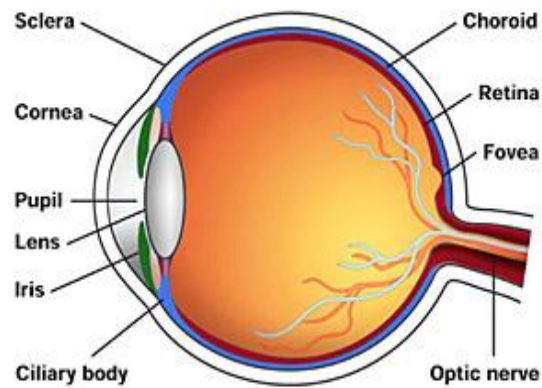


# Southampton Eye Unit

## Orthoptic Induction Pack



## Orthoptics

Orthoptics is an **Allied Health Profession**. It is a graduate profession with a 3 year degree course offered at Liverpool and Sheffield Universities, or a 4 year course at Glasgow University..

Orthoptists are involved in the diagnosis and treatment of problems with visual development and eye movement.

Main areas of expertise are the **assessment of vision in children and the assessment and diagnosis of squint (misalignment or deviation of the eyes) in all ages.**

Elizabeth O'Flynn	Head Orthoptist, clinical tutor.
Megan Ranger	Deputy Head Orthoptist, Research Orthoptist
Marion Hedley-Lewis	Lead Clinical Tutor
Kathryn Thatcher	Paediatric Family Support Service
Sarah Lambert	Clinical Tutor
Richard Evans	AMD injections and Clinical Tutor
Daniel Osborne	Research and Clinical Tutor
Ross Cahill	Medical Retina Specialist/ AMD injections
Rachel McKeivitt	Clinical Tutor

Examples of cases assessed by the orthoptist are:

- Amblyopia (lazy eye)
- Vision assessment in infants, children and those with specific learning difficulties
- Squint – any age
- Suspected squint – babies
- Patients with ptosis (droopy eye lids)
- Patients with “eye strain” or blurred vision
- Patients with double vision (various reasons)

Many orthoptists are also skilled in performing and interpreting a variety of other diagnostic procedures in the eye clinic.

Examples of these tests are:

- Perimetry - Visual Field Assessment
- Tonometry -Measurement of pressure within the eye
- Fundus Photography
- Measurement of the length of the eye and curvature of the cornea (Biometry)
- Measurement of electrical potentials from the eye and brain (Electro-diagnosis - EDTs)
- Low Vision assessment (e.g.magnifiers for those registered partially sighted)
- Injections for AMD

## Visual Development

### Vision

- The eyes of a full term neonate are relatively well developed compared with other organs
- Fixation i.e. looking directly at a given object can be demonstrated even in a neonate using an appropriate target.
- Smiling is often reported before 6 weeks of age
- There is rapid development in vision during the first 6 months of age. This is due to differentiation of the fovea, continuing myelination of the visual pathways and increasing neuronal synapses in the visual cortex
- Vision continues to mature over the next 7-8 years provided there is a **clear image on the fovea of each retina** during this critical time period

## Amblyopia (lazy eye)

**Amblyopia** is **reduced vision** due to a **degraded visual image on the fovea** during the “sensitive” visual developmental period (first 7-8 years of age).

The amblyopic eye appears normal on examination of the fundus and when any refractive error (long or short sight) is appropriately corrected with glasses, the vision does not improve.

It is usually unilateral, occasionally bilateral.

It is a neurological condition - a disorder of visual development.

### Causes

- **squint** (misalignment ) of one eye - **images** from the deviating eye are “mentally “ ignored or **suppressed** to avoid double vision
- **anisometropia**- usually due to significant “long sight ” in one eye only -the image on that fovea will be blurred resulting in the **image being suppressed**
- **ptosis** – if the upper eye lid covers the visual axis, the fovea will **not** actually **receive an image** of the fixation target.

Pathology of the eye during the sensitive period, will also cause amblyopia if the foveal image is not clearly focussed e.g.cataract

### Treatment

Any significant refractive error would be corrected with glasses. In some cases vision can improve with glasses alone.

