouth movements;
• awareness of hand movements;
• at what distance and with what clues does the child identify the adult.
Table-top activities
Observe visual acuity and visual field, depth and distance perception, contrast vision:
• this can be observed through activities such as peg boards, threading, sorting and matching, fitting objects together, filling and emptying, etc;
• Note the child's painting and drawing skills. Is paper filled or limited to a small area? Note the movement potential of his upper limbs to reach the corners of the paper.

Picture recognition:
Note:
• the simplicity of the picture;
• lack of ‘clutter’;
• good contrast and clarity;
• size of picture;
• how are pictures recognised? are they learned by rote? which visual clues are used?
• how close the child is, head position, which eye is being used.

3. Considering the child's learning style

All children have their own particular strategies for accessing information and their preferred ways of exploring and interacting with their environment. These differences can be seen in a range of everyday play situations. A group of children playing at a sand tray, for example, will play in many different ways. Some will want to dig holes and bury objects, to build sandcastles or make patterns or ‘roads’ in the sand. Others will want to experiment with filling, emptying and pouring. This play may reflect the child’s developmental level, but it also points up individual interests and methods of experimentation. These are the individual child’s style of learning.

This preferred style of learning can affect or be affected by the way an individual child’s vision develops, and will have implications for those working with these children, in terms of both assessment and input.

Their visual ability and their perceptual understanding will influence the way that visually impaired children learn. However, other kinds of sensory input and especially their individual interests, likes and dislikes will also be crucial. Information about the child can come from the parents and those who know them well, but detailed, ongoing observation is also vital. By using an approach, and structuring an environment that complements and makes use of the knowledge gained from these observations, we can begin to encourage the children to use their vision more effectively.
There are certain elements which are important to all aspects of learning, that appear to have particular relevance to the learning strategies used by this group of children. They are:

• motivation;
• context;
• repetition;
• routine;
• familiarity;
• sound;
• movement.

The following case studies show the importance of these elements in the visual development of two young children.

**Case study: Moira**

Moira is a little girl with limited movement and who is just beginning to develop speech. She is an anxious child, very dependent on a familiar and predictable routine, but also very sociable and loves adult attention.

When Moira first entered the pre-school unit, her parents felt that she may have been aware of people moving around the room, but reported little other visual awareness. It soon became apparent that Moira was indeed aware of people’s movements, but that she was using additional auditory clues to ‘cue’ her into this. She was very alert to familiar sounds, such as doors opening and the footsteps and voices that preceded people coming into a room. She was able to follow them as they moved around, even at a distance, but at the same time she appeared oblivious to objects moving across her line of vision that were much closer to her.

At this time, if someone familiar was seated in front of Moira when she was in a play area, she appeared completely unaware of them until they spoke to her, at which point she would shout out their name and demand attention! However, she was able to identify different people, without hearing their voices, as they came in and moved around a room.

The improvement in Moira’s functional vision went hand in hand with her general understanding, but proceeded in a way particular to her.

In the first place motivation was paramount, and in her case this came in the form of people, and the attention they gave her. Movement was also crucial in enabling her to become visually aware in the first place, and at a later stage it is likely that by focusing so much of her attention on the way people moved, she was actually using this knowledge to help her to identify and recognise them. This was reinforced by her inability to recognise or even be aware of someone sitting still, although quite close to her. Sound, in the form of different footsteps, and the
direction they came from, also helped in identifying the person, and these auditory clues helped her to build up visual images of the different people.

In Moira’s case two further elements seemed to play an especially crucial role in the development of her vision - routine and context. She learned that at certain times of the day, particular people would come into the room, for example, someone coming in for an individual session after break or for a group session after lunch. She was able to use sound and movement clues and link these to a visual image of their face, because it was in context, and because it happened at regular times everyday (repetition). If a person came in unexpectedly she would have been unable to identify them. She seemed at this stage to have a visual image of the person that she was expecting, and was thus able to link them to the ‘real thing’.

As her understanding and visual ability developed she soon learned to do without the other clues, and was able to identify people and objects in any context, even extending this to pictures. However, in the early stages the elements discussed were of paramount importance in encouraging her to use her vision, thus building up a visual memory and enabling her to make sense of what she was seeing.

**Case study: John**

John was a four year old boy in a pre-school setting. He had cerebral palsy, was severely developmentally delayed and also visually impaired. He had no independent mobility, was unable to sit without support, but had good head control. He was a very sociable little boy, who was motivated by sound, and above all by food. He showed little response to anything other than a bright light within a dark room.

John was unable to hold a spoon and needed an adult to feed him. The adult was seated in front and slightly to the side of him. Observation of him at mealtimes confirmed that John was opening his mouth at the exact moment that the spoon reached his mouth. Any chance of sound or touch being involved was eliminated, and it became clear that John was seeing the movement of the adult’s hand and was able to judge accurately when it reached his mouth. He was only able to do this if the angle and direction that the spoon approached from was consistent.

