Table 3.1. 🕮

History	
Age	
Ophthalmic:	
Subnormal vision	Duration. Difference between eyes
Disturbances of vision	Distortion, haloes, floaters, flashing lights, momentary losses of vision – field defects
Pain/discomfort	Increase/decrease
Discharge	Change in appearance – discolouration
Change in lacrimation	Swelling/mass
Diplopia	Displacement
General medical:	Diabetes/ hypertension/ COAD/dysthyroid/ connective tissue disease
Drugs	FH social/ occupational
Examination	
VA: distance/near (with and without glasses)	
Colour vision	
Visual fields	
Orbit	Proptosis/ enophthalmos
Ocular movements – conjugate and convergence	Eyelids and lacrimal apparatus
Pupils	Intraocular pressure
Position of eyes	
Conjunctiva, cornea	
AC	
Iris	
Media – lens/vitreous	
Fundus – retina/choroid, optic disc	
Special investigations	
Fluorescein angiography	
Radiological and ultrasound	
Haematological/biochemical	
Bacteriological/immunological	
Diagnosis	
Anatomical	E.g., cataract
Aetiological	E.g., diabetes

Figure 3.1. The Snellen chart. 🕮

letters, decreasing in size down to the bottom. The size of letter normally visible to a normal-sighted person at 6 m is usually on the second-to-bottom line. Patients reading this line are said to have a vision of 6/6. If a patient cannot read the top letter, he is taken nearer to the chart. If the top letter becomes visible at 3 m, the acuity is recorded as 3/60. If the letter is still not visible, the patient is asked if he can count fingers (recorded as "CF") and, failing this, if he can see hand movements ("HM"). Finally, if even hand movements are not seen, the ability to see a light is tested ("PL").

Figure 3.2. The Stycar test. 🕮

Young children and illiterates can be asked to do the "E" test, in which they must orient a large wooden letter "E" so that it is the same way up as an indicated letter "E" on a chart. Perhaps better than this is the Stycar test (Figure 3.2), in which the child is asked to point at the letter on a card that is the same as the one held up at 6 m. Other ways of measuring visual acuity are discussed in Chapter 17.

Visual Field

Some measurements of the visual field can be made by sitting facing the patient and asking if the movement of one's fingers can be discerned. The patient is instructed to cover one eye with a hand and the observer also covers one of his eyes so that he can check the patient's field against his own. The test can be made more accurate by using a pin with a red head on it as a target. None of these confrontation methods can match the accuracy of formal perimetry. A number of specialised instruments of varying complexity are available. Using such equipment, the patient is presented with a number of different-sized targets in different parts of the visual field, and a map of the field of vision is charted. An accurate map of the visual field is often of great diagnostic importance. In the past, it was customary to map out the central part of the visual field using the Bjerrum screen, and the peripheral field using a perimeter. The Goldmann perimeter was then introduced, and this instrument allows both central and peripheral fields to be plotted out on one chart. The Humphrey field analyser is a further development in field testing. It provides an automated visual field recording system (Figure 3.3). It also records the reliability of the patient by showing false-positive and false-negative errors. In practice this is very useful, as poor reliability is often an explanation for poor performance.

Figure 3.3. The Humphrey field analyser.

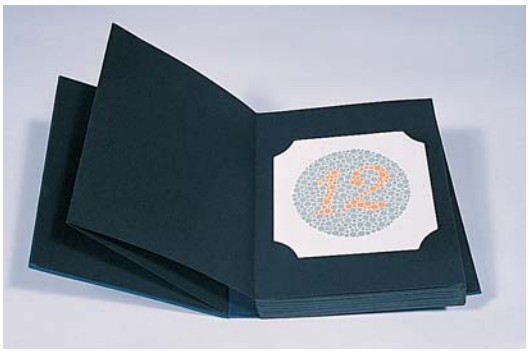


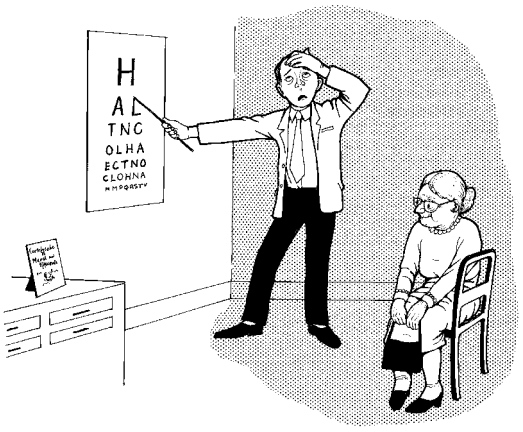
Figure 3.4. Ishihara plates for colour vision.

Colour Vision

The Ishihara plates provide a popular and effective method for screening for colour vision defects (Figure 3.4). The patient is presented with a series of plates on which are printed numerous coloured dots. The normal-sighted subject will see numbers on the majority of the plates, whereas the colour-defective patient will fail to see many of the numbers. The test is easy to do and will effectively screen out the more common red–green deficiency found in 8% of the male population. There are other tests available that will measure blue–green defects, for example, the City University test. Other tests, such as the Farnsworth 100 Hue test, are available for the more detailed analysis of colour vision.

Spectacles

Measurement of the visual acuity might not be valid unless the patient is wearing the correct spectacles. Some patients, when asked to read a Snellen chart, will put on their reading glasses. As these glasses are designed for close work, the chart might be largely obscured and the uninitiated doctor might be surprised at the poor level of visual acuity (Figure 3.5). If the



I borrowed my husband's glasses. . . .

Figure 3.5. The uninitiated might be surprised at the poor level of visual acuity. 🕮

glasses have been left at home, long sight or short sight can be largely overcome by asking the patient to view the chart through a pinhole. Similarly, an appropriate spectacle correction (near) must be worn when testing visual fields and colour vision. In an ophthalmic department, a check of the spectacle prescription is a routine part of the initial examination. Figure 3.6 shows how the converging power of the optical media and the length of the eye are mismatched to produce the need to wear spectacles (the dotted lines indicate the paths for rays of light without any corrective lens).

How to Start Examining an Eye

Evaluating the Pupil

Examination of the pupil is best performed in a dimly lit room.

Size and symmetry of pupils is assessed by asking the patient to fixate on a distant object, such as a letter on the Snellen chart. A dim light is then directed on to the face from below so that both pupils can be seen simultaneously in the diffuse illumination. Normally, the two pupils in any individual are of equal size, although slight differences in size might be observed in up to 20% of the population. Usually, physiological unequal pupils (anisocoria) remain unaltered by changing the background illumination.

In order to assess the pupil light reflex, a strong focal light is shone on the pupils, one after the other. The direct reaction and the consensual reaction (other pupil) are observed. If the afferent arc of the pupil pathway were normal, the direct and consensual reactions would be equal.

To assess the near response of the pupil, ask the patient to gaze at a distant object (e.g., Snellen chart), then at a near object (e.g., his own finger tip just in front of his nose). Observe the pupil as the patient changes gaze from distant to near fixation and vice versa. Generally, if the pupil light reflex is intact, the near reflex is normal.

