BrienHoldenVisionInstitute

INTRODUCTION TO THE EYE

THINK

A person comes to you because they got a piece of sand stuck under their eyelid. They are afraid that the piece fos and will get stuck in the back of their eye and will never come out.

You can help this person by explaining why the piece of sand can never go to the back of the eye.

WHAT YOU WILL LEARN

When you have worked through this unit you should be able to:

- Identify and name the main parts of the eye
- Describe what each of those parts do.

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ANATOMICAL TERMS

When we talk about the parts of the eye, or when trying to locate or describe where an injury is on the eye (e.g. corneal ulcer), we sometimes use terms to help us describe where one part of the eye is compared to another part of the eye.

- **Anterior:** towards the front
  - e.g. the cornea is anterior to the lens
- **Posterior:** towards the back
  - e.g. the retina is posterior to anterior chamber
- **Inferior:** below or lower
  - e.g. the corneal ulcer is located on the inferior cornea
- **Superior:** above or higher
  - e.g. the foreign body is on the superior cornea
- **Nasal:** closest to the nose
  - e.g. the stye is located on the nasal lower lid
- **Temporal:** closest to the temple
  - e.g. the haemorrhage is on the temporal conjunctiva.

LOOKING AT THE EYE

Some parts of the eye can be seen by looking at a person's face. Some parts of the eye are inside the eye and can only be seen with special instruments. We will start by naming the parts of the eye we can see without needing to use special instruments (anterior) and then move to naming the parts of the eye we need special instruments to see (posterior).

Whenever we look at the eye we need to have good lighting. We can use a lamp, slit lamp or flashlight. If you don't have these things you can make do with good sunlight.

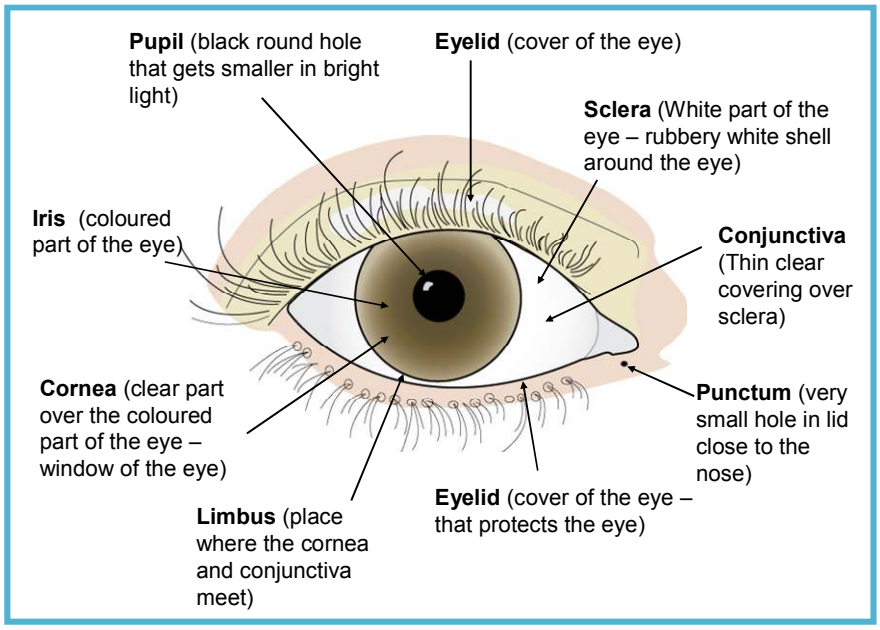

Figure 1-1: The external eye

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If we take away the eyelids and cut the eyeball in half like an apple or a coconut, it would look like the diagram below.