When a similar situation was set up outwith the context of the mealtime, John did not at first react. However, after a few weeks when this was repeated he opened his mouth on cue. The orientation and trajectory of the movement was then changed, so the spoon approached John from a different side, or from slightly above or below eye level. John quickly adjusted to this change and soon learned to see the spoon approaching from slightly differing positions and he would open his mouth at the appropriate time. As long as the basic movement pattern was the same, he was able to visually process it, even though it was made in different areas of his visual field.
The most powerful elements that were at work in helping John to see were motivation, repetition and movement. Context was equally important in the early stages. These elements acting together meant that John learned to see this particular movement, and was able to generalise this to other situations. Shortly after this, it was observed that one of John’s favourite play activities was moving his arm up and down, over which had been draped lots of chains and beads, so that the objects hit against a surface, making a considerable noise. Sound played an important part in this game, but he also appeared to be visually aware of the rhythmic up and down movement of his arm in front of his eyes. His visual awareness was being enhanced by a movement pattern that resulted in a rewarding feedback.

4. *Consideration of the environment*

Determining how and what a child with cerebral palsy and associated visual impairment is seeing is a complex task, but as the above case studies indicate, careful observation can teach us a great deal about the environmental influences that will encourage the child to make the most of any vision he has. We can, therefore, go a long way to meeting the child’s needs through consideration of the environment in which he lives and learns.

The environment should be looked at from a multi-sensory perspective. It is important to provide opportunities for developing the use of other senses. The principles outlined for vision are relevant for the other senses as well.

5. *Learning strategies*

*Time*

It should be borne in mind that most children with CVI will need a longer time to process visual information and to integrate sensory input. Activities should be demonstrated slowly and carefully, ensuring that the child is following the steps in the process. When presenting a visual stimulus to a child, allow time for the child to respond to this.

Visual tasks can be very tiring for a child with CVI and this should be borne in mind when structuring tasks that involve the child in the processing of visual information. Ten minutes on a visual task is enough for some.

*Control*

The child’s interest and involvement in activities and stimuli provided by the environment is likely to be related to the amount of control he has over them. For example, he will probably find it more satisfying to watch a ball that he is banging vigorously on a table, than to watch something that floats past his line of vision. If a child is allowed to handle an object, the eyes are drawn to the hands and the child will hold it where he can see it best.
In the everyday environment, it is important to think about how much control the child really has over what he is doing, where he goes and whom he is with. The more independence he develops in mobility and general life skills, the more he will be motivated to use his vision to its full potential.

**Routine**
Daily routine, both at home and at school, can help a child to begin to anticipate what will happen next and to feel some measure of control over it. The routine should comprise *what* will happen, *when* and *with whom*.

**Structure**
The activities that go to make up the child’s routine can in themselves be structured. For example, learning to build a tower or learning to wash his hands. The adult should use the same language and sequence of actions each time the task is carried out. The sequence can be carried out with the child’s hands over the adult’s so that the child learns the motor patterns required. This can be particularly useful for the child who tends to look away when reaching for an object. (If a child looks away, do not follow with the object. The child may be using his peripheral vision to monitor the activity.) Once the task is understood then vision is more likely to be used. Adult support can be gradually removed.

**Motivation**
Motivation can be a strong factor in encouraging children to use their vision and build up a visual memory. An object that has become associated with fun or enjoyment may be easily recognised, whereas other objects appear not to be worthy of attention. Objects are more likely to be recognised when they have been made a part of an enjoyable interaction because, through this, they will have acquired significance and meaning.

**People**
It can be a feature of CVI that the child cannot recognise faces and/or facial expression. If this is the case then the voice can be used to help the child identify familiar people, making sure that the person speaks before approaching the child. Most children, including those with an additional hearing impairment, will use touch and smell to recognise familiar people. Intonation in the voice can also be used imaginatively to convey emotion and to make language more meaningful. A tactile sign system should be considered for any non-verbal child with visual impairment.

**Using other senses**
It is important to take account of those senses a child uses most easily. These may be touch and feel, taste and smell, vision or hearing. Consider carefully the tactile qualities of an object that the child is expected to look at. If he does not like the way it feels, then he is unlikely to want to look at it. Tasks may need to be broken down to involve sensory input through only one or two channels. Sound, for example, may be useful as a means of initially attracting a child’s attention to a
visual stimulus. However, some children, once their attention is engaged, will be more likely to maintain focus and track the object, if there is no sound. Both looking and listening at once can be difficult in the early stages.

6. Presentation of materials and activities

Simplicity
Children with CVI vary in the amount of sensory information they can absorb at the same time. They may, for example, find that using their vision in a busy room is very difficult because they are intent on listening. For these children, the creation of a quiet, distraction free area, where they can concentrate on using their vision, is very important.

When handling objects, some will only be able to cope with one object at a time, in order to be able to take in the various properties of the object. Others, however, may require and prefer to be surrounded by a variety of objects in order to make choices and comparisons.