External Eye and Lids

The eyelids should be inspected to make sure that the lid margins and puncta are correctly

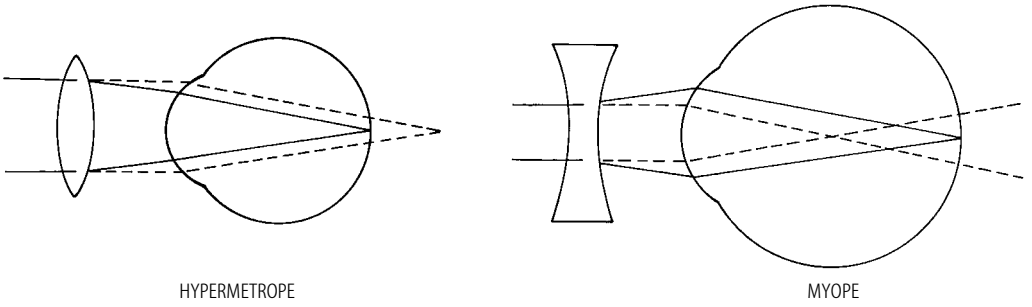


Figure 3.6. Optical defects of the eye. 🕮

aligned against the globe and that there are no ingrowing lashes. Early basal cell carcinomas (also known as rodent ulcers) on eyelid skin can easily be missed, especially if obscured by cosmetics. The presence of ptosis should be noted and the ocular movements assessed by asking the patient to follow a finger upwards, downwards and to each side. Palpation of the skin around the eyes can reveal an orbital tumour or swollen lacrimal sac. Palpation with the end of a glass rod is sometimes useful to find points of tenderness when the lid is diffusely swollen. Such tenderness can indicate a primary infection of a lash root or the lacrimal sac. Both surfaces of the eyelids should be examined. The inside of the lower lid can easily be inspected by pulling down the skin of the lid with the index finger. The upper lid can be everted by asking the patient to look down, grasping the lashes gently between finger and thumb, and rolling the lid margins upwards and forwards over a cotton-wool bud or glass rod. The lid will usually remain in this everted position until the patient is asked to look up. Foreign bodies quite often lodge themselves under the upper lid and they can only be removed by this means. As a general rule, if a patient complains that there is something in his eye, there usually is, and if you find nothing, it is necessary to look again more closely or refer the patient for microscopic examination. A feeling of grittiness can result from inflammation of the conjunctiva and this might be accompanied by evidence of purulent discharge in the lashes. The presence of tear overflow and excoriation of the skin in the outer canthus should also be noted.

The Globe

Much ophthalmic disease has been described and classified using the microscope. In spite of this, many of the important eye diseases can be diagnosed using a hand magnifier and an ophthalmoscope. At this point, it is important to understand the principle of examining the eye with a focused beam of light. If a pencil of light is directed obliquely through the cornea and anterior chamber, it can be made to illuminate structures or abnormalities that are otherwise invisible. One might inspect the glass sides and water of a fish tank using a strong, focused torch in the same manner (Figure 3.7). Many ophthalmoscopes incorporate a focused beam of light

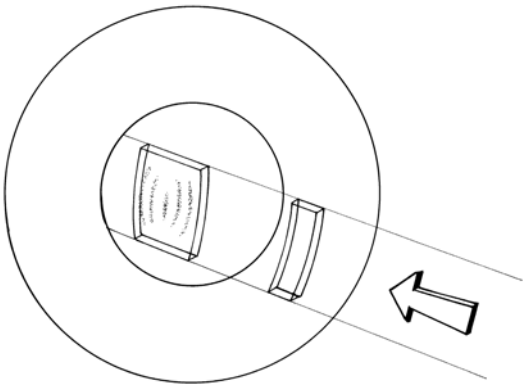


Figure 3.7. Focal illumination. 🕮

that can be used for this purpose. A magnified image of the anterior segment of the eye can be viewed with a direct ophthalmoscope held about 1/3 m away from the eye through a +10 or +12 lens. The principle has been developed to a high degree in the slit-lamp (Figure 3.8). This instrument allows a focused slit of light to be shone through the eye, which can then be examined by a binocular microscope. By this means, an optical section of the eye can be created. The method can be compared with making a histological section, where the slice of tissue is made with a knife rather than a beam

Figure 3.8. Slit-lamp examination. 🕮

of light. The slit-lamp is sometimes called the biomicroscope. By means of such optical aids, the cornea must be carefully inspected for scars or foreign bodies. The presence of vascular congestion around the corneal margin might be of significance. Closer inspection of the iris might show that it is atrophic or fixed by adhesions. Turbidity or cells in the aqueous might be seen in the beam of the inspection light. The lens and anterior parts of the vitreous can be examined by the same means.

Once the anterior segment of the eye has been examined, the intraocular pressure is measured. The "gold-standard" method of measurement is to use the Goldmann tonometer (Figure 3.9), which relies on the principle of "applanation". In essence, the application of this principle provides a derived measurement of intraocular pressure by flattening a small known area of cornea with a variable force. The amount of force required to flatten a specific area is proportional to the intraocular pressure reading, and this is read from a dial. The readings provided by this measurement are highly reproducible and are given in millimetres of mercury (mmHg).

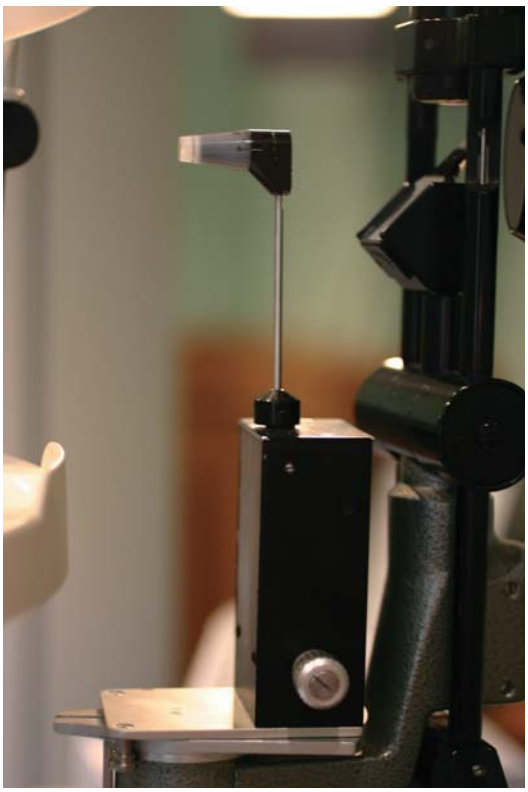


Figure 3.9. The Goldmann tonometer.

Figure 3.10. The Tonopen.

Some optometrists, however, employ "air-puff" tonometers, which are more portable and do not require attachment to a slit-lamp. These instruments are excellent for screening but are generally not as accurate as applanation tonometers. A convenient hand-held instrument (the Tonopen) is available (Figure 3.10) and is commonly used by ophthalmologists when a slit-lamp is not available.

At this stage, the pupil can be dilated for better examination of the fundi and optical media. A short-acting mydriatic is preferable, for example tropicamide 1% (Mydriacyl). These particular drops take effect after 10 min and take 2–4 h to wear off. Patients should be warned that their vision will be blurred and that they will be more sensitive to light over this period. Most people find that their ability to drive a car is unimpaired, but there is a potential medicolegal risk if the patient subsequently has a car accident. Once the pupils have been dilated, the eye can then be examined with the ophthalmoscope.