Figure 1-2: Cutting the eye in half

OUTSIDE OF THE EYE

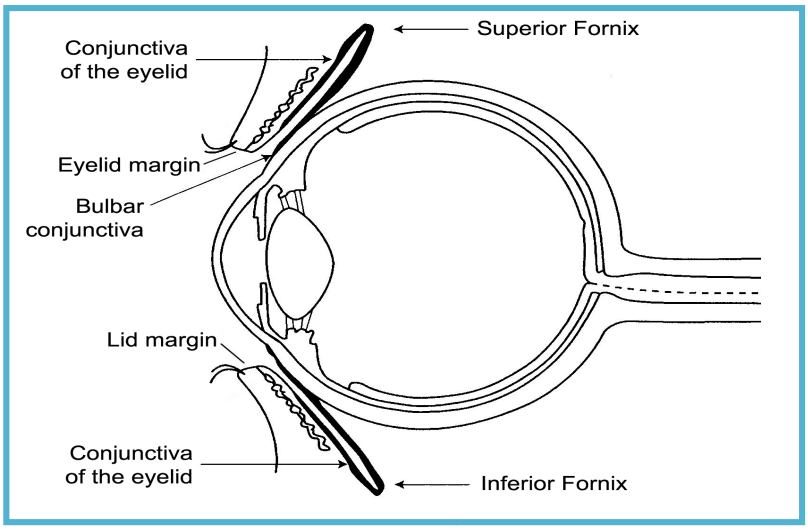

Figure 1-3: Conjunctiva and Eyelids

The Eyelids

- The front of the eyeball can be covered or uncovered by two folds of skin called the eylids
- The edge of each eyelid is called the lid margin
- Along the front of the lid margin are the eyelashes
- Inside the eyelids are glands that produce the tear film
- The eyelids and eyelashes protect our eyes from:
  - Sunlight
  - Wind
  - Dust
  - Foreign bodies
  - Infection
- The eyelids also spread out the tears each time we blink – this stops the eyes from drying out.

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PTOSIS:

- **Drooping of the upper eyelid**
- **A ptosis can be present at birth, caused by an injury, surgery or can happen with age.**

Figure 1-4: This person's right eye has a ptosis (drooping eyelid)

Punctum

- A very small hole on the lower and upper lid near the nose
- Is where the tears drain away from the surface of the eye.

BLOCKED PUNCTUM:

- **Common in babies and older people**
- **The tears will run over their cheeks and may look like they are crying**
- **The punctum needs to be opened or unblocked by a medical practitioner.**

Conjunctiva

- The conjunctiva has two parts:
  - **Bulbar conjunctiva:** covers the inside of the top and bottom eyelids; to see the conjunctiva under the top lid you need to evert (or flip) the eyelid
  - **Palpebral conjunctiva:** covers the inside of the top and bottom eyelids; to see the conjunctiva under the top lid you need to evert (or flip) the eyelid
- The conjunctiva does not have as many pain centres as the cornea. If there is an eye problem that affects the conjunctiva, it will not be as painful as an eye problem that affects the cornea
- The conjunctiva helps protect the eye from infection and from damage caused by foreign bodies
- When you look at a healthy eye you see the white sclera through the clear bulbar conjunctiva
- You will see a few small blood vessels in a healthy conjunctiva.

SUB-CONJUNCTIVAL HAEMORRAGE:

- **When one of these small blood vessels breaks it becomes a sub-conjunctival haemorrahage**
- **The blood will spread between the two layers (sclera and bulbar conjunctiva).**

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FOREIGN BODIES IN THE PALPEBRAL CONJUNCTIVA:

- **People are afraid that a piece of grain, stone or metal can slip behind the eyeball**
- **This is not possible, because the bulbar conjunctiva joins the conjunctiva of the eyelid and a foreign body can go no further than the folds in the conjunctiva**
- **These folds are called superior fornix and the inferior fornix.**