Contrast/clarity
The physical environment should be carefully organised to ensure that there is clear colour contrast, good lighting and that objects are presented in the best way to take account of the child's optimum viewing position. This may involve a sloping surface, hanging objects, or storing equipment in the same place after each activity. If a child has difficulties in his lower visual field, then keep the floor clear of clutter. Those children who have difficulty with depth perception are helped by the provision of, for example, well-contrasted tasks, objects, stairs, etc, in their environment.

Repetition
Many children need to constantly repeat activities in order to gradually absorb all the elements of a task. The more complex their disabilities, the more repetition they are likely to need. Children with CVI may well have problems integrating sensory information, and repetition will help them towards this goal. The sequencing of the stages of a visual task may present the child with difficulties, and here again, repetition can help.

Familiarity
Familiarity with places, objects and people is important for children who have to work hard to make sense of what they see and hear. A child who appears not to be using his vision in a given situation may well react differently when a known object is introduced. This can be a key factor in the development of children at a very early level of visual function. Once they have become familiar with an object through repeated, active exploration of it, they may begin to respond visually to this object, even though they may appear oblivious to other, less familiar, objects.
**Movement**

Some children with CVI see things that are moving in their peripheral vision more readily than if they are stationary. This should be ascertained from careful observation of the child in natural situations and should be given consideration when tasks are presented to a child. The second case study above illustrates this aspect and indicates how knowledge of the child’s visual functioning can enable us to structure activities that encourage exploration and, in so doing, develop the child’s ability to use vision more effectively.

**Context**

Many children will rely on context to enable them to recognise objects and people. A cup, for example, may only be recognised in the context of a mealtime. Activities should always be carried out in the relevant surroundings, e.g. a dressing programme should take place in the bedroom, in order to help the child make sense of the task. Introduce new elements to a task, one at a time. Try not to change everything at once. Experiential signifiers or objects of reference can be useful tools to help the child to recognise where they are or who is approaching them.

**Positioning**

Positioning should be assessed with the help of a physiotherapist, to ensure that a balance is achieved between the child’s physical needs and his optimum viewing position. The child must be comfortably positioned before he is expected to use his vision, as it may be very tiring to have to, for example, maintain head control and concentrate on using the eyes at the same time. The child’s potential for movement should be assessed; can he reach out with his arms? How close does an object have to be positioned?

7. **A multi-sensory approach**

It is important to look at the environment from a multi-sensory perspective, and to provide opportunities for developing the use of all senses. The environment must be right to enable the child to function within it to his full potential.

Whilst in this section the focus has been on vision, we need also to consider all the other senses when we are looking at environmental factors. The child with a visual impairment may rely more on other senses. For example, hearing may be a more motivating and more meaningful way of understanding the environment and identifying people. It is important to look at the children’s skills and help them to use these to access their environment to the best of their ability. Some children will have difficulty using hearing and vision together and this must be taken into account. A child will be using different senses and skills for different tasks and all must be taken into consideration to enable the child to best make sense of his environment. The principles outlined for vision are relevant for the other senses as well. Structure, routine, motivation, repetition, simplicity and time are important to facilitate all the children’s learning experiences.
Reference

CHAPTER 8

Meeting the Young People

Anne - a pupil in a mainstream secondary school

Janis Sugden

Anne is a third year pupil who attends her local secondary school. She has diplegic cerebral palsy, which affects her mobility and balance. It is more evident in her lower limbs. She walks slowly and has difficulty climbing stairs and stepping from kerbs. Towards the end of the day Anne tires due to lack of stamina.

Anne is of normal intelligence and she is currently doing Standard Grade course work at general and credit level. However, her use of vision fluctuates. Visual acuity is probably normal but she has visual perceptual difficulties that are most likely neurological in origin. A consequence of this is that her use of vision fluctuates. In functional terms she has difficulty judging depth and distances. At times she has difficulty discriminating and ‘seeing’ individual words and objects on a page.

Anne has a history of seizures which started during her upper primary years. Epilepsy was diagnosed. Hospitalisation and fluctuating ill health caused her to miss a considerable amount of schooling. This affected her self-confidence, emotional well being and stamina. Anne found it difficult to attend school at this time. During the transition between primary and secondary education a review of Anne’s special educational support needs was held. Anne’s primary teacher thought she would struggle educationally, socially and physically. Anne’s parents were keen for her to attend the local secondary. They were open to a restricted curriculum and any other adaptations that might be needed. The educational psychologist was of the opinion that Anne was academically able for mainstream secondary education. The principal teacher, support for learning, was established as the key worker for Anne at this stage. An Individualised Educational Programme (IEP) was initiated and Anne attended school on a part-time basis.

A learning support assistant who was working with Anne in class noticed that she was having problems reading work on the blackboard and from worksheets. This was noted at the initial review meeting at secondary. Anne’s parents contacted the consultant neurologist. The neurologist contacted the visual impairment service.