Any pathology would be treated as appropriate.

Occlusion (**Patching**) of the eye with better vision is carried out to improve the vision in the amblyopic eye. This must be carried out during the sensitive period to be effective.

Occlusion is monitored carefully.

The amount of daily occlusion and overall duration of treatment depends on several factors including the age of the child and level of vision at presentation and compliance.

Occasionally it may be possible to improve vision after 8 years of age but very careful orthoptic assessment and monitoring is necessary due to the **risk of inducing permanent double vision**.

In some circumstances, atropine drops are used to stop the better eye focussing properly.

## Binocular Single Vision

The eyes of most babies are well aligned by 5 weeks of age, though many “normal” babies demonstrate misalignments for short periods up to 2 months of age

These misalignments seem to be attempts at focussing and converging the eyes and are indistinguishable from an actual emerging convergent squint (esotropia)

**Any constant squint (misalignment of the eyes), convergent or divergent, in a baby or child should be referred to an ophthalmologist a.s.a.p.**

**Any intermittent squint after the age of 4 months in a baby should be referred a.s.a.p.**

**Binocular Single Vision (B. S. V.)** is the ability to **combine** the **images from each eye** to appreciate **a single image**.

The **two images** are locked or **fused** together in the visual areas of the brain.

The **fused image** is seen as 3-dimensional  
i.e. **stereoscopic vision or 3D vision**

BSV begins to develop around 2-3 months of age, as the neurones in the visual cortex begin to differentiate into “columns” that are sensitive to images from the right eye, the left eye or both eyes

Requirements for BSV to develop include eyes that are well aligned, similar retinal images from each eye, good ocular motility and developed higher (cortical) visual pathways.

**Some people are unable to demonstrate or develop BSV** even if treatment achieves good vision in both eyes and the eyes become well aligned. This is due to reasons such as genetic factors or developmental delay.

## Squint (Strabismus)

### Manifest Squint

**A manifest squint is a misalignment of the visual axes.**

One eye is looking directly at the target and the other is deviated.

Deviated toward the nose - convergent squint / esotropia

Deviated away from the nose - divergent squint / exotropia

Eyes can also be deviated vertically.

A manifest squint can range in size from very small and not cause a cosmetic problem to very large.

Regardless of size, a squint can have a profound effect on the development of vision and binocular vision if it occurs during the first 6-7 years of life when the visual system can adapt to change i.e. the sensitive period.

Images from the squinting eye are "switched off" or suppressed by the brain to avoid double vision.

This results in the **vision of that eye failing to develop** to its potential i.e. **amblyopia**

If a very large squint alternates, i.e. sometimes the right eye is squinting and at others the left, amblyopia will not develop as one eye is not constantly being suppressed

A very small squint may have gone undetected until a school eye check demonstrates amblyopia

If the eyes are not well aligned **Binocular single vision (BSV)** cannot develop. This is the ability to use the eyes together - to move together in a coordinated way and to and appreciate 3D vision.

See separate sheets on amblyopia and BSV.

### Latent Squint

This is a **tendency for the eyes to misalign.**

The eyes are **aligned** (straight) **until a cover** is placed in front of one eye.

The eye behind the cover deviates and then straightens again when the cover is removed

If the eye behind the cover is deviated toward the nose - esophoria

If the eye behind the cover is deviated toward the nose - exophoria

**The majority of people, children and adults, have a small amount of exophoria and in the majority of cases does not cause any problem.**

## Squint – continued

Manifest or latent squints can further be classified as concomitant or inconcomitant

### Concomitant

**The squint is the same size in all directions of gaze**

The eye muscles are essentially working normally.

Most squints in children are concomitant

### Causes

- Most squints in **children** are associated with **HYPERMETROPIA (long sight)**  
Extra focussing effort involves the medial rectus muscles. The action of these muscles is to converge the eyes.
- There may be pathology in one eye or both eyes e.g.cataract, aniridia, coloboma affecting the vision. This can cause amblyopia and affect the development of binocular single vision
- Family history
- Developmental delay

### Inconcomitant

**The squint varies in size depending on the direction of gaze**

Specific muscle/s or muscle actions are affected.