How to Use the Ophthalmoscope

Before the middle of the nineteenth century, nobody had seen the inside of a living eye and much of the science of medical ophthalmology was unknown. In 1851, Hermann von Helmholtz introduced his ophthalmoscope and it rapidly became used in clinics dealing with ophthalmological problems. The task of von Helmholtz was to devise a way of looking through the black pupil and, at the same time, illuminate the interior of the globe. He solved the problem by

arranging to view the fundus of the eye through an angled piece of glass. A light projected from the side was reflected into the eye by total internal reflection. Most modern ophthalmoscopes employ an angled mirror with a small hole in it to achieve the same end. They also incorporate a series of lenses that can be interposed between the eye of the patient and that of the observer, thereby overcoming any refractive problems that might defocus the view. These lenses are positioned by rotating a knurled wheel at the side of the ophthalmoscope. A number on the face of the instrument indicates the strength of the lens. When choosing an ophthalmoscope, it is worth remembering that large ones take larger batteries, which last longer (or, better still, they might have rechargeable batteries); small ophthalmoscopes are handy for the pocket. Some ophthalmoscopes have a wider field of view than others and this is an advantage when learning to use the instrument.

If examining the patient's right eye, it is best to hold the ophthalmoscope in the right hand and view through one's own right eye. A left eye should be viewed with the left eye using the left hand (Figure 3.11). It is best if the patient is seated and the doctor is standing. The first thing to observe is the red reflex, which simply refers to the general reddish colouring seen through the pupil. If viewed from about 30 cm away from the eye, slight and subtle opacities or defects in the optical media can be seen against the background of the red reflex. The patient's eye must always be brought into focus by rotating the lens wheel on the ophthalmoscope.

Having observed the red reflex, the eye can be approached closely and the focus of the ophthalmoscope adjusted so that fundus detail becomes visible. It is best to look for the optic disc first, remembering its position nasal to the posterior pole and slightly above the horizontal meridian. The patient should be asked to look straight ahead at this point. The important points to note about the disc are the clarity of the margins, the colour, the nature of the central cup, the vessel entry and the presence or absence of haemorrhages. Once the disc has been examined carefully, the vessels from the disc can be followed. For example, the upper temporal branch vessels can be followed out to the periphery and back, then the lower temporal branch vessels, then the upper nasal vessels and then, finally, the lower nasal vessels. Having examined the vessels, ask the patient to look directly at the ophthalmoscope light and the macular region should come into view. At first, this might look unremarkable, like a minute dot of light that follows our own light. More careful examination will reveal that it has a yellowish colour. To obtain a highly magnified view of the macular region, it is usually necessary to examine it with a special contact lens on the slit-lamp microscope, the Goldmann fundus lens. A fundus photograph is also helpful. After viewing the macula, the general fundus background should be observed. The appearance here depends on the complexion of the patient: in a lightly pigmented subject, it is possible to see through the stippled pigment epithelium and obtain an indefinite view of the choroidal vasculature. In heavily pigmented subjects, the pigment epithelium is uniformly black and prevents any view of the choroid, which lies behind it. Finally, the peripheral fundus can be inspected by asking the patient to look to the extremes of gaze and by refocusing the ophthalmoscope. Examining the peripheral fundus demands some special skill, even with the ordinary ophthalmoscope, but it is best seen using the triple-mirror gonioscope. This is a modified contact lens that has an angled mirror attached to it. A view through this mirror is obtained using the slit-lamp microscope.

Figure 3.11. Direct ophthalmoscopy.

There are a number of other methods of examining the fundus. The ophthalmoscope described above is known as the direct ophthalmoscope. The indirect ophthalmoscope was introduced shortly after direct ophthalmoscopy. If one examines an eye with the pupil dilated through a mirror with a hole in it, the patient

Figure 3.12. Indirect ophthalmoscopy.

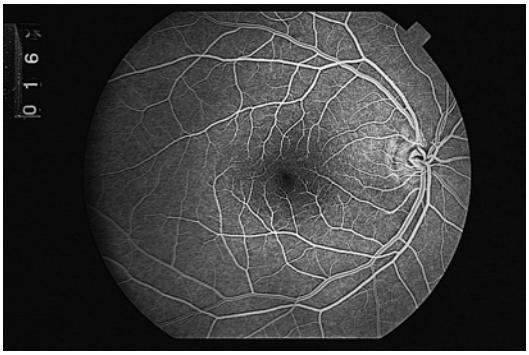


Figure 3.14. Fluorescein angiogram of normal fundus.

being at arm's length from the observer and the mirror being held close to the observer's eye, the red reflex is seen. If a convex lens is placed in the line of sight about 8 cm from the patient's eye, then, rather surprisingly, a clear wide field inverted view of the fundus is obtained. The view can be made binocular, and the binocular indirect ophthalmoscope is an essential tool of the retinal surgeon (Figure 3.12). If we want a highly magnified view of the fundus, the slit-lamp microscope can be used. However, a special lens must be placed in front of the patient's eye. This can be in the form of the triple-mirror contact lens (Figure 3.13). In recent years, it has become a routine practice to examine the fundus with the slit-lamp and strong convex lenses (e.g., VOLK +60, +78 or +90DS aspheric lenses). These high-power convex lenses provide inverted reversed images like the indirect ophthalmoscope. Another useful way of examining the fundus is by means of fundus photography. The photographs provide a permanent record of the fundus. A special type of fundus photograph, known as a fluorescein angiogram, shows up the retinal vessels, including the capillaries, in great detail. The technique involves taking repeated photographs in rapid succession after the injection of the dye fluorescein into the antecubital vein. The dye in the vessels is selectively photographed by using filters in the camera (Figure 3.14). Indocyanine green angiography (ICG) is more useful in assessing the choroidal circulation as ICG-A fluorescence is transmitted through the retinal pigment epithelium (RPE; compared with fluorescein [Figure 3.15]). Video filming is

Figure 3.13. The Goldmann triple mirror.

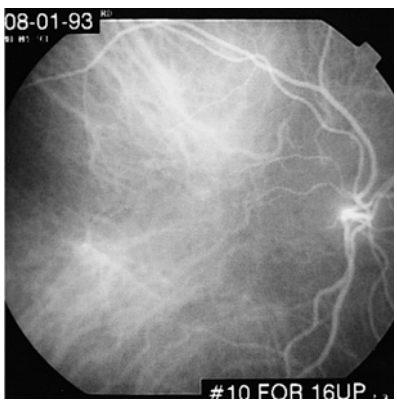


Figure 3.15. Indocyanine green angiography of normal fundus.

becoming an important method for observing changing events in the fundus and it is now possible to view a real-time image of the optic fundus on a television screen using the scanning laser ophthalmoscope. This type of equipment will undoubtedly become a routine tool for the ophthalmologist.

Other Tests Available in an Eye Department

Several special tests are available to measure the ability of the eyes to work together. A department known as the orthoptic department is usually set aside within the eye clinic for making these tests. When there is a defect of the ocular movements, this can be monitored by means of the Hess chart (see Chapter 14). The ability to use the eyes together is measured on the synoptophore, and any tendency of one eye to turn out or in can be measured with the Maddox rod and Maddox wing test (Figure 3.16). The use of contact lenses and also of intraocular implants has demanded more accurate measurements of the cornea and of the length of the eye. A keratometer is an instrument for measuring the curvature of the cornea, and the length of the eye can now be accurately measured by ultrasound. If one eye appears to protrude forwards and one wishes to monitor the position of the globes relative to the orbital margin, an exophthalmometer is used (Figure 3.17). X-rays of the eye and orbit are still used. An X-ray is essential if an intraocular foreign body is suspected and it is useful for detecting bony abnormalities in the walls of the orbit caused by tumours. Computed tomography (CT) scanning has become an important diagnostic technique, especially for lesions in the orbit (Figure 3.18), particularly those involving bony tissues. This specialised X-ray has surpassed plain X-rays for most ophthalmic purposes. Magnetic resonance imaging (MRI) is more useful in assessing soft tissues of the orbit and cranium. Ultrasonography is a technique for measuring the length of the eye (which is a prerequisite for all cataract surgery); it can also be used to depict tissue planes within the eye, showing, for example, the size of intraocular tumours or the presence of vitreous membranes. It can be used to determine the presence or absence of retinal diseases, especially in eyes with opaque media (e.g., cataract or vitreous haemorrhage). Electroretinography provides a measure of the electri-

