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EXAMINATION

INTRODUCTION

In the assessment of a patient with eye disease, it is important to take a good history, examine the eyes with adequate illumination and test the visual function.

Recently, retinal and macular diseases have become more common as causes of severe visual loss. In these cases, a fundal examination with dilatation of the pupils in a darkened room is necessary.

HISTORY

A careful history of the patient's ocular symptoms is essential. His past history and general illnesses, such as diabetes and hypertension, frequently provide useful clues.

Myopia, squint, open-angle glaucoma and dystrophic conditions have a hereditary tendency which is revealed by an inquiry into the patient's family history. It is also useful to take note of allergies and of the medical therapy the patient is undergoing.

OCULAR SYMPTOMS

The more important symptoms include decreased visual acuity, floaters, ocular pain, headaches, itching, flashes, watering and double vision (diplopia).

Decreased visual acuity

Decreased visual acuity must always be investigated and the cause found. The cause of a sudden loss of vision could be vascular in nature such as retinal vein occlusion, retinal artery occlusion or vitreous haemorrhage. It could also be due to acute glaucoma, retinal detachment or inflammatory conditions such as acute uveitis and optic neuritis.

Gradual loss of vision is usually due to a refractive error such as myopia or presbyopia, or to degenerative conditions of which cataract is the most common. It could also be due to macular degeneration or chronic glaucoma.

Floaters

Another common ocular symptom which calls for further investigation is the appearance of floaters usually described by the patient as small, semi-translucent particles of varying shapes moving across the visual field with the movement of the eye. Single or double floaters of many months or years are common and usually harmless. But a sudden increase in floaters, especially when associated with lightning flashes and visual loss in patients with high myopia or in the elderly, suggests retinal disease, particularly retinal detachment.

Flashes

Flashes are momentary flashes of light due to stimulation of the retina and are seen in retinal tears and detachments and also in vitreous detachment. Other sensations of light may arise from migraine or lesions of the visual pathway.

Eye pain and headaches

Eye pain and headaches may be due to either ophthalmic or non-ophthalmic causes. Of the ophthalmic causes, acute glaucoma is the most important. Less frequent but just as important is iritis. Uncorrected refractive error, migraine and anxiety are common causes of headaches.

Itchy eyes

Itching around the eyes is frequently due to allergy. It may also be due to blepharitis.

Watering

In infants, watering is usually due to a blocked nasolacrimal duct. A rare but important cause of watering and irritable eyes is congenital glaucoma. Another cause is entropion of the lower lid.

In adults, watering has many causes, a common one being a blocked nasolacrimal duct. It can also occur in association with surface irritation, as in conjunctivitis, keratitis or when a foreign particle is in the eye.

Double vision (diplopia)

It is important to note whether double vision (binocular diplopia) occurs only when both eyes are open or when one eye is occluded (monocular diplopia).

Binocular diplopia is usually due to extraocular muscle paralysis. Monocular diplopia is caused by diseases in the eyeball, such as early cataract, lens dislocation or corneal opacity.

EXAMINATION

VISUAL ACUITY

The assessment of distant and near visual acuity is important as it reflects the state of the macular function (central vision). The visual acuity can be tested by asking the patient to cover one of his eyes with a cardboard or with the palm of his hand. By testing the ability of the patient to see objects such as a clock or newspaper in his own environment, it is possible to get a gross assessment of the visual acuity as blind, grossly defective, subnormal or normal.

Distant visual acuity

It is usually necessary to record a patient's distant visual acuity more accurately using Snellen's chart. It is read at six metres, with the letters diminishing in size from above.

The patient has normal vision if he is able to read the line of letters designated as 6/6 at or near the bottom of the chart. The scale for decreasing distant visual acuity is 6/9, 6/12 (industrial vision), 6/18, 6/24, 6/36 and 6/60 (legal blindness in some countries).

If the patient is unable to read the letters, he is asked to count the examiner's fingers which are held a metre away. If his answers are correct, he has a distant visual acuity of "counting fingers" at a metre. If he is unable to count the fingers, the examiner should move his hand in front of the patient's eyes. The visual acuity is then said to be "hand movement". If he can see only light, visual acuity is recorded as "perception of light". If he cannot see any light, visual acuity is recorded as "no perception of light" which is total blindness.