Investigations are to determine if the defective movement is involving the eye muscle or its nerve supply.

### Causes include

- \*Vascular – diabetes / high blood pressure etc.
- Anatomical anomalies – orbit
- Neuro-developmental conditions
- Tumour
- Trauma
- Inflammation
- Infection
- Multiple Sclerosis
- Myasthenia
- Thyroid Eye Disease
- Myopathies

\*Micro-vascular causes of double vision in the elderly are most common.



## Implications of Squint

### Amblyopia

In the developing visual system, i.e. less than 6-7 years of age, **double vision** resulting from a squint is transient. The second image is quickly “switched off” or **suppressed** when both eyes are open, and this leads to **amblyopia** of that eye.

Treatment to regain /develop vision in an amblyopic eye must be carried out during the sensitive period when vision can be improved by glasses and / or occluding (patching) the fellow eye as necessary. This is usually done before 7 years of age.

**Loss of vision** in the non amblyopic eye can have dramatic effect on the life style of a subject depending on the level of vision in the amblyopic eye. Driving and paid employment may no longer be possible.

### Career choices

A level of vision in the weaker eye may be required.  
Stereopsis is required in some careers e.g. pilot / surgeons using binocular microscopes

### Asthenopic

Symptoms of general eye discomfort /strain / blurred vision / double vision

### Cosmesis

Some patients can be affected psychologically, finding eye contact especially difficult with resulting socialising and employment difficulties.

## Management of Squint

### Children

#### **Orthoptic assessment**

The eyes are dilated for cycloplegic **refraction** and examination of the **fundus** and media.

Any systemic or neurological **cause** is investigated and managed as appropriate.

#### **Glasses**

Glasses may be needed to correct any refractive error

Correction of the hypermetropia (long sight) can fully correct an esotropia (convergent squint) in some cases.

In some cases wearing glasses over a period of time will improve the vision in an amblyopic eye.

#### **Prisms**

These are used in the investigation of some squints to help plan surgery.

#### **Occlusion**

If amblyopia is present, patching of the better eye is carried out.

This is monitored carefully with follow up visits every 6-8 weeks initially.

The amount of patching depends on various factors e.g. the age at presentation, vision level and any other developmental issues.

In some circumstances drops that stop the better eye focussing properly are used.

#### **Surgery**

The aim of surgery is to improve eye alignment by weakening or strengthening the extra ocular muscles as appropriate. B.S.V. may be re established.

If an improvement in cosmetic appearance alone is the goal, i.e. no BSV is demonstrable, the squint could become noticeable again in the future, and further surgery would then be needed.

## **Adults**

It is important in the presenting adult patient to determine if the squint was present in childhood or is of recent onset.

If the squint is not longstanding it is necessary to investigate the cause.

## **Prisms**

Fresnel prisms (thin flexible plastic discs temporarily attached to a patients glasses) are frequently used to join double vision. e.g. while awaiting expected recovery in cases of micro vascular neuropathy in older patients with diabetes or hyper tension .

## **Orthoptic Exercises**

Orthoptic exercises may benefit a patient if BSV is present and the deviation is not large.

## **Botulinum Toxin Injections**

Botulinum toxin can be used to manage or further investigate certain squints by temporarily changing the angle of squint. The toxin paralyses a specific extra ocular muscle for approx 4 months.

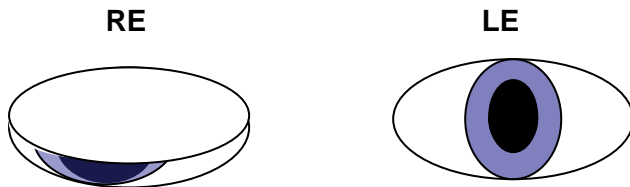
## **Surgery**

In adults, any underlying cause should be treated as necessary before considering squint surgery. Squints must also be stable for several months.

Extra ocular muscles are weakened or strengthened as appropriate to reduce the size of the squint.