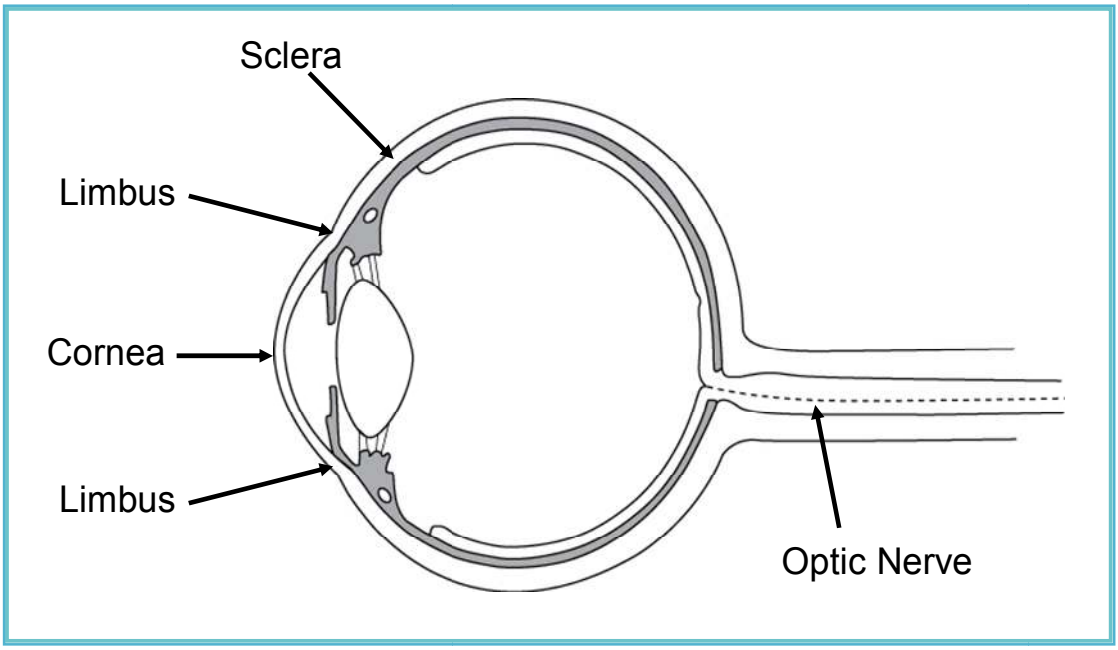

Figure 1-5: Sclera, Cornea and Limbus

Sclera

- The sclera is white and can be thought of as a rubbery white shell around the eye
- The sclera is very strong
- It protects the inside of the eyeball and gives the eye its shape
- Attached to the outside of the sclera are six extraocular muscles.

Extraocular muscles

- The extraocular muscles control eye movement
- They allow us to look in all directions (e.g. up, down, left and right)
- There are six different muscles that are attached to the outside of the eyeball (called extraocular muscles)
- In an eye examination, if a person cannot move their eye in a specific direction, it can mean that there is a problem with one or more of the extraocular muscles.

EYE TURN (SQUINT):

- **Can be caused by one or more extraocular muscles not working or a muscle being weak**
- **Extraocular muscles can be damaged at birth, injury or disease (e.g. diabetes).**

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Cornea

- The cornea is clear, like glass
- When we look at a person's eye we can see through the clear cornea to the coloured part of the inside of the eye (iris)
- The cornea needs to be clear so that it can let light into the eyeball, to allow us to see
- The cornea can be thought of as the *window of the eye*
- The cornea also helps to focus light that enters the eye
- The cornea is strong and helps to protect the eye
- The cornea has lots of nerves that send pain messages to the brain. This is why it can be very painful if the cornea has an injury or a disease.

