The Extraocular movements.

The examination should always occur after you have taken a history. If a patient complains of double vision then you will need to ascertain if it is present all the time or intermittent, if the patient only notices it for near or distance vision or both. You will also need to ask if the images are side-by side, one above the other or diagonal. Ask whether the displacement of the images is greater when looking in one direction or another as this should give you a clue of which muscles or nerves may not be working properly. Don’t forget that the eyelid height and pupil size is also controlled by the 3rd cranial nerve, so you must check these as part of the ocular motility.

The examination.

Extraocular movement examination should start with a general examination of the face, looking for abnormal head posture, alteration of palpebral fissures (widening and narrowing), facial asymmetry, ptosis before moving onto the cover test. You may be performing this as part of a Cranial Nerve examination, in which case you will be checking the integrity of the 3rd, 4th and 6th nerves together in the test. You should have already evaluated the visual acuity and fundus, (2nd Cranial Nerve) the pupil reactions to light and accommodation and the visual fields.

Performing the cover test is the first part of the examination of the extra ocular movements, followed by testing the movements themselves.

Watch the video on examining the extra ocular movements. The orthoptist asked the patient to move their eyes through the nine positions of gaze by following a target. The target is always returned to the centre point known as primary position and then out towards the periphery. You should be looking for nystagmus in the primary position but it often becomes more obvious on the extremes of gaze.

Cover Test

- This Test is performed at near (visual target at 1/3 m) using a pen torch shone at the patient and at distance using a target (6 m).
- Firstly use the light to look at corneal light reflections; The corneal light reflections are the pinprick of light on the corneal surface reflected back from the pen torch.
- Then examine the lids, pupils, and head posture as well as the position of the eye.

- Secondly assess using an accommodative target (this is a target with fine detail which the patient will need to focus on.
- If an abnormal head posture (AHP) is present, compare with and without ; consider why the patient has developed an AHP
- If there is a deviation is it latent (only shows up on cover test), manifest (can be seen all the time) or intermittently manifest?
- Is the deviation eso (turned in), exo (turned out), hyper (one eye too high), or hypo (one eye too low), or a combination of these?
- compare the primary and secondary deviations in incomitant cases (see below for secondary deviations)
- ask about diplopia
- look for nystagmus, lid anomalies, pupil anomalies, exophthalmos, enophthalmos etc.

Cover-uncover test- see video
Assess the position of the uncovered eye – this is used to detect a manifest squint.

Alternate cover test- see video
Assess the position of the eye under the cover, just as you take the cover away – this is used to detect a latent squint (also called a phoria). At the end of testing as you take the cover away look at the rate of recovery to a straight position, this indicates how well the latent squint is controlled.

**Strabismus**

**Esotropia** (convergent squint) – the eye turns inwards

![Esotropia](image)

Note temporal corneal reflection of left eye

Eye is on the temporal side

**Exotropia** (divergent squint) – eye that turns outwards

![Exotropia](image)

Note nasal corneal reflection of right eye

**Hypertropia/Hypotropia** – an eye that turns upwards/downwards, caused by vertical muscle paresis

![Hypertropia](image)

Note hyper corneal reflection of left eye

(eye is rotated downwards)

**The cover test on a right esotropia:**

![Cover Test](image)

Right Esotropia

Left eye covered, right eye takes up fixation, left eye now turns in under the cover.

When cover removed, left eye will take up fixation, and right eye will turn inwards again.

2University Hospitals Coventry and Warwickshire, Orthoptic Department 2004, updated by F Dean 2012
Ocular Movement testing (smooth pursuit movement)

- versions are tested binocularly using a spotlight to observe the movement from the primary position into 8 cardinal positions, with the head erect and stationary. The end point of movement is taken as the point where the limbus (where the cornea, iris and sclera come together) is touching the eye lid.

- When there is a difference in the end point of the right and left eyes you should be asking yourself whether this is due to an underaction.

This diagram shows the directions which you should move the target from the centre point:

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Thus when you are moving the target from the centre, down and towards the patient's left you are testing the movements of the Right superior oblique and the left inferior rectus.

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Normal movements of both eyes when following a target will end when the white of the sclera disappears behind the eye lids and no more white can be seen.

This diagram shows complete movement of the patient’s right eye when following a target to the left but the left eye has stopped early showing lateral rectus weakness.
Diagram showing the eight cardinal positions of gaze

- the corneal reflections are noted and a cover test is performed in each position
- ductions are tested monocularly to compare with versions and the following noted:
  - underactions / overactions / restrictions
  - whether the movement is smooth or jerky
  - nystagmus
  - change in position of lid (e.g., lid lag in thyroid eye disease)
  - change in position of globe/ change in palpebral fissure size

Ocular nerve palsies
- Can have IIIrd (total or partial, affecting medial rectus, inferior rectus, superior rectus, inferior oblique, pupil and lid), IVth (superior oblique) or VIth (lateral rectus)
- most common acquired palsy is VIth nerve
- most common congenital palsy is IVth nerve

The pathological cause of each nerve palsy alters with age.
Ocular posture in nerve palsies

