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Physiology of the eye lids

An eyelid is a thin fold of skin that covers and protects the human eye. They keep the eyes from drying out when asleep. Moreover, the blink reflex protects the eye from foreign bodies.
Functions:

1-The eyelids act to protect the anterior surface of the globe from local injury, it protects the eye from dust, sun light, and insect.

2- They aid in regulation of light reaching the eye; in tear film maintenance, by distributing the protective and optically important tear film over the cornea during blinking;

3- Help in tear flow, by their pumping action on the conjunctival sac and lacrimal sac.

4-They keep the eyes from drying out when asleep. Moreover, the blink reflex protects the eye from foreign bodies.

The upper and lower eye lids considered as a layer of protection of the eye, It consist of:

1- Two folds covers by skin from out side and lining by conjunctiva from inside.

2- Muscles.

3-Tarsus.

4- Blood vessels.

5- Nerves.

The skin of the eye lids differs from the skin of the whole body by:

1- Very thin.

2- There is no fat.

3- The hair is short and strong lies at the margin of the lid called (eye lash) which arranged in two or more rows, and at root of the hair there is opining of two glands:

1- Zeis gland which is a sebaceous gland.

2- Moll gland which is a sweat gland ,its opened at the root of hair or with the opining of zeis gland not directly out side as other sweat gland in the body.

Tarsal plates

The tarsal plates are two thick, elongated plates of dense connective tissue, about 2.5 cm in length; one is found in each eyelid, and contributes to its form and support. They are located directly above the lid margins and its two plates:

1- Superior tarsal plate.

2-Inferior tarsal plate.

Superior tarsal plate

Its larger than the inferior plate, contain a sebaceous gland called (meibomian gland) which is opened at the margin of eye lids behind the eye lash .Its about (15-30) gland in each eye lid and it could be seen through the conjunctiva.

The grey line: it’s the line in which the opining of the meibomian gland arranged and it's very important in the surgery because it’s the line that separated between tarsal plate and the muscles of the eye lids.

Muscles of the eye lids

There are two types of muscles:

1- Voluntary muscles.

2- Involuntary muscles.

Voulantary muscles

These muscles responsible for opining and closing the eye lids:

1- Levator palpebrae superioris

Origin : from the roof of the orbit .

Insertion: at (3) place

1- Skin of the eye lid.

2- Superior tarsal plate.

3- Upper fornix's of the conjunctiva.

Action: opining the eye lids

Nerve supply: Oculomotor nerve C3

2- Orbicularis oculi muscle

This muscle under the skin immediately its circular in shape and it contain (3) parts:

1- Orbital part. Its responsible for closing the eye lid firmly from sunlight, dust or bright light.

2- Palpebral part .help in closing the eye lids in normal condition.

3- Lacrimal part.its promot ythe flow of lacrimal fluid through the canaliculi.

Nerve supply Fascial nerve C7

Involuntary muscles

These muscles called Mullers muscle and its two types:

1- Superior mullers

This muscle originated from levator palpebral superioris muscle fibers and inserted in the upper part of superior tarsal plate.

2- Inferior mullers muscle.

This muscle originated from inferior rectus muscle fibers and inserted in the inferior tarsal plate .

The function of mullers muscles is for stiffness and supporting of both upper and lower eye lids.

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Extra Ocular Muscles

The extra ocular muscles are the six muscles that control movement of the eye. The actions of the six muscles responsible for eye movement depend on the position of the eye at the time of muscle contraction.

Since only a small part of the eye called the fovea provides sharp vision, the eye must move to follow a target. Eye movements must be precise and fast.

The 6 voluntary muscles which differs from other muscles in the body by its shape ,anatomical structure and their nerve supply and these muscles are:

1- Superior Rectus Muscle.

2- Inferior Rectus Muscle.

3-Lateral Rectus Muscle.

4-Medial Rectus Muscle.

5-Superior Oblique Muscle.

6- Inferior Oblique Muscle.

The different points from other muscles are:

1- Highly nerve supply.

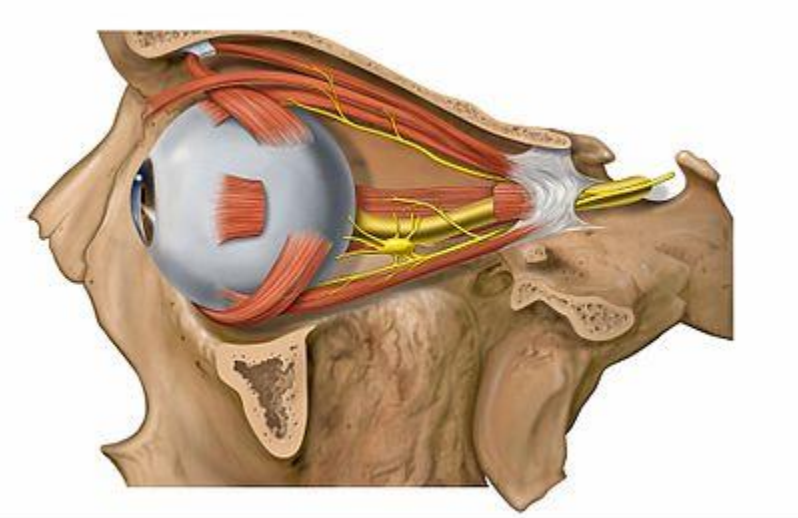
2-The muscle fibers are very small and strongly attached to each other with out connective tissue but connected by thin soft tissue.

3- Its shape is spindle and short in length.