Figure 3.17. The exophthalmometer. 🕮

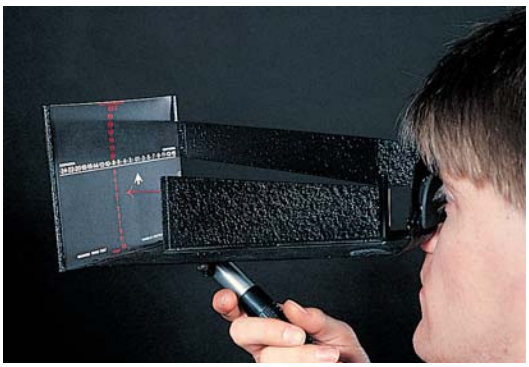


Figure 3.16. The Maddox wing. 🕮

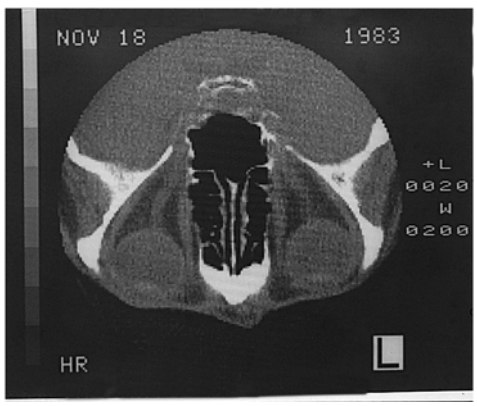


Figure 3.18. Computed tomography (CT) scan of eyes and orbit (normal). 🕮

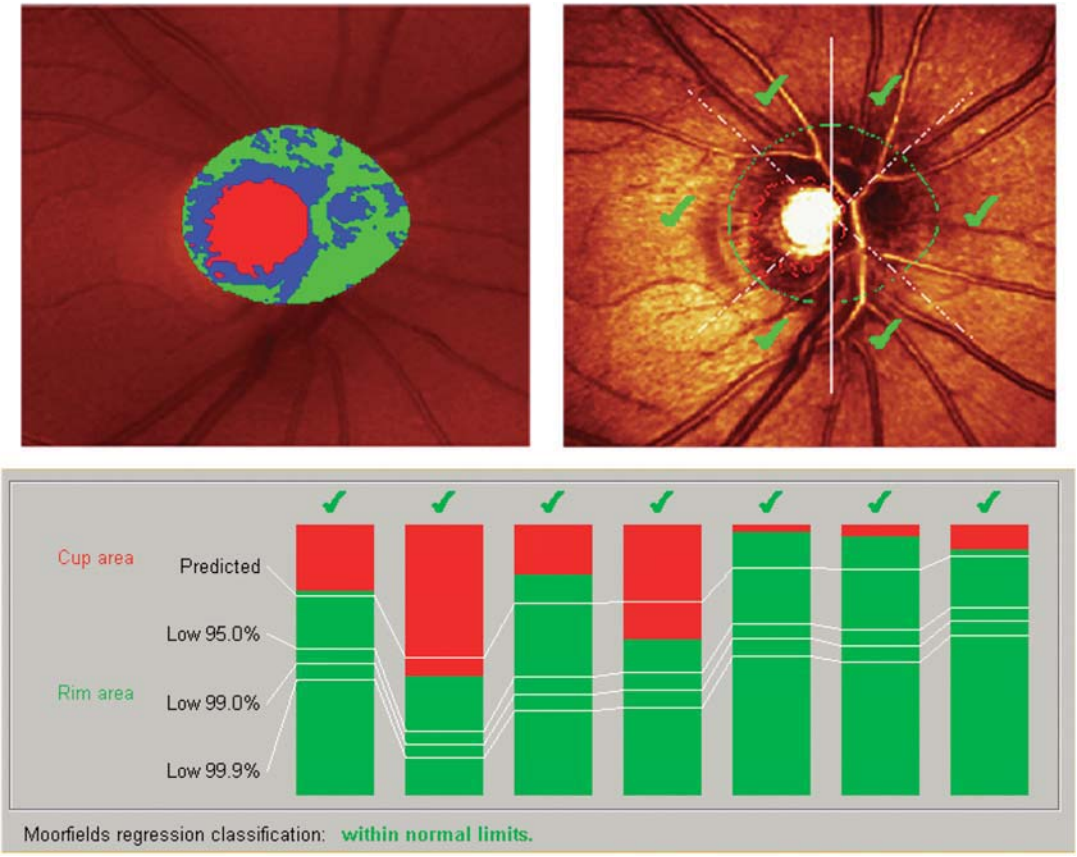


Figure 3.19. The Heidelberg retina tomograph.

cal changes that take place in the retina when the eye is exposed to light. It can indicate retinal function in the same way that the electrocardiogram indicates cardiac function. The visually evoked potential is a measure of minute electrical changes over the back of the scalp, which occur when the eyes are stimulated with a flashing light. This test has been shown to be useful in detecting previous damage to the optic nerve in patients with suspected multiple sclerosis.

Technological advances have led to increasing dependence on imaging devices, such as digital fundus cameras for retinal screening in patients with diabetes. In addition, recent laser technologies, such as the Heidelberg retina tomograph, allow for a quick and easy way of scanning the optic nerve head in three dimensions (Figure 3.19) and the retinal nerve fibre layer. This is especially helpful in evaluating changes in patients with glaucoma.

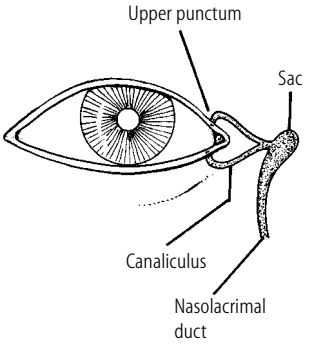


Figure 5.1. The lacrimal passageway.

laxity of the skin in the elderly but it might also result from scarring and contracture of the skin caused by trauma (cicatricial ectropion). Ectropion can be corrected effectively by suitable lid surgery.

Drainage of tears along the lacrimal canaliculi depends to some extent on the muscular action of certain fibres of the orbicularis oculi muscle. This band of fibres encloses the lacrimal sac and it is thought that the walls of the sac are thereby stretched, producing slight suction along the canaliculi. Whatever the exact mechanism, when the orbicularis muscle is paralysed, the tear flow is impaired even if the position of the punctum is normal. Sometimes patients who have suffered a Bell's palsy complain of a watering eye even though they appear to have otherwise made a complete recovery.

Figure 5.2. Bilateral entropion. The inwardly turned lower eyelids are largely obscured by purulent discharge.

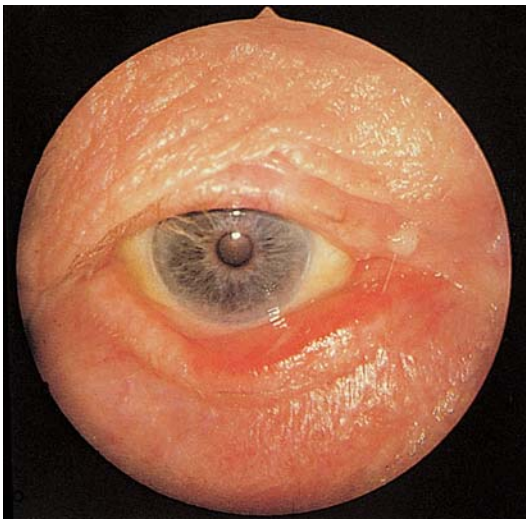


Figure 5.3. Ectropion.