## Extra Ocular Muscle Palsies – examples

### Right 3<sup>rd</sup> Nerve palsy



In a total right 3<sup>rd</sup> nerve palsy, the eye is divergent and hypotropic - **“down and out “**  
Also the pupil is dilated and there is a right ptosis.

### Right 4<sup>th</sup> Nerve palsy



The right eye will tend to be elevated – this could be a manifest or a latent vertical squint.  
There may be an associated horizontal deviation.  
The right eye will demonstrate an under action when looking down to the left.  
A **head tilt** is often present which helps to control the vertical squint.

### Right 6<sup>th</sup> Nerve Palsy



The right eye will demonstrate an esotropia when looking in the distance and **will not move fully into abduction** i.e. out to the right.

Above are classic pictures but more than one nerve may be involved and the deviation may be due to a mechanical or myopathic aetiology rather than neurogenic

## Testina Ocular Motilitv

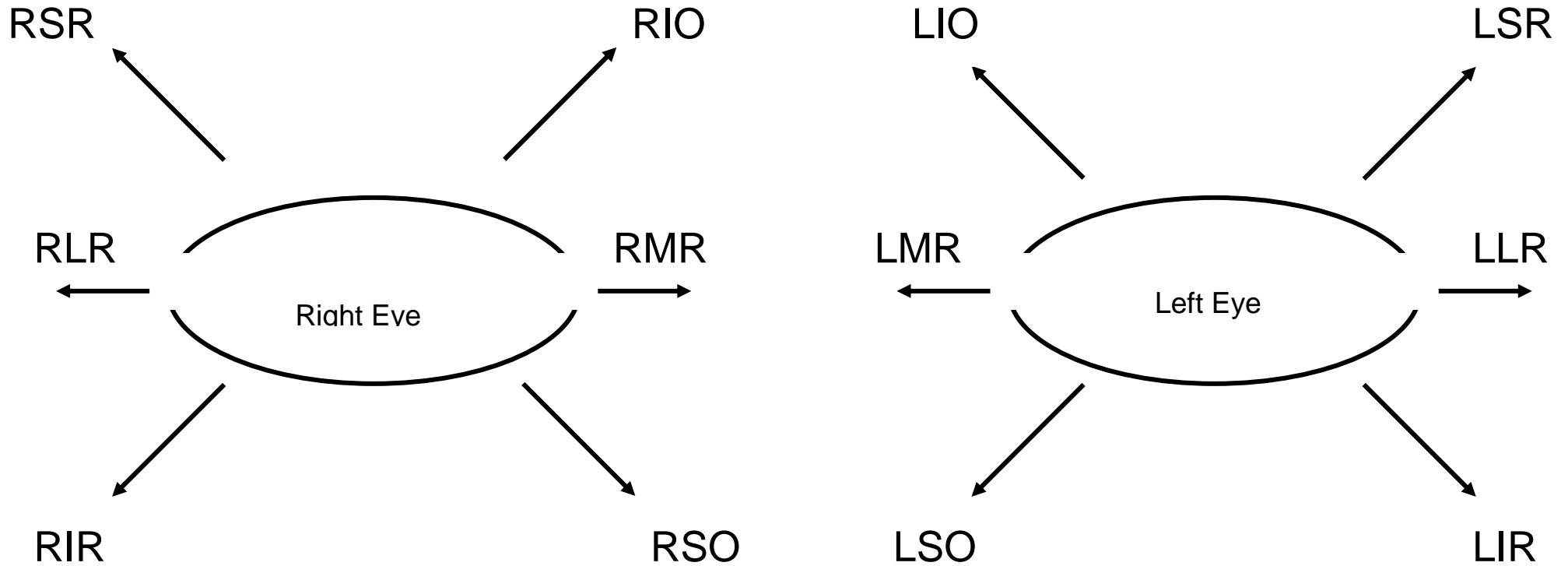


Diagram is as facing patient ....

Arrows indicate the **direction of gaze** required to assess the main **action** of each extra ocular muscle.

RMR right medial rectus      RLR right lateral rectus      RSR right superior rectus      RIR right inferior rectus  
 RSO right superior oblique      RIO right inferior oblique (Arrows do not indicate anatomy)