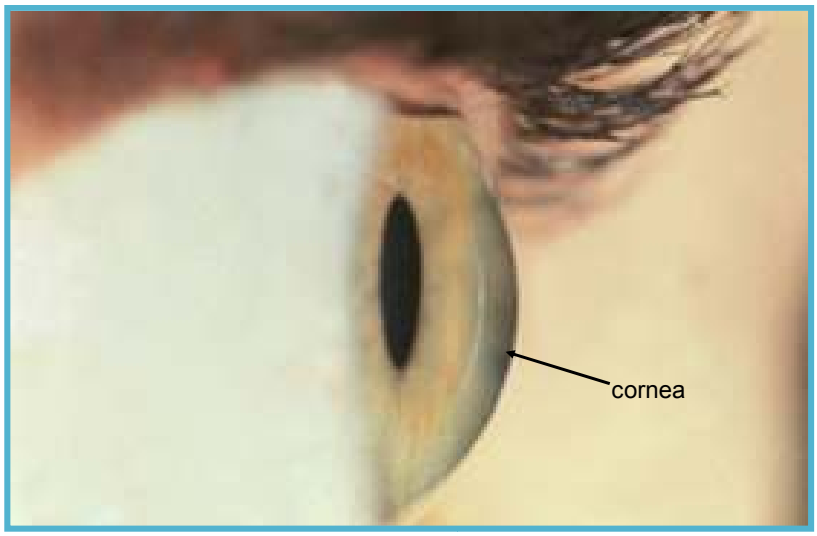

Figure 1-6: The cornea (photo courtesy of the Brien Holden Vision Institute)

A SCRATCHED CORNEA:

- **Is very painful**
- **A small scratch on the cornea will heal without causing a scar**
- **If the scratch is deep or becomes infected, it can cause a permanent scar**
- **A scar can block light from getting into the eye and cause poor vision**
- **This is why it is important for a person who has hurt their cornea, or somebody who has a disease of the cornea, to be given the right treatment immediately.**

Limbus

- This is where the clear cornea meets the white sclera
- Because, the clear cornea covers the coloured part of the eye, when we look at a person's eye we see the limbus as the circle where the coloured part of the eye meets the white of the eye
- The limbus can be thought of as a landmark in the eye.

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INSIDE OF THE EYE

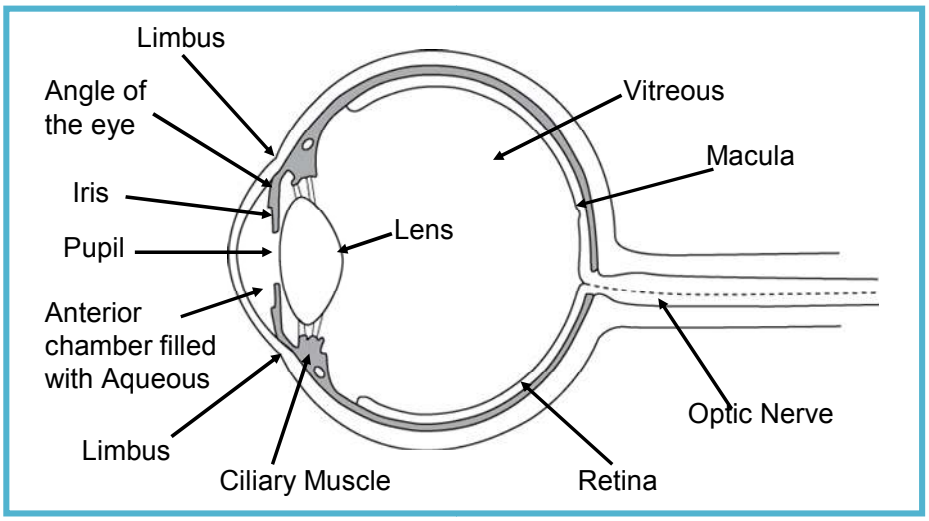

Figure 1-7: The internal eye

Iris

- The iris is round and flat with a hole in the middle
- It is located behind the cornea and the anterior chamber and in front of the vitreous
- The iris divides the eye into anterior chamber (between the cornea and the iris), and the posterior chamber (between the iris and the retina)
- Iris colour is different in different people. It can be brown, green, blue, or grey.

Anterior Chamber

- The anterior chamber of the eye is the space between the cornea and the iris
- It is filled with a watery liquid called the aqueous humour (or simply the aqueous)
- The aqueous in the anterior chamber helps feed the inside of the eye and gives the front of the eye its shape.