Misplacement of the drainage channels, particularly of the punctum, can thus affect the outflow of tears, but perhaps more commonly the drainage channel itself becomes blocked. In young infants with lacrimal obstruction, the blockage is usually at the lower end of the nasolacrimal duct and takes the form of a plug of mucus or a residual embryological septum that has failed to become naturally perforated. In these cases, there is nearly always some purulent discharge, which can be expressed from the tear sac by gentle pressure with the index finger over the medial palpebral ligament. The mother is shown how to express this material once or twice daily and is instructed to instil antibiotic drops three or four times daily. This treatment alone can resolve the problem and many cases undoubtedly resolve spontaneously. Sometimes it is necessary to syringe and probe the tear duct under a short anaesthetic. Usually one waits until the child is at least nine months old before considering probing. In adults, the

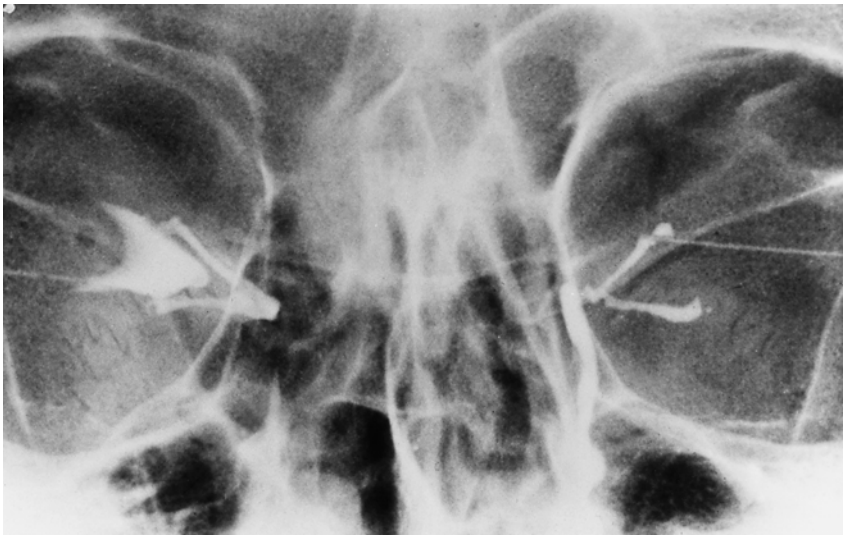


Figure 5.4. Dacryocystogram (with acknowledgement to Mr R. Welham).

obstruction is more often in the common canaliculus or nasolacrimal duct. In these cases the tear duct can be syringed after the instillation of local anaesthetic drops. This procedure is simple, although it must be done with care to avoid damaging the canaliculus, and even if the obstruction is not cleared, it can allow the surgeon to identify the site of the obstruction. Sometimes a permanent obstruction is identified at the lower end of the nasolacrimal duct, which can be relieved by surgery under general anaesthesia or the more recently introduced laser treatment applied through the nose. The initial investigation of lacrimal obstruction entails syringing and if this does not give the information required, it is possible to display the tear duct by X-ray using a radio-opaque contrast medium. This is injected into the lower canaliculus with a lacrimal syringe (Figure 5.4). The technique is known as dacryocystography.

Acute Dacryocystitis

Sometimes the lacrimal sac can become infected. This can occur in children or adults but is more common in adult females. The condition might present initially as a watering eye and, in its early stages, the diagnosis can be missed if the tear sac is not gently palpated and found to be tender. Subsequently, there is marked swelling and tenderness at the inner canthus and eventually the abscess can point and burst. In its early stages, the condition can be aborted by the use of local and systemic antibiotics, but once an abscess has formed this can point and burst on the skin surface. Surgical incision and drainage of a lacrimal abscess can lead to the formation of a lacrimal fistula (Figure 5.5).

Rarely, the lacrimal canaliculi can become infected by the fungus Actinomycosis and a small telltale bead of pus can be expressed from the punctum. The condition is resistant to ordinary treatment with local antibiotics, and is best treated by opening up the punctum with a fine knife specially designed for the purpose – the procedure being called canaliculotomy – and then irrigating the canaliculi and tear duct with a suitable antibiotic.

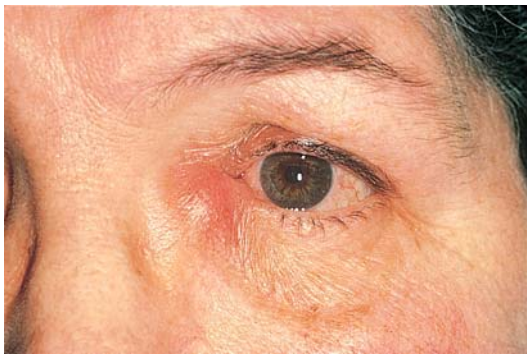


Figure 5.5. Acute dacryocystitis (with acknowlegement to Mr R. Welham).

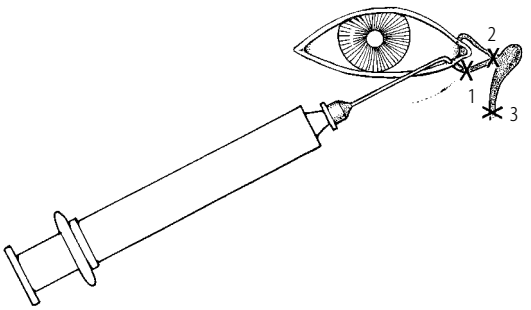


Figure 5.6. Diagnostic use of lacrimal syringing. (1) Obstruction in canaliculus shown by regurgitation of saline back through punctum. (2) Common canaliculus obstruction shown by return of saline through upper punctum. (3) Obstruction in nasolacrimal duct shown by filling of lacrimal sac. 🕮

The diagnosis of lacrimal obstruction therefore depends firstly on an examination of the eyelids, secondly on syringing the tear ducts, and then if necessary dacryocystography. Figure 5.6 illustrates the diagnostic use of lacrimal syringing.

Excessive Secretion of Tears

A wide range of conditions affecting the eye can cause an excessive production of tears, from acute glaucoma to a corneal abscess, but these do not usually present as a watering eye because the other symptoms, such as pain or visual loss, are more evident to the patient. Occasionally the unwary doctor can be caught out by an irritative lesion on the cornea, which mimics the more commonplace lacrimal obstruction. For example, a small corneal foreign body or an ingrowing eyelash can present in this way. Not uncommonly, a loose lash may float into the lower lacrimal canaliculus where it might become lodged, causing chronic irritation at the inner canthus. Its removal after weeks of discomfort produces instant relief and gratitude.

The Dry Eye

A patient might complain of dryness of the eyes simply because the conjunctiva is inflamed, but when the tear film really is defective, the patient might complain of soreness and irritation rather than dryness. The diagnosis of a dry eye depends on a careful examination and it is quite erroneous to assume that the tear film is inadequate simply because the patient complains of dryness, or even if the symptoms appear to be improved by artificial tears.