Multi-disciplinary review meetings are held regularly to review Anne’s progress. She now has a Record of Special Educational Needs.
Anne is enjoying school again

**Figure 8.1**

Anne attends school three days full time and two days part time. Her parents believe that the time at home has been vital to her success at secondary. Anne and her parents remain very positive about the current provision. Anne is now enjoying school again. There are no difficulties getting her to attend. The school has set up a lunchtime club that Anne attends on the days she remains in school. The teacher of the visually impaired gives advice on the adaptation and provision of curricular materials. In-service was provided to staff working with Anne. Anne either goes for a ‘walk’ or swimming lessons instead of PE lessons. She spends about an hour a day in a standing frame at home to improve her posture. This is on the advice of her physiotherapist. In classes Anne has a reader and scribe. However, she has recently been using a laptop computer with additional software that enlarges the font and has speech output. Anne finds this particularly useful as she knows immediately if she has made a mistake. Special arrangements are made for any assessments. The key person ensures that Anne is given any assessments in the same format as course materials, if necessary, first consulting with the subject teachers and other specialists.

**Mairi - a pupil in a secondary special school**

*Lynn Lymer*

Mairi was referred to the Visiting Teaching and Support Services for visual impairment support in February 2001. She had moved with her family from England and was now attending a school for children with severe physical difficulties and associated learning difficulties. Mairi was 14 years old and came with her mother for a functional vision assessment¹. The assessment was carried out in school, by the consultant community paediatrician who has responsibility for visual impairment and the visiting teacher of the visually impaired, with support from the school medical officer.

¹ See Appendix 2 - An approach to functional vision assessment in special school.
We knew that Mairi has spastic quadriplegia, problems with tracking and ‘communication difficulties’. She was referred because of problems interpreting complex picture material, particularly in a testing situation. However, Mairi has good visual acuity (6/4) and can read very small text so the problem was not caused by poor visual acuity.

During this assessment she demonstrated her ability to read fluently text size N8 using the Maclure Reading Type for Children chart. She did not show any visual field loss. She could track a Stycar ball in all directions, but had jerky eye movements and tended to move her head as well as her eyes. Mairi pointed out that small amounts of text did not present difficulty, but larger amounts of close print were harder to read. Mairi was very keen to understand and to help us work out what was causing these problems. She is a lively and articulate teenager and was clearly relieved at being taken seriously - having good acuities but problems with accessing text had not always been understood by teaching staff in previous settings, as a recognised effect of her cerebral palsy. We discussed the advantages of masking out parts of a page to reduce the effects of crowding and also the effect of double line spacing in making text more readable.

We moved on to The Manual for Teachers of Children with Learning Difficulties and looked at the crowded pictures. Mairi could pick out the features we asked her to find, but it was evident that she was having to scan the whole picture laboriously to find the detail she needed. We tried out the different coloured papers with printed text on them. Mairi was very clear that she could read black on white, but that black on pale green, yellow or other pastel shades was easier for her. Her own ability to tell us what she found helpful made the assessment particularly satisfactory.

We talked about using computers and adapted keyboards. Mairi has difficulties with hand function, especially when she is tired or stressed, so a normal keyboard presents problems. We agreed to contact the Technology Support Service and ask for a Big Keys keyboard for her to try. We discussed using a scribe and reader and Mairi pointed out that she likes to be able to see the text while it is being read to her. If it is good quality, enlarged and well spaced, it is easier for her to follow. The reader helps to take the pressure off, so that Mairi can process the information most effectively. She is also used to working with cassette tape and having her work recorded for her.

By the end of this meeting we had established a good starting point with Mairi and her mother for working together to share information and help her school staff to understand the implications of the combination of cerebral palsy and visual impairment.

Since that meeting a year and a half ago, Mairi has sat her Standard Grades and done well and has moved on to Highers. School staff are aware of her needs. The Exam Board are kept informed of her need for extra time, adapted papers and a scribe/reader. Text books are gradually becoming available on CD or in electronic format, which Mairi can access, with the support of her family, for homework and revision through a reading programme on her computer at home. The Big Keys keyboard is useful for small
amounts of work, but typing is still time-consuming and tiring for Mairi. There are enormous challenges to be met, but a sharing of information and understanding between the student, the family and the various school and support staff involved has been essential.

References

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**Sam - a primary school pupil**

*Lynn Lymer*

Sam is a lively, chatty boy and is now in primary 4 in his local school. He attended a nursery for children with special needs, where he gained very useful pre-school experience and then moved into mainstream at the start of his primary schooling. The Visiting Teaching and Support Service became aware of Sam only after this, when the ophthalmologist at the hospital referred him for a functional assessment to the consultant community paediatrician specialising in visual impairment. She and I met Sam with his mother to carry out this assessment in his school, during his first year.

Sam has athetoid cerebral palsy and it has been noted that his MRI scan shows a condition called periventricular leukomalacia which often has associated cerebral visual impairment. He had had an operation for a squint at four years of age and had also recently started further patching, as the squint had reappeared. His mother observed that Sam has always had some problems with his vision, failing to notice things until they are directly in front of him and sometimes bumping into things. His concentration span is not good. He likes pictures but his mother feels he does not always see real objects when they are static. Sam can walk for short distances, but uses a wheelchair for longer distances or on uneven ground. His sitting balance is not good.