Angle of the Eye

- The area in the anterior chamber where the cornea and iris meet is known as the angle of the eye
- This is the place where the aqueous drains from the eye
- The aqueous humour is produced in the ciliary body
- The aqueous travels through the pupil into the anterior chamber and exits the eye through the angle of the eye
- The balance between production and drainage of aqueous fluid determines the eye's intraocular pressure (IOP).

GLAUCOMA:

- **Is an eye disease caused by increased pressure inside the eyeball**
- **When there is too much aqueous in the anterior chamber, or when the aqueous cannot drain out of the eye, the IOP will elevate**
- **If the IOP is too high for long periods of time, it can cause blindness.**

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Pupil

- In the middle of the iris is a round hole called the pupil
- The pupil looks black because the inside of the eyeball is dark
- Muscles in the iris change the pupil's size to let the right amount of light into the eye
- In bright light the pupil is small and in dim light the pupil is large
- A person's pupils should be equal in size and react to light.

PUPIL SIZE:

- **Unequal pupils or pupils that do not respond to light can sometimes be a sign of a more serious problem.**

Lens

- The crystalline lens of the eye (simply called 'the lens') is behind the iris and the pupil
- The lens is clear and cannot usually be seen without a slit lamp
- The purpose of the lens is to change the focus of the eye, so that we can see things at different distances.

CATARACT:

- **When the lens inside the eye becomes cloudy, this is called a cataract.**

Ciliary Muscle

- The ciliary muscle is a ring of muscle located around the lens
- When the ciliary muscle pulls together the lens changes focus
- This is called accommodation.

Posterior Chamber

- The posterior chamber of the eye is the space between the iris and the retina
- The posterior chamber is filled with a jelly-like material called the vitreous.

Vitreous

- The vitreous is a clear jelly inside the eye
- The vitreous helps give shape to the eye ball
- It is attached to the retina and the optic nerve.

Fundus

- The fundus includes the retina, the optic disc, and the blood vessels at the back of the eye
- We use a special instrument, such as an ophthalmoscope, to examine the posterior parts of the eye
- This is called a fundus examination.

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Retina

- The retina is the inside layer of the eye
- The retina catches the light that comes into the eye and changes it into nerve messages that are sent to the brain
- The nerve messages travel to the brain through the optic nerve
- The retina contains many arteries and veins which supply it with blood and oxygen.

Retinal Blood Vessels

- The blood in the retinal arteries is a brighter red than the blood in the retinal veins
- The retinal arteries are a little narrower than the veins
- Both retinal arteries and retinal veins have many branches
- The retinal arteries and veins taper (get narrower) as they extend further from the optic disc.