VISUAL ACUITY TRANSCRIPTION TABLES
(Adopted by the International Council of Ophthalmology, 1954)

Decimal V Notation	6 metre Equivalent	20 feet Equivalent	Visual Angle (minutes)
1.0	6/6	20/20	1.0
0.9	–	–	1.1
0.8	5/6	20/25	1.3
0.7	6/9	20/30	1.4
0.6	5/9	15/25	1.6
0.5	6/12	20/40	2.0
0.4	5/12	20/50	2.5
0.3	6/18	20/70	3.3
0.2	–	–	5.0
0.1	6/60	20/200	10.0

In some countries, patients with less than 6/60 vision are classified as legally blind. Patients who can see 6/12 have sufficient vision to work in most industries and are said to have "industrial vision" which is also the visual requirement for driving.

Pinhole

In testing distant visual acuity, looking through a pinhole is useful for patients with blurred vision. Vision can be improved if the defective vision is due to refractive error. It cannot be improved if it is due to organic eye disease.

Near visual acuity

The common near visual acuity tests are the Jaegar test and the "N" chart, usually read at a distance of 30 cm. The Jaegar test is recorded as J1, J2, J4, J6, etc, and the "N" chart as N5, N6, N8, N10, etc. Standard small newsprint is approximately J4 or N6. Each eye is tested in turn with the other covered. Middle-aged patients (presbyopic age) must be tested with their reading glasses.

Difficulties in examination

It is often difficult to test visual acuity in young children as well as patients who are illiterate, uncooperative or malingering. Frequently only an estimate can be made. The E-chart, picture cards or small coloured objects may be used. It can be extremely difficult to determine whether a patient is malingering without the use of special tests.

VISUAL FIELDS

Confrontation

The visual fields can be recorded approximately by using the confrontation test. The patient covers the eye which is not being tested with his palm and fixes the other at the examiner's nose, ear or eye. A target is then brought into his field of vision from the side and the point at which the patient sees the object is noted. The eye is tested in the different meridians, usually 8.

Alternatively, the examiner's fingers are held at a distance of one metre and the patient is asked to count them in the different quadrants, i.e., the superior temporal, the inferior temporal, the superior nasal and the inferior nasal quadrants.

EXTERNAL EYE EXAMINATION

This is done with good illumination from either a window or a bright torch. A magnifying glass facilitates examination and should be used whenever available.

The position and appearance of the eyelids should be noted, especially with regard to their position in relation to the limbus. Also note whether there is eyelash crusting, watering, oedema, discharge or inflammation. Common problems include drooping of the upper eyelid (ptosis), lid retraction, inability to close the lids (lagophthalmos), eversion of the lid margins (ectropion) and inversion of lid margins (entropion).

The conjunctiva and sclera should be almost white with only a few small vessels. The transparent disc-like cornea is best seen with either a good oblique light from a torch or window. Staining with fluorescein dye will help to show ulcers or abrasions of the cornea. The fluorescein is highlighted by blue light. The colour and pattern of the iris should be observed. A dense cataract can be seen through the pupil as a white reflex.

Eversion of upper eyelid

It is sometimes necessary to evert the upper lid to examine the tarsal conjunctiva if the patient is suspected of having a foreign body under the lid. This is also done for diagnosis of the conjunctival follicles of the upper lid as in trachoma. To evert the lid, ask the patient to look downwards and apply slight pressure on the lid with a finger or rod. The lid margin is then gently pulled upwards to evert it.

PUPIL RESPONSES

The response of light directed at one pupil in a darkened room is known as the direct pupillary response. The reaction of light by the fellow pupil is called the consensual pupillary response.

Where a darkened room is not available, the pupillary response can be tested by having the patient cover both his eyes with his palms. The contraction of the pupil is observed when the palm is removed from one eye. This indicates the response of the pupil to direct light.

If there is no pupillary reaction to light, the reaction to accommodation is tested by asking the patient to fix his eyes on an object at a distance and then to focus on another object at about 10 cm away from him.

EXTRAOCULAR MUSCLES

The extraocular muscles are examined by observing the position of the eyeballs with the patient looking straight ahead. Any gross malposition of the eyes can easily be seen. One eye may be observed to be turned inwards (convergent squint) or outwards (divergent squint). Occasionally, one of the eyes may be seen to be higher than the other (vertical squint).

Corneal light reflex

The corneal light reflex is a useful method of determining whether one of the eyes is turned inwards or outwards, or vertically displaced. Normally, when the patient is asked to look at a torch, a light reflex is seen at the centre of the pupil. If one of the eyes is misaligned, the reflex will not be at the centre of the pupil. In a convergent squint, the light reflex will be at the outer side of the cornea, and in a divergent squint, at the inner side of the cornea. A general guide is that if the reflex is at the limbus, the degree of convergence or divergence is approximately 40°. If it is halfway between the centre of the cornea and the limbus, it is approximately 20°. The corneal light reflex is also a useful means to exclude pseudosquints where there is an appearance of a convergent squint because of medial epicanthal lid folds. In pseudosquints the corneal light reflex is central in both eyes.