Sam’s corrected distance visual acuity, measured with the Sonksen Silver Acuity System, was 6/24 binocular. Using the Maclure Reading Chart he was able to read size N14 print. His visual fields were tested using the Stycar Ball, and Sam showed a complete left hemianopia and a right field reduced to about 35 degrees. He could identify fine detail in crowded pictures and he located and identified all the objects presented during the testing. Sam’s visual tracking was slow and jerky.

The assessment meeting allowed us to discuss with Sam’s mother what we would do to support him and the staff in school. At first Sam preferred to use N18 sized print, which
was fine for infant reading books and other texts. He has now moved happily to using size 10-12, with no loss of fluency.

The key to success with Sam was collaborative working with the occupational therapist and the physiotherapist. Once Sam was comfortably positioned in an appropriate chair or in his standing frame, he would tackle his work willingly (most of the time!). A Write-angle board has also helped to achieve better posture and ensure good light on his work. Sam can now work from the blackboard with the same ease as his peers and his handwriting has become very neat. He still finds it helpful to have busy pages of text masked, so that he has less information to process, and he does get frightened when objects or people appear soundlessly from his left. He is uncomfortable when there is glare from low sunlight, but the school has had blinds fitted in each classroom. He works with a support assistant who is well aware that it is her role to facilitate Sam’s independence, not create unnecessary dependence.

Staff have taken on board the nature of Sam’s needs and know that his vision does fluctuate. They position him carefully in the room or within a group so that he can use his field of vision to best advantage. He is learning to type, using his ‘good’ hand, so that he has a skill to fall back on if writing becomes too onerous as he makes his way through his schooling. The technology support staff visit school to ensure that Sam has access to any equipment which might facilitate his learning. All this has been achieved through collaborative planning between the various agencies and is significantly easier because Sam has very supportive and involved parents, who are willing to share their own views.

Reference

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Celia

*Jean Halligan*

My daughter, Celia who is now 16, has quadriplegic cerebral palsy. She is severely physically disabled but has good language skills although her speech can be distorted at times and needs to be tuned into. Celia very obviously has good cognitive abilities but this is accompanied by specific learning difficulties which are quite severe and which affect learning in different ways. She can see well but has a variety of perceptual problems affecting how her brain interprets what she sees. The muscles of her eyes have been affected as well so that her eye movements when reading are jerky and the pace of her reading is very slow. These eye movements also affect her vision in moving down from one line to the next, or, if her eyes lift off the page, finding the correct place again especially when a word is repeated on the page. This difficulty occurs frequently if Celia is reading aloud, as her head tilts back when she speaks, resulting in her eyes coming off the page all the time.
When Celia was a baby I was told that she may have perceptual difficulties when she got older and it was likely that these would affect her ability to learn. Taking that on board, I decided to do what I could to help develop Celia’s language skills to give her the best possible start with learning, and as a possible way round any learning difficulties which might appear, by encouraging listening skills. Celia was immersed in story reading, nursery rhymes and songs both from me and from tapes from a very early age. Her communication skills developed from an exceptionally early age as did her speech. However, after a short while, her speech development virtually stopped although it was obvious her ability to understand language continued to develop. Once Celia started using her speech again it developed rapidly and became advanced relative to her age very quickly.

When Celia started primary school at the age of 5 and a half, it soon became clear that reading was not going to develop easily. She had problems decoding and tried to use her memory to read which became more and more difficult the older she got. She exhibited symptoms very similar to someone with dyslexia. At home we religiously practised her reading but I continued reading books to her and she always listened to an age appropriate story tape when she went to bed. By about 8 however, it was fair to say that Celia was a reader and by the age of 9 there were clear signs that she was monitoring her own comprehension so metacognition had developed. Her reading age was tested by an educational psychologist at the age of 11 and by that time her reading and comprehension ages were 15+ with silent reading producing considerably better results than reading aloud because of the problem of her eyes lifting off the page.

As Celia got older, the rate of reading became the greatest problem and the one which was holding up her ability to show what she could understand. By this time we had moved to Edinburgh and after discussion with the consultant paediatrician, Celia was assessed by the VI service. As a result of this assessment Celia was diagnosed as having a moderate visual impairment due to the degree of perceptual difficulties. Recommendations were given to her teachers about using specific colour of paper and size of print for contrast but, much more importantly, a recommendation was made for Celia to have a reader as well as a scribe to help her cope with the volume of work. This was particularly helpful for exam level work. Celia did very well in the 3 Standard Grades she sat at her special school and is now going on to do Higher Modern Studies in one year with a B in the prelim and Intermediate 2 English and French this year. She has expressed a desire to attempt Advanced Higher Modern Studies next year as well as taking English and French to Higher Level. To help cope with this level of work, Celia has a program on her laptop which allows notes and books to be read aloud so that she can go over her work independently.

I am delighted that ways round Celia’s many difficulties have been found and am extremely grateful to her teachers and other staff, including the VI teacher, for all the hard work and willingness to embrace new ideas and suggestions. Who would have thought...?
APPENDIX 1

Yorkhill Audit Project

Nicola Tennant

This study examined the working relationship between physiotherapists and teachers in schools for children with learning difficulties in the Greater Glasgow Area.