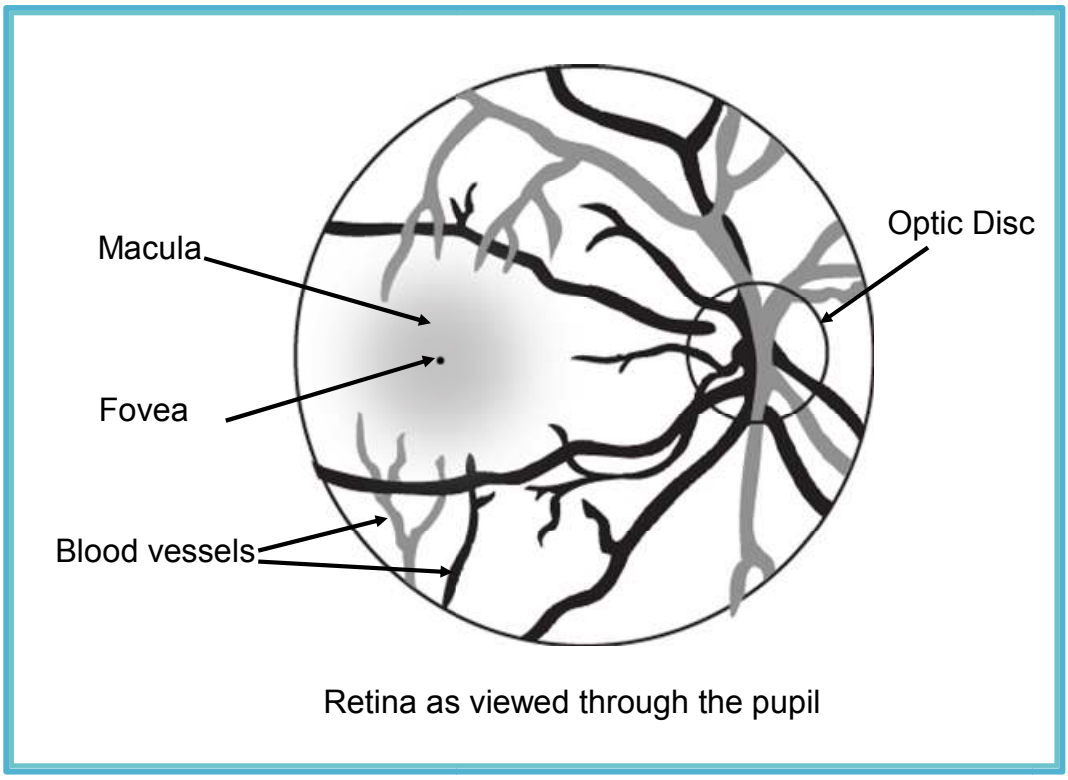

Figure 1-8: Diagram of the fundus when viewed with an ophthalmoscope

HAEMORRHAGES:

- **When a blood vessel leaks, this will form a retinal haemorrhage**
- **A haemorrhage can be caused by a disease (e.g. diabetes) or an injury (e.g. blunt injury to the eye)**
- **Retinal haemorrhages can come in different shapes and sizes:**
  - **Dot haemorrhage**
  - **Blot haemorrhage**
  - **Flame haemorrhage.**

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Macula

- The macula is the part of the retina we use when we look directly at something
- The centre of the macula is called the fovea, and it is the part of the eye that gives us the clearest vision
- When we look at the macula with an ophthalmoscope, there is a pinpoint light reflection at the centre of the fovea (the foveal reflex). This foveal reflex is usually very bright in children, but may not be present in older people
- If the fovea is damaged, this may result in very poor visual acuity, even if the rest of the retina is unaffected.

AGE RELATED MACULAR DEGENERATION (ARMD):

- **Sometimes, with age, the macula is not able to work properly. It no longer gets enough nourishment and begins to deteriorate**
- **An accumulation of debris (called drusen) can become trapped between the layers of the retina in the macular area**
- **People with ARMD will lose their central vision.**

Optic Nerve

- The optic nerve can be thought of as a telephone wire that lets the eye talk to the brain
- The optic nerve sends the messages from the retina to the brain
- When looking at the fundus through the pupil, using an ophthalmoscope, you can see the optic nerve
- There are two parts to the optic nerve:
  - **Optic cup:** the inner part, which is yellow in colour
  - **Optic disc:** the outer rim, which is pinkish in colour.

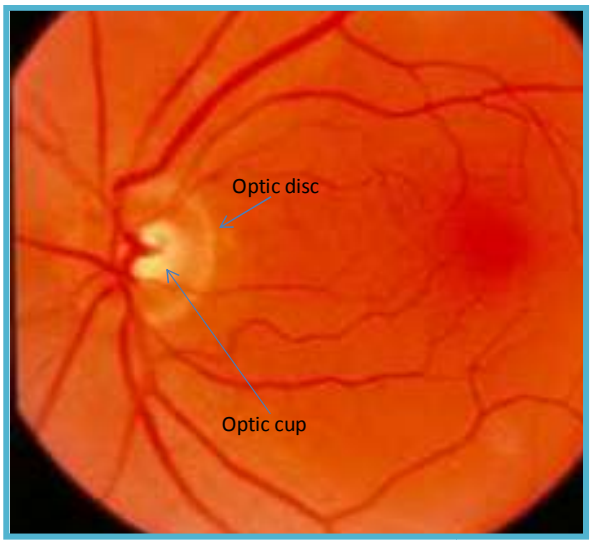

Figure 1-9: Optic Nerve (photo courtesy of Pak Sang Lee: International Centre for Eye Health)