Ocular movements

When the extraocular muscles are severely paralysed, the restriction in movement is tested by asking the patient to look in different directions (positions of gaze). If the extraocular muscles are less severely affected, special techniques have to be used.

Movement	Right Eye	Left Eye
Right	Right lateral rectus	Left medial rectus
Up and right	Right superior rectus	Left inferior oblique
Down and right	Right inferior rectus	Left superior oblique
Left	Right medial rectus	Left lateral rectus
Up and left	Right inferior oblique	Left superior rectus
Down and left	Right superior oblique	Left inferior rectus

The six cardinal positions of gaze and their corresponding primary extraocular muscle actions.

OPHTHALMOSCOPY

The ophthalmoscope is used to observe abnormality in the ocular media, optic disc, retinal vessels, fundal background and macula.

Red reflex

With the lens power of the ophthalmoscope turned to 0 and the ophthalmoscope held one metre away from the patient's eye a red reflex is seen through the pupil. Alternatively the lens power can be turned to about +5 dioptres and the eye examined approximately 10 cm away. This is caused by the reflection of the light of the ophthalmoscope from the choroidal vessels. It appears as a bright red round area which is evenly lighted. Any opacity in the cornea, lens (cataract) or vitreous will be seen as a dark area. In retinal detachment, the reflex appears grey instead of red.

Fundus

Examination of the fundus is usually done with the direct ophthalmoscope. The refractive error in both the patient and examiner has to be compensated for by adjusting the lens power of the ophthalmoscope. Alternatively, the examiner and patient may use their glasses or contact lenses, in which case no adjustment will be required. The patient is then instructed to look at a distant object. When the right fundus is examined, the ophthalmoscope is held in

the right hand. The examiner uses his right eye to examine the patient's right eye approaching from the right side. The patient's left fundus is examined with the examiner's left eye and the patient is approached from the left. It is important to get near enough so that the examiner's forehead touches his own thumb which is used to lift the upper lid of the eye being examined.

It is best to approach the eye from the temporal side so that a good view of the disc can be seen before the pupil contracts when light is shone on the macula. The nasal retinal vessels and the temporal retinal vessels are examined before the macula. Because of the extreme sensitivity of the macula to light, which results in rapid constriction of the pupil, examination of the macula is difficult and usually requires a mydriatic eyedrop to dilate the pupil.

Difficulties in examination of the fundus

Examination of the fundus can be difficult because of:

- Uncooperative patient
- High myopia
- Opacity in the cornea, lens or vitreous
- Poor ophthalmoscope or old batteries
- Bright room
- Small pupils

In high myopia, examination is simplified by looking through the patient's glasses or his contact lenses. As the lenses of an ophthalmoscope can sometimes be fogged with dust or mould, especially in the tropics, they may have to be cleaned to enable adequate examination of the fundus.

The small pupil

In order to see the fundus clearly, the pupils should be dilated. Examination in a darkened room may be adequate for patients who have naturally large pupils. For patients with small pupils, examination can be difficult and a short-acting mydriatic such as Tropicamide, which acts in less than 30 minutes and has an effect of about four hours, should be used. Long-acting mydriatics are no longer used because of their length of action: Homatropine (one day) and Atropine (one week).

SPECIAL TECHNIQUES

Modern technology has enabled ophthalmologists to examine ocular conditions with greater precision. The techniques and equipment

commonly used by ophthalmologists are described here to help other practitioners understand ophthalmic reports.

- **Tests for extraocular muscles**

The cover-uncover test is done by covering one of the patient's eyes while the other eye looks at an object. When the cover is removed, the uncovered eye may move to look at the object. By observing the movement of the eye, the presence of a squint may be confirmed.

A number of tests can be carried out to analyse diplopia with the use of red-green goggles to dissociate the eyes. The synoptophore is a machine with specially designed pictures to measure the angle of a squint accurately and to test the ability of the patient to see with both eyes together (binocular single vision).

- **Binocular slit-lamp microscopy**

The binocular slit-lamp microscope enables accurate observation of the eye up to a magnification of 40 times. It consists of two parts, an oblique light which can be adjusted to a slit and a binocular microscope. Other uses of the slit-lamp include examination of the retina with magnification from a +78D hand-held lens or contact lens and checking of the filtration angle of the glaucoma patients (gonioscopy).