Unfortunately the mere presence of professionals, regardless of their individual competencies, does not guarantee that children with learning difficulties receive educationally relevant services. The effective provision of services to these children depends on effective collaboration among professionals. Few other aspects of a child’s education have such long-term implications as the results of interactions among those responsible for the design, implementation and evaluation of Individualised Educational Programmes (IEP). It is this co-ordination of related services that allows children access to the curriculum and the necessary number of practice opportunities to acquire skills. Where interaction is poor among professionals, understanding and awareness of other team members is reduced, opportunities for communication lost, and care is fragmented.

For some time there has been concern about inter-professional and inter-agency co-operation, and ultimately the education of children with learning difficulties is compromised when input from related service professionals is not adequately synthesised.

Professional collaboration has evolved as a result of the frustration of parents and teachers at the inability of children to carry over skills from the treatment room to everyday situations.

The initial ‘multi-disciplinary’ team where professionals functioned independently of one another progressed to the ‘interdisciplinary’ method where individual assessment and treatments were still performed but exchange of information across disciplines improved. A further progression to effective collaboration produced the ‘transdisciplinary’ approach where professionals of different disciplines not only exchanged increasing amounts of information and expertise across traditional boundaries but also exchanged methods. In this case the whole team shares responsibility for assessment, setting of joint goals, the process involving the transfer of skills and joint evaluation. This method of service delivery has been recognised as ‘best practice’ for several decades.

This study carried out in Greater Glasgow took the form of a questionnaire to both physiotherapists and teachers examining issues such as communication, setting of joint goals, attending meetings, exchange of methods and willingness to work together.
The main issues highlighted by the study were that both teachers and physiotherapists had similar beliefs about best practice, spent little time communicating with one another, thought that it was important to set joint goals and attend meetings, but very few did so. There was a willingness to work together and to exchange methods in the form of ‘role release’ but all professionals felt that they did not receive enough training to do so effectively. Both teachers and physiotherapists stated that lack of time and the inflexibility of their timetables was the main barrier to effective collaboration and that better communication was essential.

To complete the audit cycle, transdisciplinary groups have been set up in one school where regular meetings are held to set joint goals, plan transdisciplinary group sessions involving as many professionals and parents as possible. This project, although progressing well, has not yet been evaluated.
APPENDIX 2

An Approach to Functional Vision Assessment in Special School

Lynn Lymer

Who is present?

- Child.
- Parents or carers.
- School doctor.
- Visiting teacher (visual impairment), (VTVI).
- Consultant community paediatrician.

Advantages of testing in school

- Child is less stressed.
- Parents may be less stressed.
- Less time lost in the child’s school day.
- Access to learning materials used by child.
- Appropriate seating available.

Parents fill in a questionnaire, prior to this assessment, to help with gathering information

- This can give very detailed observations of the child’s use of his vision.
- It can help to start the conversation about the child and raise any anxieties.

Several pairs of eyes, experienced in observing children with visual or processing difficulties, can monitor the assessment and raise issues of concern.

Information is noted and shared by all present and the implications can be discussed immediately.

Children are seen on entry to nursery and reviewed on moving into primary, again in mid/upper primary and before they leave school. They may be seen for additional assessment at any time if they or their parents or school staff raise concerns.

Tests used depend on the age and abilities of the child

- Preferential Looking.
- Cardiff Cards.
- Hiding Heidi.
• BUST-LH playing cards.
• Maclure Reading Type for Children.
• Manual for Teachers of Children with Learning Difficulties.
• Crowded Symbol Book.
• Low Contrast Test.
• Colour vision.
• Stycar Ball.
• Materials from the Reynell-Zinkin Scales.

The findings can be discussed with parents and the young person immediately and the community paediatrician will follow this with a formal written medical report.

At the end of the report she will include a short list of recommendations agreed by those present. This might include comments on:

• the type of toys appropriate;
• the kind of text or pictures most likely to be suitable;
• the use of magnifiers or referral to the low vision aid clinic;
• positioning the child;
• positioning the work;
• VTVI involvement;
• further assessment or follow-up.

A summary of the functional vision information is then prepared, on a single page, for the classroom staff, under the headings:

Distance vision
Near vision
Visual fields
Mobility
Colour
Contrast
Crowding
Other (attention, processing, lighting)
Glasses or other equipment used for seeing work.

This page has a column for teaching strategies which might help the classroom staff to alleviate the difficulties noted.

The page has a date at the top and is kept under review.

Staff are encouraged to comment on the findings and help to adjust them as appropriate - the child may perform differently in class and under assessment with less familiar adults present.
At the initial meeting, parents are given contact details for the visiting teacher (visual impairment), so that they can let her know if there are problems, e.g. with accessing text or picture material at home.

The young person can raise concerns, e.g. if there are particular difficulties in certain subjects and the visiting teacher can then meet with relevant staff and ensure they are aware of the difficulties and strategies available to compensate.

This system may be far from perfect, but it allows us to learn from one another (child, parents and professionals) and develop our practice. It sets the scene for useful communication.