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CUP TO DISC RATIO:

- **The cup to disc ratio is the diameter of the cup divided by the diameter of the disc**
- **The normal cup:disc ratio is about 1/3 or 1:3**
- **If a person has glaucoma, cup grows due to the damage from the high intraocular pressure and occupies a larger area of the optic disc**
- **In a person with glaucoma, the cup:disc ratio will be more.**

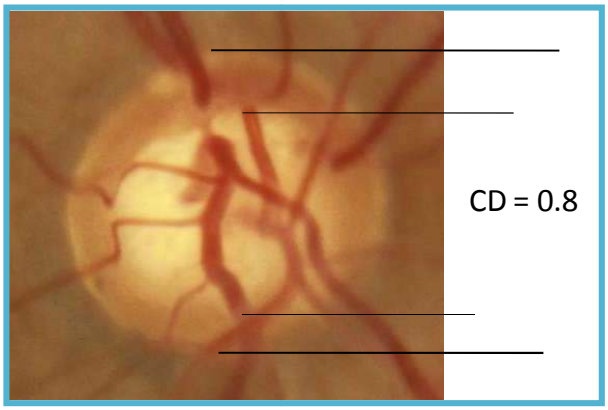

Figure 1-10: *Cup:disc ratio in a person with glaucoma*
(photo courtesy of Richard Bourne: International Centre for Eye Health)

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SUMMARY – INTRODUCTION TO THE EYE

Eyelids

- Protect the eyes from the environment
- Spread tears when blinking to keep the eye wet.

Punctum

- Drains tears from the eye.

Conjunctiva

- A very thin layer that is clear except for a few small blood vessels
- The bulbar conjunctiva covers the sclera, but not the cornea
- The white sclera can be seen underneath the bulbar conjunctiva
- The palpebral conjunctiva covers the inside of the top and bottom eyelids
- The pink eyelid can be seen underneath the palpebral conjunctiva
- It is not *too* painful if the conjunctiva has an injury or disease, because the conjunctiva has fewer nerves than the cornea.

Sclera

- Strong white covering of the eyeball
- Protects the eye and gives it its shape.

Extra Ocular Muscles

- There are six different muscles attached to the outside of each eye
- These extraocular muscles control eye movement
- They allow us to look up, down, left and right, as well as roll the eyes.

Cornea

- Like the window of the eye
- Transparent, so that it can let light into the eyeball to allow us to see
- Helps to focus light that enters the eye
- Has many nerves so is very sensitive to touch or pain.

Limbus

- The limbus is located where the cornea and the conjunctiva meet.

Iris

- The round coloured part of the eye is called the iris
- It divides the eye into the anterior and posterior chamber.

Anterior Chamber

- Filled with a watery liquid called the aqueous
- Provides nutrients to the cornea and the lens.

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Angle of the Eye

- The area in the anterior chamber where the cornea and iris meet is known as the angle of the eye
- This is the place where the aqueous drains from the eye
- The aqueous travels through the pupil into the anterior chamber and exits the eye through the angle of the eye.

Pupils

- In the middle of the iris is a round hole called the pupil
- Muscles in the iris change the pupil's size to let the right amount of light into the eye
- In bright light the pupil is small and in dim light the pupil is large.

Lens

- Transparent in a normal eye
- Changes in the lens shape change the eye's focus from distance to near – this is called accommodation.

Ciliary Muscle

- Changes the focusing ability of the eye by changing the shape of the lens.

Posterior Chamber

- Is between the iris and the retina
- Contains a jelly-like material called the vitreous.

Vitreous Body

- Transparent gel between the lens and the retina
- Helps give shape to the eyeball.

Retina

- Catches the light that comes into the eye and changes it into nerve messages that are sent to the brain.