The normal tear film consists of three layers and the integrity of this film is essential for comfort and more importantly for good vision. The anterior, or outermost, layer is formed by the oily secretion of the meibomian glands and the layer next to the cornea is mucinous to allow proper wetting by the watery component of the tears, which lies sandwiched between the two. This three-layered film is constantly maintained by the act of blinking.

Causes

- Systemic disease with lacrimal gland involvement:
  - sarcoidosis
  - rheumatoid arthritis (Sjögren's syndrome).
- Trachoma (chlamydial conjunctivitis and keratitis – see next chapter).
- Neuroparalytic keratitis.
- Exposure keratitis.
- Old age.
- Other rare causes.

Signs

Slit-lamp Examination

In a normal subject, the tear film is evident as a rim of fluid along the lid margin and a deficiency of this can be seen by direct examination. Prolonged deficiency of tears can be associated with the presence of filaments – microscopic strands of mucus and epithelial cells, which stain with Rose Bengal. Punctate staining of the corneal epithelium is also seen after applying a drop of fluorescein. In some dry eye syndromes, for example, ocular pemphigoid and Stevens–Johnson syndrome, keratinisation of the cornea and conjunctiva with the formation of contracting adhesions between the opposed surfaces of the conjunctiva occurs. A similar change is apparent following chemical or thermal burns of the eyes.

Schirmer's Test

One end of a special filter paper strip is placed between the globe and the lower eyelid. The

Figure 5.7. Schirmer's test.

other end projects forward and the time taken for the tears to wet the projecting strip is measured. The test is not an accurate measure of tear secretion but it provides a useful guide (Figure 5.7).

Tear Film Break-up Time

Using the slit-lamp microscope, the time for the tear film to break up when the patient stops blinking is measured. This test is sometimes used as an index of mucin deficiency.

Management of the Dry Eye

This, of course, depends on the cause of the dry eye and the underlying systemic cause might require treatment in the first place. Artificial tear drops are a mainstay in treatment and various types are available, their use depending on which component of the tear film is defective. In severe cases, it might be necessary to consider temporary or permanent occlusion of the lacrimal puncta.

Deformities of the Eyelids

The Normal Eyelid

Figure 5.8 is a diagram of the normal eyelid in cross-section. The lids contain two antagonistic voluntary muscles: the more superficial orbicularis oculi, supplied by the seventh cranial nerve, which closes the eye, and the tendon of the levator palpebrae superioris, supplied by the third cranial nerve, which opens the eye. We must not forget that there is also some smooth muscle in the upper and lower eyelids, which has clinical importance apart from its influence on facial expression when the subject is under stress. Loss of tone in this muscle accounts for the slight ptosis seen in Horner's syndrome; increased tone is seen in thyrotoxic eye disease. These muscles (that in the upper lid is known as Muller's muscle) are attached to the skeleton of the lid, which is the tarsal plate, a plate of fibrous tissue (not cartilage) that contains the meibomian glands.

Epicanthus

Figure 5.9 shows that this is characterised by vertical folds of skin at the inner canthus. These folds are seen quite commonly in otherwise normal infants and they gradually disappear as the facial bones develop. Children with epicanthus might appear to the uninitiated to be

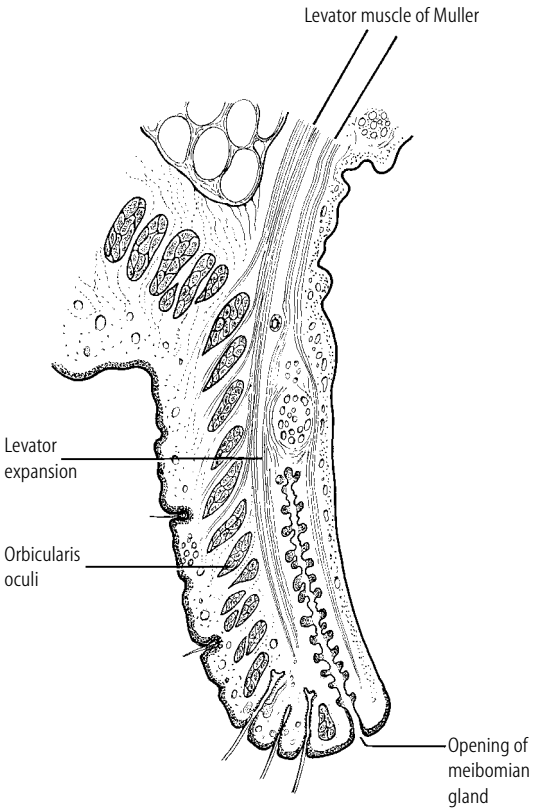


Figure 5.8. Cross-section of a normal eyelid.

Figure 5.9. Epicanthus. 🕮

squinting and this can cause considerable parental anxiety. It is important to explain that the squint is simply an optical illusion once the absence of any true deviation of the eyes has been confirmed. Epicanthus persists into adult life in Mongolian races, and occasionally it is seen in European adults. It can also be associated with other eyelid deformities.

Entropion

This is an inversion of the eyelid. The common form is the inversion of the lower eyelid seen in elderly patients. Often, the patient does not notice that the eyelid is turned in but complains of soreness and irritation. Closer inspection reveals the inverted eyelid, which can be restored to its normal position by slight downward pressure on the lower eyelid, only to turn in again when the patient forcibly closes the eyes. The inwardly turned eyelashes tend to rub on the cornea and, if neglected, the condition can lead to corneal scarring and consequent loss of vision. The condition is often associated with muscular eyelids and sometimes seems to be precipitated by repeatedly screwing up the eyes. Slackening of the fascial sling of the lower eyelid with ageing combined with the action of the orbicularis muscle allows this to happen. This common type of entropion is called spastic entropion and it can be promptly cured without leaving a visible scar by minor eyelid surgery. Entropion can also be seen following scarring of the conjunctival surface of the eyelids and one must mention, in particular, the entropion of the upper eyelid caused by trachoma. This is rare in the UK but still common in the Middle East and countries where trachoma is still rife.

Ectropion

This commonly seen outward turning of the lower eyelid in the elderly is eminently treatable and responds well to minor surgery. Senile ectropion can begin with slight separation of the lower eyelid from the globe, and the malposition of the punctum leads to overflow of tears and conjunctival infection. Irritation of the skin by the tears and rubbing of the eyes lead to skin contracture and further downward pulling of the eyelids. Like entropion, ectropion can be cicatricial and result from scarring of the skin of the eyelids. It can also follow a seventh cranial nerve palsy caused by complete inaction of the orbicularis muscle; this is called paralytic ectropion.

Lagophthalmos

This is the term used to denote failure of proper closure of the eyelids caused by inadequate blinking or lid deformity. In all these cases, the cornea is inadequately lubricated and exposure keratitis can develop. If untreated, this can lead to a serious situation; initially, the cornea shows punctate staining when a drop of fluorescein is placed in the conjunctival sac and subsequently, a corneal ulcer might appear. This, in turn, can lead to the spread of infection into the eye and without prompt treatment with antibiotics, the eye might eventually be lost.

As a general principle, it is important to realise that the sight could be lost simply because the eyes cannot blink. The principle applies especially to the unconscious or anaesthetised patient, where a disaster can be avoided by taping or padding the eyelids and applying an antibiotic ointment.