References

Woodhouse, J M *Cardiff Acuity test*. Windsor: Keeler Ltd.


*Keeler Acuity cards (Preferential Looking)*. Windsor: Keeler Ltd.

Kinsley-Crisp, Ronald (1998) *Do you have a child with a visual dysfunction in your classroom?* Ipswich: JAG Enterprises.


*Maclure Reading Type for Children*. Harlow: Clement Clarke International Ltd.


Suppliers

Clement Clarke International Ltd, Edinburgh Way, Harlow, Essex, CM20 2TT.
Tel: 01279 414969 Fax: 01279 635232 http://www.clement-clarke.com/

Keeler Ltd, Clewer Hill Road, Windsor, Berkshire, SL4 4AA.
Tel: 01753 857177 Fax 01753 827145 http://www.keeler.co.uk/
APPENDIX 3

Support from Technology

Fionna Balfour

Generally when considering computer access technology for people with a visual impairment the combination offered consists of a screen reader or screen enlargement with a braille or standard keyboard. When considering those with an additional physical impairment then alternative keyboards and mousing devices or switches are likely to be the most suitable devices.

Although a wide range of hardware and software exists offering a choice for many users, it must be borne in mind that there is no one simple solution and often a number of methods and combinations need to be tried before finding the most suitable for an individual.

For those with sufficient control and dexterity, a standard keyboard may be used with optional large keyboard letters (stickies); perhaps a keyguard to help separate the keys and allow the hand(s) to rest without pressing extra keys; keyboards with larger keys and a better contrast may help; particularly useful for some is a one-handed keyboard (right or left) which offers all the keys on a standard keyboard but provides a fast input method.

If a standard keyboard is not suitable then an adapted or overlay keyboard may provide the best solution. These are flat programmable devices consisting of a grid of cells which can be programmed to offer any number of keys displayed as text, braille, graphics or which have tactile signifiers attached.

Those for whom a keyboard is inaccessible can choose from a range of switches which come in all shapes and sizes, can be operated by various parts of the body (head, hand, knee, mouth) and be used to operate an extensive range of programs. A switch box and some commercially available switches have sockets for attaching additional switches. Thus the user’s own switch solution can be used to control the computer or operate a program. Switches can directly access programs set up to respond to one switch press or be more effectively used in conjunction with software providing visible and/or auditory scanning.

Often a simple magnification of the screen will be all that’s needed to enable access to programs. Many word processing packages offer a range of fonts and sizes for the user although menus and dialogue boxes are set at a standard size. Use of a commercial magnification program offers a better range of facilities including reversal of screen view, choice of pointer size and shape and more controlled movement around the screen, although some of these are provided with system software.
Auditory feedback is either a requirement or an additional support and can be achieved in a number of ways. Commercial screen readers, capable of reading any text, icons, menus and dialogue boxes on screen, generally give control of the mouse pointer to the numeric keypad and text is read out at the position of the pointer. Confusion can arise in a word processing package, however, as the text insertion bar is not necessarily at the same position as the mouse pointer, therefore a high level of cognitive awareness and concentration is required as well as the ability to operate the keypad in order to use this system. There is a limited range of packages on offer which vary in their suitability and ease of use for certain tasks. They require careful consideration and investigation before identifying the most suitable.

Alternatively a talking word processor or document reader can be used with more sophisticated versions offering a range of font, size and style, background and text colour, as well as a range of reading options (from single character to whole document) and an interesting choice of voices.

Software which provides switch users with key entry options can be programmed to offer a range of set-ups with any combination of standard keyboard keys as well as options to link to other programs and set-ups. Scanning can provide auditory cues and feedback as well as large text or graphic cells on screen - a very versatile tool opening up access to a wide range of commercial programs beyond the simple word processor. One commercial switch program offers the option of morse code entry which can greatly speed up the text entry process for a student requiring faster access than a standard auditory scanning set-up.

Access to the Internet and e-mail can similarly be made available through programming switch software, screen readers and document readers, although it has to be said this can be offered with various levels of support and independence, again catering for the individual.

A final comment must be added here for anyone with any influence! There is a wealth of commercial switch accessible materials and an extensive range of switch devices to enable all needs to be met. Unfortunately what there is not such a range of is programs with uncluttered screens, clear graphics with good use of colour and contrast and, most importantly, AUDITORY scanning. It seems such a pity that so much is now being invested in switch accessible educational and attainment programs which would only need an auditory cue to enable those with a visual or physical impairment to access them.
GLOSSARY

**Adaptive behaviour** - a purposeful and goal directed behaviour made in anticipation of or in response to an environmental challenge.

**Associated reaction** - an increase in muscle tone in the more affected part of the body when effort is used in a less affected part of the body.

**Autonomic nervous system** - the part of the nervous system responsible for the control of bodily functions that are not consciously directed, including regular beating of the heart, intestinal movements, sweating, salivation, etc.