<table>
<thead>
<tr>
<th>Nerve palsy</th>
<th>Deviation</th>
<th>Underaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIth nerve palsy</td>
<td>Patient has an Esotropia greater for distance fixation with diplopia</td>
<td>Limited abduction</td>
</tr>
<tr>
<td>IVth nerve palsy</td>
<td>Esotropia, hypertropia and extortion greater for near and looking down, with diplopia</td>
<td>Underaction of superior oblique</td>
</tr>
<tr>
<td>IIIrd nerve palsy</td>
<td>Exotropia, hypotropia and intortion. Ptosis. May have dilated pupil. Diplopia if ptosis not complete.</td>
<td>Underacting superior rectus, inferior rectus, inferior oblique, medial rectus and levator.</td>
</tr>
</tbody>
</table>

Note the presentation may be different if the patient had a pre-existing squint, and depends whether the palsy is complete or partial.

Additional information related to ocular motility

What is an Orthoptist?

An Orthoptist diagnoses and manages defects of visual development, binocular vision and eye movements.

What happens when an adult is referred?

- usually, an adult will complain of symptoms such as double vision, tired eyes, or poor cosmetic appearance
- adult assessed by an Orthoptist who determines cause and whether problem is recently acquired or a longstanding condition which has worsened.
- symptoms relieved by use of prisms, occlusion or exercises
- patient assessed by an ophthalmologist when problem thought to be due to a palsy of the cranial nerves, or when surgery may be required.
- discharged when problem resolved, or symptom free.

What happens when a child is referred?

- child assessed by an Orthoptist
- cycloplegic refraction carried out by an optometrist (the child has eye drops of cyclopentolate or atropine to paralyse the focusing mechanism.)
- fundus and media assessed by an ophthalmologist
- any amblyopia (lazy vision) is treated first usually by patching
- squint operation if cosmetically poor, or if a ‘functional’ result can be obtained
- reviewed until age 6/7 years, then discharged to community optician
Normal Development of vision in children

- **0-1 month**: 6/240 (poor vision levels), looks at a light source, blinking as a defensive response, pupillary response, horizontal tracking present, although slow
- **2-3 months**: 6/90-60 accommodation adult level, smooth pursuit accurate, convergence now developed, intense eye contact, interested in lip reading, interest in mobiles, vertical tracking present, eyes mostly straight
- **3-6 months**: vision 6/36 using preferential looking, stereopsis (3D vision) present (abrupt onset at 4/12), OKN symmetrical, watches own hands, reaches for objects, able to dissociate eye movements from head movements
- **1-2 years**: vision good and easily tested using preferential looking, grating acuity reaching adult level, good binocular vision
- **2-3.5 years**: refraction should be within normal limits, will name colours but not perfectly

Risk factors for disruption of development of vision

- the plasticity of the visual system extends up to approx 8 years of age
- critical period for visual acuity has a fast phase from birth to 10 months then a much slower phase lasting up until the age of approx 8 years
- abnormal visual development occurs when a clearly focused image on the retina cannot be maintained
- the critical factors are the age of onset, the severity of insult, the age at which treatment was commenced, compliance with treatment and the health of the fellow eye
- when significant interruption of normal visual development occurs then amblyopia is the term used to describe this loss of vision
- amblyopia affects 2-5% of the general population

Family History

- If one parent has suffered from a squint or amblyopia, there is a 35-46% chance of the infant being affected
- if both parents have suffered from squint or amblyopia, the figure rises to 78% or more

Birth History

- prematurity produces a 1 in 5 risk of developing squint and or amblyopia, the prevalence also rises in difficult or traumatic births

General Health

- children with Down’s are 10 x more likely to have squints or amblyopia
- infants with brain damage are 50 – 60% more likely to have squint or amblyopia

Pathology

- externally if there is a problem with the lids such as haemangioma, this can cause refractive errors
- corneal scarring can cause refractive errors or amblyopia
- congenital cataracts cause dense amblyopia if not removed

Refractive errors

**Hypermetropia** / long-sightedness (smaller eye)
- most children slightly hypermetropic - normal
- corrected with +ve lenses (convex)
- children can overcome this using accommodation – but can cause a strabismus (eso)
Myopia / short-sightedness (larger eye)
- often starts in teens, corrected with –ve lenses (concave)

Astigmatism - caused by corneal steepness, corrected by cylindrical lenses. The eye is Rugby ball shaped.

Anisometropia - difference of refractive error between the eyes, can cause amblyopia

Amblyopia - Term used to describe a ‘lazy eye’, often found in addition to strabismus and refractive errors. This is treated by occlusion of the good eye, to stimulate the development of the 'lazy eye'. Can only be carried out until the age of 8, after this age, visual development is complete

Assessing the red reflex

Ideally should assess in a darkened room
The presence of the following should be noted:
• absent red reflex
• red reflex paler in one eye
• hazy appearance
• distortions
• any ‘spec’ like appearances
It can also be useful to assess the pupils.

Useful websites www.futureoptometrist.com/physiological_optics_iv.htm
A useful website, which takes you through tutorials on binocular vision anomalies.
www.eyeconditions.org.uk/
Provides links to other websites on a huge range of eye conditions.