Blepharospasm

Slight involuntary twitching of the eyelids is common and not usually considered to be of any pathological significance other than being a symptom of fatigue or sometimes of an anxiety state. The condition is termed "myokymia". True blepharospasm is rare. It can

be unilateral or bilateral and cause great inconvenience and worry to the patient. It tends slowly to become more marked over many years. A small proportion of patients eventually develops Parkinsonism. Cases of recent onset need to be investigated because they might result from an intracranial space-taking lesion. In most cases, though, no underlying cause can be found. Patients with this type of blepharospasm (essential blepharospasm) can often be treated quite effectively by injecting small doses of botulinum toxin into the eyelids, but these need to be repeated every few months.

Redundant Lid Skin

Excessive skin on the eyelids is commonly seen in elderly people, often as a family characteristic. It might result from chronic oedema of the eyelids caused, for example, by thyrotoxic eye disease or renal disease. The problem is made worse in some cases by herniation of orbital fat through the orbital septum, and excision of the redundant skin and orbital fat might sometimes be necessary.

Ptosis

Drooping of one upper lid is an important clinical sign. In ophthalmic practice, ptosis in children is usually congenital and in adults is either congenital or caused by a third cranial nerve palsy. These more common causes must always be kept in mind but there are a large number of other possible ones. When confronted with a patient whose upper lid appears to droop, the first thing to decide is whether the eyelid really is drooping or whether the lid on the other side is retracted. The upper lid might droop because the eye is small and hypermetropic or shrunken from disease. Having eliminated the possibility of such "pseudoptosis", the various other causes can be considered, beginning on the skin of the eyelid – styes, meibomian cysts – and advancing centrally through muscle – myasthenia gravis – along nerves – oculomotor palsy, Horner's syndrome – to the brainstem. Marked ptosis with the eye turned down and out and a dilated pupil is an oculomotor palsy, whereas slight ptosis, often not noticed by the patient or sometimes by the doctor, is more likely to mean Horner's syndrome. This syndrome is caused by damage to the sympathetic nervous supply to either upper or lower lids or both and is characterised by slight ptosis, small pupil, loss of sweating on the affected side of the face and slight enophthalmos (posterior displacement of the globe).

The management of ptosis depends on the cause and thus on accurate diagnosis. Surgical shortening of the levator tendon is effective in some cases of congenital ptosis and sometimes in long-standing third cranial nerve palsies. Before embarking on surgery, it is important to exclude myasthenia gravis and corneal anaesthesia. Children with congenital ptosis need to be assessed carefully before considering surgery. In young children, ptosis surgery is indicated where the drooping lid threatens to cover the line of sight and where the ptosis causes an unacceptable backwards tilt of the head. In one rather strange type of congenital ptosis, the problem disappears when the mouth is opened and the patient might literally wink unavoidably when chewing. Careful consideration is needed before making the decision for surgery in these cases.

Causes of Ptosis

- Pseudoptosis: small eye, atrophic eye, lid retraction on other side.
- Mechanical ptosis: inflammation, tumour, and excess skin.
- Myogenic ptosis: myasthenia gravis.
- Neurogenic ptosis: sympathetic – Horner's syndrome, third cranial nerve palsy, any lesion in the pathway of these, carcinoma of the lung can cause Horner's syndrome.
- Drugs: guanethidine eye drops cause ptosis.
- Congenital: ask for childhood photograph, ask for family history.

Ingrowing Eyelashes (Trichiasis)

The lashes could grow in an aberrant manner even though the eyelids themselves are in good position. This might be the result of chronic infection of the lid margins or follow trauma. Sometimes one or two aberrant lashes appear for no apparent reason (Figure 5.10). The lashes tend to rub on the cornea producing irritation and secondary infection. The condition is referred to as "trichiasis". When one or two

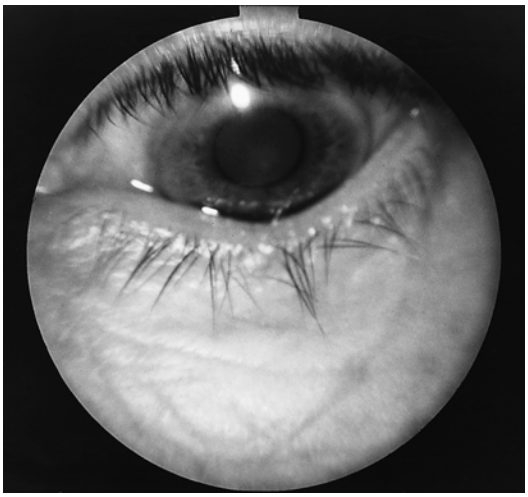


Figure 5.10. Trichiasis. This ingrowing eyelash on the lower eyelid has been causing a sore eye for three months.

lashes are found to be the cause of the patient's discomfort, it is common practice simply to epilate them with epilating forceps. This produces instant relief, but often the relief is short-lived because the lashes regrow. At this stage, the best treatment is to destroy the lash roots by electrolysis before epilation. Needless to say, before removing lashes it is essential to be familiar with the normal position of the lash line and to realise, for example, that hairs are normally present on the caruncle. When the lash line is grossly distorted by injury or disease, the rubbing of the lashes on the cornea can be prevented by fitting a protective contact lens or, if this measure proves impractical, it might be necessary to transpose or excise the lashes and their roots.

Infections of the Eyelids

Meibomian Gland Infection

The opening of the meibomian glands could become infected at any age, resulting in meibomitis, seen initially as redness along the line of a gland when the eyelid is everted. A small abscess might then form, with swelling and redness of the whole eyelid, and this can point and burst either through the conjunctiva or less often through the skin. The orifice of a gland could become occluded and the gland then becomes distended and cystic. The retained secretions of the gland set up a granulating reaction and the cyst itself might become infected. The patient might complain of soreness and swelling of the eyelid, which subsides, leaving a pea-sized swelling that remains for many months and sometimes swells up again. During the stage of acute infection, the best treatment is local heat, preferably in the form of steam. This produces considerable relief and is preferable to the use of systemic or local antibiotics. Antibiotics might be required if the patient has several recurrences or if there are signs and symptoms of septicaemia. Once a pea-sized cyst remains in the tarsal plate, this can be promptly removed under a local anaesthetic unless the patient is a child, in which case a general anaesthetic might be required. The method of removal involves everting the eyelid and incising the cyst through the conjunctiva and then curetting the contents. Postoperatively, local antibiotic drops or ointment are prescribed (Figure 5.11).

Styes

These are distinct from meibomian infections, being the result of infection of the lash root. The eyelid might swell up and become painful and at this stage, the site of the infection can be uncertain. However, a small yellow pointing area is eventually seen around the base of an eyelash.

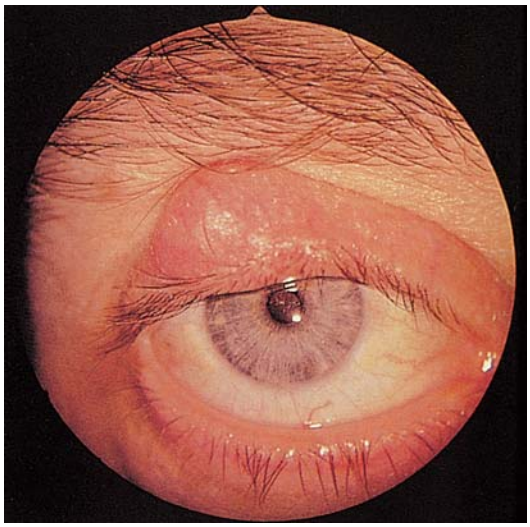


Figure 5.11. A meibomian cyst.

Hot steaming, again, is effective treatment and once the pus is seen, the eyelash can be gently epilated, with resulting discharge and subsequent resolution of the infection.