**Ataxia** - jerky, unco-ordinated movements.

**Athetosis** - involuntary movements - uncontrolled/unwanted movements outwith the child's control.

**Contracture** - permanently tight muscles with some loss of joint movement.

**Deformity** - joints permanently fixed in abnormal positions, e.g. hip dislocation.

**Diplegia** - all four limbs affected but lower limbs more affected than upper limbs.

**Dyskinetic** - a group of involuntary movements seen as the child moving too much and is unable to control his movements.

**Dystonic** - sudden changes in postural tone which can result in a movement that is extreme in range.

**Functional** - a task that involves the co-ordination of the whole child to perform an activity.

**Grapho-motor skills** - pre-writing skills.

**Hemiplegia** - one side of the body affected arm and leg may be equally or unequally affected.

**Hypertonia** - increased postural tone, 'stiffness' of muscles.

**Hypotonia** - reduced postural tone, 'floppiness' of muscles.

**Lesion** - an area of tissue with impaired function as a result of damage by disease or wounding.

**Lilli Nielson's 'Little Room'** - a large box with no bottom and holes in the top so that a variety of real objects can be suspended over the child. Any movement the child makes when lying in the 'little room' should cause him to come into contact with something. The child is then encouraged to explore further and gradually comes to realise that he can have an effect on his environment.

**Postural tone** - the level of activity in the muscles, which enables maintenance of posture against gravity but still allowing for smooth flowing movement of the body and its parts.

**Prognosis** - an assessment of the future course and outcome of the child's condition, based on knowledge of the course of the condition in other children together with the general health, age and sex of the child.

**Proprioceptive** - related to the sense of movement and position of the body parts.

**Quadriplegia** - all four limbs affected but upper limbs more affected than lower limbs and the children are not able to use their upper limbs efficiently to support themselves when moving from one position to another.
**Retinoscopy** - is a way to assess if a child might benefit from wearing glasses. By moving a light across the pupil an estimate of how long or short sighted an eye is can be made. Optometrists and ophthalmologists can perform this test. Dynamic retinoscopy is a way of doing the test that allows an estimate of the power of 'near focusing' (accommodation) as well. The test is done without putting any drops into a child's eyes, and comparing the results of the test when a child is looking at a distant object and then at a near object. This information can help decide if a child might also benefit from wearing bifocal or multifocal glasses for near work.

**Sensory processing** - the process by which the nervous system takes in, recognises and assigns significance to information arising from one of the various sensory systems. The latter step involves inhibiting or enhancing perception of this information. Finally, the process organises sensory information for use in selecting and planning adaptive behaviour.

**Snellen Letter Chart** - a distance acuity vision chart that is commonly seen in the doctor's surgery. The test is usually carried out at 6m. In order to use the test the tester needs to be certain that the child can confidently recognise the letters of the alphabet. If the child has 6/6 vision it means she has normal vision. The scores are in multiples of 6. A score of 6/24 means that the child can see at 6m what the normal eye is expected to see at 24m and is a moderate visual impairment. A score of 6/60 means the child can see at 6m what the normal eye can see at 60m and is a more severe visual impairment.

**Tactile** - relating to or affecting the sense of touch.

**Vestibular** - related to the sense of head position and movement of the body through space.
Useful Websites

Cerebral palsy (CP)

- **Scope** (was the Spastics Society England & Wales service) - it has good information, etc, about CP.
  http://www.scope.org.uk/home/scope.shtml
- **Capability Scotland**
  http://www.capability-scotland.org.uk/
- **Bobath Children's Therapy Centre Scotland**. A non-profit making organisation that specialises in the treatment of cerebral palsy and acquired neurological conditions in children and adults, the training of postgraduate therapists and doctors in the Bobath approach, and carries out research into these conditions and the ways of mitigating their effects.
  http://www.bobath.org.uk/
- **Cerebral Palsy Info Central** (USA). Information about cerebral palsy. Material is written and compiled by a cerebral palsy sufferer.
  http://www.geocities.com/aneecp/
- **National Institute of Neurological Disorders and Stroke: Cerebral Palsy: Hope Through Research** (USA - medical & research information)
- **CALL Centre**
  http://callcentre.education.ed.ac.uk/

Visual impairment and other disabilities

- **Scottish Sensory Centre** http://www.ssc.mhie.ac.uk/
- **Visual Impairment Scotland** http://www.viscotland.org.uk/
- **International Council for Education of People with Visual Impairment**
- **RNIB** http://www.rnib.org.uk/
- **Sense** http://www.sense.org.uk/
- **Sense Scotland** http://www.sensescotland.org.uk/
- **SeeAbility** A charity working with adults who are blind or partially sighted and have a range of additional disabilities. Services and research (reports).
  http://www.seeability.org/index.htm

Video

- **Let me see**. This video was filmed at Westerlea School, Edinburgh, which caters for pupils who have cerebral palsy. It considers ways in which children with CPVI can be enabled to make best use of their vision while fully taking account of their physical disability. Cost: £17.63 (inc VAT). Available from: MALTS, Moray House School of Education, The University of Edinburgh, Paterson’s Land, Holyrood Road, Edinburgh, EH8 8AQ.