Macula

- Gives us clear central vision
- The centre of the macula, called the fovea, is what we use when we look directly at something
- It is the part of the eye that gives us the clearest vision.

Optic Nerve

- Sends messages to the brain
- When looking at the fundus through the pupil, using an ophthalmoscope, a part of the optic nerve can be seen
- This part of the optic nerve is called the optic disc
- Inside the optic disc is the optic cup
- The normal cup:disc ratio is 0:3.

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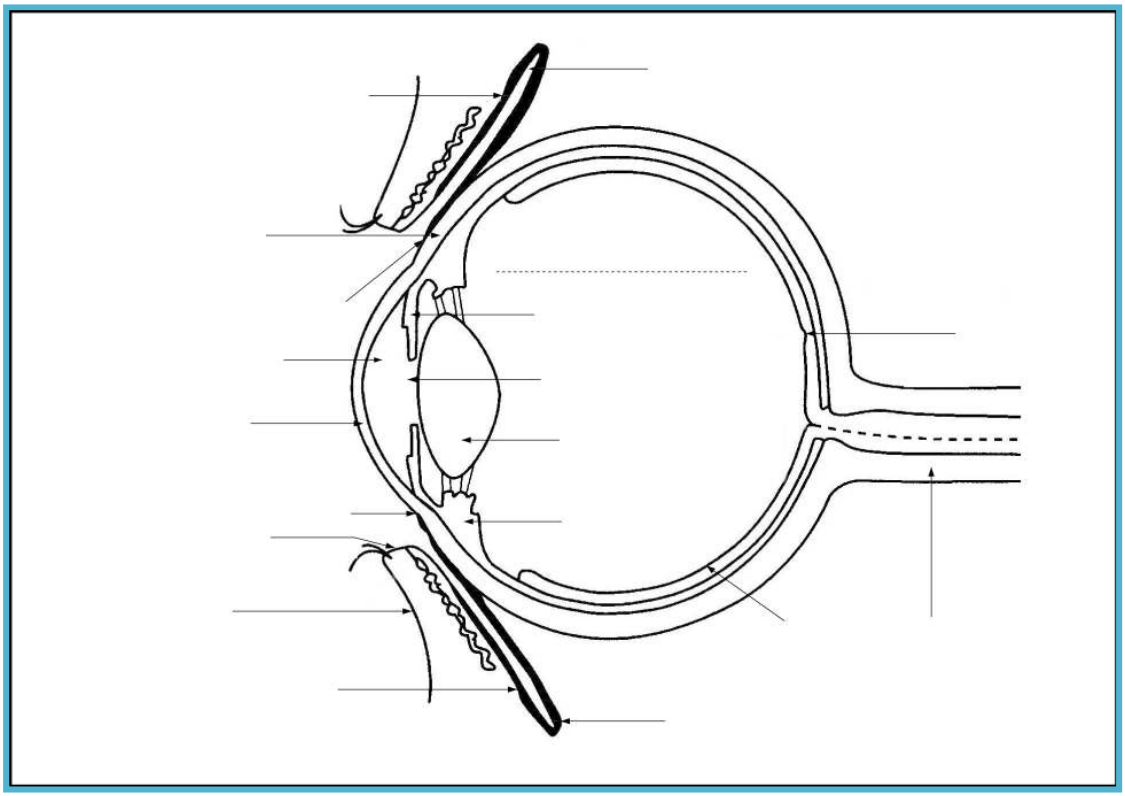
TEST YOURSELF QUESTIONS

1. Name parts of the eye in this diagram:



2. Complete this table:

FUNCTION:	PART OF THE EYE:
Protects the eye and stops the eye drying out	
Covers the sclera and inside of the eyelid	
White part of the eye	
Clear window of the eye	
Changes size according to amount of light available	
Coloured part of the eye	
Changes shape to focus the eye at different distances	
Catches light at the back of the eye	
Sends light messages from the retina to the brain	
This is where tears drain away from the eye	
Clear jelly in the posterior chamber of the eye	

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