Children aged from about six to ten years sometimes seem to go through periods of their lives when they can be dogged by recurrent styes and meibomian infections, much to the distress of the parents. Under these conditions, frequent baths and hairwashing are advised and sometimes a long-term systemic antibiotic might be considered. Recurrent lid infections can raise the suspicion of diabetes mellitus but in practice, this is rarely found to be an underlying cause.

Eyelid infections such as these rarely cause any serious problems other than a day or two off work and it is extremely unusual for the infection to spread and cause orbital cellulitis. Recurrent swelling of the eyelid in spite of treatment can indicate the need for a lid biopsy because some malignant tumours can, on rare occasions, present in a deceptive manner.

Blepharitis

This refers to a chronic inflammation of the lid margins caused by staphylococcal infection. The eyes become red rimmed and there is usually an accumulation of scales giving the appearance of fine dandruff on the lid margins. The condition is often associated with seborrhoea of the scalp. Sometimes it becomes complicated by recurrent styes or chronic infection of the meibomian glands. The eye itself is not usually involved, although there could be a mild superficial punctate keratitis, as evidenced by fine staining of the lower part of the cornea with fluorescein. In more sensitive patients, the unsightly appearance can cause difficulties, but in more severe cases, the discomfort and irritation can interfere with work. Severe recurrent infection can lead to irregular growth of the lashes and trichiasis.

In the management of these patients, it is important to explain the chronic nature of the condition and the fact that certain individuals seem to be prone to it. Attention should be given to keeping the hair, face and hands as clean as possible and to avoid rubbing the eyes. When the scales are copious, they can be gently removed with cotton-wool moistened in sodium bicarbonate lotion twice daily. Dandruff of the scalp should also be treated with a suitable shampoo. A local antibiotic can be applied to the lid margins twice daily with good effect in many, but not all, cases. In severe cases with ulceration of the lid margin, it might be necessary to consider prescribing a systemic antibiotic, preferably after identifying the causative organism by taking a swab from the eyelids. Local steroids when combined with a local antibiotic are very effective treatment, but the prescriber must be aware of the dangers of using steroids on the eye and long-term treatment with steroids should be avoided. Steroids should not be used without monitoring the intraocular pressure.

Molluscum Contagiosum

This is a viral infection usually seen in children. The lesions on the eyelids are discrete, slightly raised and umbilicated and usually multiple. There are also likely to be lesions elsewhere on the body, especially the hands, and brothers or sisters might have the same problem. It is rare for the eye itself to be involved. In persistent cases, an effective form of treatment with children is careful curettage of each lesion under a general anaesthetic; in adults, cryotherapy is used for individual lesions, especially if they are adjacent to the lid margin with the propensity to cause conjunctivitis.

Orbital Cellulitis

Although this is not strictly a lid infection, it may be confused with severe meibomitis. The infection is deeper and the implications much more serious. In a child, where the condition is more common, there is eyelid swelling, pyrexia and malaise; urgent referral is needed. This applies especially if there is diplopia or visual loss, because a scan will be required to decide whether surgical intervention is going to be needed to drain an infected sinus.

Lid Tumours

Benign Tumours

Papilloma

Commonly seen on lids near or on the margin, these can be sessile or pedunculated, and are

Figure 5.12. Lid margin papilloma.

sometimes keratinised. These lesions are caused by the papilloma virus and are easily excised, but care must be taken if excision involves the lid margin (Figure 5.12).

Naevus

This is a flat brown spot on the skin; it might have hairs, and rarely becomes malignant.

Haemangioma

Seen as a red "strawberry mark" at or shortly after birth, this lesion can regress completely during the first few years of life. Figure 5.13 shows a gross example of the rare cavernous haemangioma, which might be disfiguring. This also can regress in a remarkable way. "Port wine stain" is the name applied to the capillary haemangioma. This is usually unilateral and when the eyelids are involved, there is a risk of association with congenital glaucoma, haemangioma of the choroid and haemangioma of the meninges on the ipsilateral side (Sturge–Weber syndrome). Children with port wine stains involving the eyelids need full ophthalmological and neurological examinations.

Dermoid Cyst

These quite common lumps are seen in or adjacent to the eyebrow. They feel cystic and are sometimes attached to bone. Typically, they present in children as a minor cosmetic problem. The cysts are lined by keratinised

a

b

Figure 5.13. **a** Large disfiguring haemangioma in infancy. **b** The same lesion, which in this case had remained untreated, showing spontaneous regression.

epithelium and can contain dermal appendages and cholesterol. A scan might be needed before removal because some extend deeply into the skull.

Xanthelasma

These are seen as yellowish plaques in the skin; they usually begin at the medial end of the lids. They are rarely associated with diabetes, hypercholesterolaemia and histiocytosis. Usually, there is no associated systemic disease.

Malignant Tumours

Basal Cell Carcinoma

This is the most common malignant tumour of the lids, usually occurring on the lower lid. It appears as a small lump, which tends to bleed, forming a central crust with a slightly raised hard surround. The tumour is locally invasive only but should be excised to avoid spread into bone. Even large lesions can be approached surgically (Figure 5.14) and "Mohs" micrographic surgery is recognised as a tissue-sparing gold-standard approach in many centres. Radiotherapy is only occasionally used with a greater risk of recurrence than formal surgical excision.

Squamous Cell Carcinoma

This tends to resemble basal cell carcinoma and biopsy is needed to differentiate. It can also be mimicked by a benign self-healing lesion known as keratoacanthoma.

Figure 5.14. Cystic basal cell carcinoma that has extended to involve most of the upper eyelid.🕮

Malignant Melanoma

This raised black-pigmented lesion is highly malignant, but rare.

Allergic Disease of the Eyelids

This can present as one of two forms or a mixture of both. The more dramatic is acute allergic blepharitis in which the eyelids swell up rapidly, often in response to contact with a plant or eyedrops. The cause must be found and eliminated and treatment with local steroids might be needed. Chronic allergic blepharitis is seen in atopic individuals, for example hay fever sufferers or patients with a history of eczema. The diagnosis might require a histological examination of the conjunctival discharge. Drop treatment to alleviate symptoms includes mast cell stabilisers (such as lodoxamide) and histamine antagonists (such as emedastine), and these agents could take weeks to take effect. Patients with seasonal allergic conjunctivitis might require medication for a prolonged period over the spring and summer months each year.

Lid Injuries

One of the commonest injuries to the eyelids is caused by the presence of a foreign body under the eyelid – a subtarsal foreign body. A small particle of grit lodges near the lower margin of the lid, but to see it the lid must be everted. Every medical student should be familiar with the simple technique of lid eversion. This is performed by gently grasping the lashes of the upper lid between finger and thumb and at the same time placing a glass rod horizontally across the lid. The eyelid is then gently everted by drawing the lid margin upwards and forwards. The manoeuvre is only achieved if the patient is asked to look down beforehand, and the everted lid is replaced by asking the patient to look upwards. If a small foreign body is seen, it is usually a simple matter to remove it using a cotton-wool bud (Figure 5.15).

Cuts on the eyelids can be caused by broken glass or sharp objects, such as the ends of screwdrivers. The important thing here is to realise that cuts on the lid margin can leave the patient with a permanently watering eye if not sewn up

Figure 5.15. Everting the upper eyelid.🕮

with proper microscopic control and using fine sutures. The lids can also be injured by chemical burns or flash burns. Exposure to ultraviolet light, as from a welder's arc or in snow blindness, can cause oedema and erythema of the eyelids. This might appear after an hour or two but resolves spontaneously after about two days.