- **Tonometry**

A tonometer is used to measure intraocular pressure. The most widely used tonometer is the Goldmann Applanation Tonometer. The Schiotz Indentation Tonometer is less accurate but is portable. The new non-contact tonometers do not require local anaesthesia.

- **Perimetry and scotometry**

Perimetry gives a more exact record of the visual fields than the confrontation test. The ability of the patient to see a small 5 mm target on an arc moving into his view from the periphery at different meridians is recorded on a chart.

Scotometry is used to assess the central 30° part of the field of vision. It involves using a small 1–5 mm target on a screen (Bjerrum or Tangent screen) placed 1 or 2 metres away and noting when the test target appears. The normal blind spot is found 15° lateral to the fixation point.

- **Goldmann and computerised perimetry**

One problem in comparative field studies is the lack of standardisation. The Goldmann bowl perimeter partially overcomes this. More recently, the introduction of computerised perimetry has sometimes been invaluable in serial visual field testing for glaucoma and pituitary tumours.

- **Tests for colour vision**

The Ishihara test is most commonly used for colour vision. It is very sensitive. Patients who are able to see colours for general purposes may in fact be found to have a colour defect. Patients who fail the Ishihara test but who respond accurately to the Lantern colour matches or Farnsworth Munsell 100 hue test should not be prevented from pursuing their occupation of choice. This includes pilots who generally need to have perfect or near perfect vision.

- **Indirect ophthalmoscopy**

The indirect ophthalmoscope is now commonly used by ophthalmologists. Its advantages are a binocular view, a wide field and easy examination of the retinal periphery. It is particularly valuable in assessing patients with opacity in the ocular media, high myopia and retinal detachment.

Fundal photography and fundal fluorescein angiography

Fundal photography and fundal fluorescein angiography are methods which supplement the examination of the fundus. In fundal fluorescein angiography, fluorescein dye is injected intravenously and serial fundal photographs are taken to reveal the retinal and choroidal circulation.

Optical coherence tomography (OCT)

This is a new non-invasive imaging technique that allows measurement of the thickness of the retina and is useful for assessment of macular and optic nerve diseases, such as diabetic maculopathy, macular oedema, and age-related macular degeneration.

Refraction

It can be objective with retinoscopy. Subjective tests are done with a trial frame and a set of lenses. Alternatively, the lenses may be mounted on a series of rotating discs (phoropter). More recently,

computerised scanning machines print out the refraction with remarkable accuracy.

Ultrasonography

Ultrasonography is now commonly used to evaluate the state of the posterior segment of the eyeball when the ocular media are opaque from corneal opacities, dense cataract or vitreous haemorrhage. It is particularly useful in severe ocular injuries and vitreous haemorrhage prior to posterior vitrectomy. Ultrasonography is also used for measuring the thickness of the cornea (pachymeter) and the axial length of the eye. In addition, it can provide essential data for calculating the required lens power prior to intraocular lens implantation in cataract extraction.

Cornea diagnostic equipment

A number of new equipment is availiable for more precise measurement of the cornea. Orbscan is a useful and popular anterior segment analyser for corneal disease or correction of refractive error with laser.

CT scan and magnetic resonance imaging (MRI)

The CT scan is used for many ophthalmic conditions, but especially for detecting orbital tumours and localisation of intraocular foreign bodies. It is also widely used for investigation of neuro-ophthalmic disorders.

Magnetic resonance imaging is a noninvasive imaging procedure that does not involve the use of ionising radiation. Its mode of action is based on the interactions of three physical properties, viz. a powerful magnetic field, radiowaves and atomic nuclei with an electric charge.

Compared to the CT scan, MRI possesses greater sensitivity to soft tissue contrast. It is also useful in detecting demyelinating lesions. A disadvantage of MRI is that, unlike the CT scan, it does not detect calcification well and is therefore less valuable in the diagnosis of retinoblastoma and bony lesions.

Macular potential acuity

It is frequently important to predict the visual outcome prior to surgery, especially cataract surgery. This can be done by testing visual acuity with the pinhole or careful examination of the macula. Special tests have recently been introduced. Evaluation with the potential visual metre (PAM) seems to be more valuable than the laser interferometer or Blue Field entoptoscope.

Electrophysiology

Clinical electrophysiology which includes electroretinography (ERG), electrooculography (EOG) and visual evoked response study (VER) is now available in small practical units for ophthalmic clinics. ERG is useful in the diagnosis of retinal dystrophy, such as retinitis pigmentosa. It is also valuable in vitreous haemorrhage when the surgeon is unsure of visual function. EOG measures retinal pigment epithelial function, and VER is diminished in optic nerve disease.