Blood supply

1-The extra ocular muscles are supplied mainly by branches of the ophthalmic artery

2- Additional branches of the ophthalmic artery include the ciliary arteries, which branch into the anterior ciliary arteries



Coordination of movement between both eyes

Intermediate directions are controlled by simultaneous actions of multiple muscles. When one shifts the gaze horizontally, one eye will move laterally (toward the side) and the other will move medially (toward the midline). This may be neutrally coordinated by the central nervous system, to make the eyes move together and almost involuntarily. This is a key factor in the study of strabismus (the inability of the eyes to be directed to one point).

Rectus eye muscles:

The origin of the four straight muscles are from (Zinn ligament) which is a tendoneous ring around the orbital canal. The insertion of these muscles are to the sclera .

1- Superior Rectus Muscle:

Origin:-Zinn ligament.

Insertion- Sclera

Action- elevated the eye ball up word and medially when the eye rotate medially .

Nerve supply- Oculomotor nerve –C3.

2-Inferior Rectus muscle

Origin:-Zinn ligament.

Insertion- Sclera

Action- Pull the eye ball down and medially when the eye rotate laterally.

Nerve supply- Oculomotor nerve –C3.

3-Medial Rectus muscle

Origin: -Zinn ligament.

Insertion- Sclera

Action- move the eye ball medially.

Nerve supply- Oculomotor nerve –C3.

4-Lateral Rectus muscle

Origin: -Zinn ligament.

Insertion- Sclera

Action- move the eye ball laterally.

Nerve supply-abducens nerve –C6.

5- Superior oblique muscle

Origin: -from the roof of the orbit passes anteriorly and turns posteriorly enter the trochlea..

Insertion- Sclera

Action- pull the eye ball down word and laterally when the eye rotate medially.

Nerve supply- Trochlear nerve- C4

6-Inferior Oblique muscle.

Origin: -.from the floor of the orbit lateral to the naso-lacrimal canal .

Insertion- Sclera

Action- move the eye ball up word and laterally when the eye ball rotate laterally.

Nerve supply- Oculomotor nerve –C3.

The lacrimal apparatus

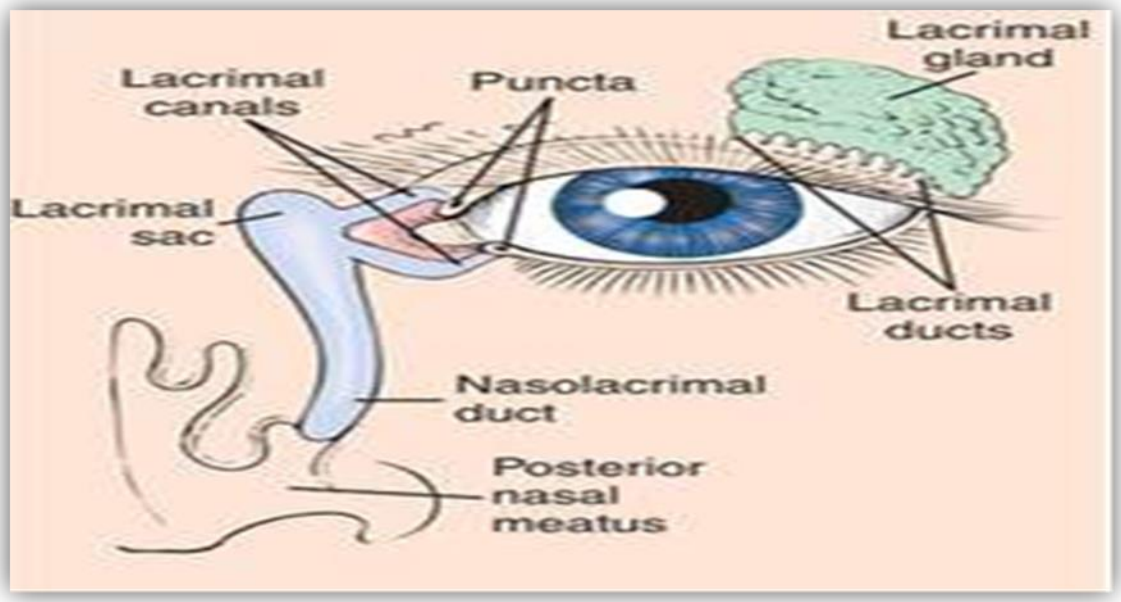
The lacrimal apparatus is the physiological system containing the orbital structures for tear production and drainage.

It consists of:

1-The lacrimal gland, which secretes the tears, and its excretory ducts, which convey the fluid to the surface of the human eye.

2-The lacrimal canaliculi, the lacrimal sac, and the nasolacrimal duct, by which the fluid is conveyed into the cavity of the nose.

3-The innervation of the lacrimal apparatus involves both the a sympathetic and parasympathetic supply through the carotid plexus of facial nerve.



Tears

The watery, slightly alkaline and saline secretion of the lacrimal glands.

Function of tears

1-Moistens the conjunctiva and cornea.

2-contain the bactericidal enzyme.

3-providing nutrients and dissolved O_2 to the cornea.

System secret the lacrimal fluid

The system contain two parts:

1-Lacrimal glands.

2-Accessory lacrimal glands.

Lacrimal glands

Its of two parts :

1- Orbital parts :which lies in the orbit.

2- Palpebral part :which lies in the eye lids.

These glands about (12) glands and they are short and opened into conjunctiva .

Accessory lacrimal glands

They are two types :

1- Gland of Krause which is small glands ,about 20 in number in the upper fornix and 8 in number in the lower fornix, each gland open its duct in the tarsal plate.

2- Gland of wolfring :Its look like Krause gland lies near tarsus.

System collectes and drain lacrimal fluid

It consist of 4 parts :

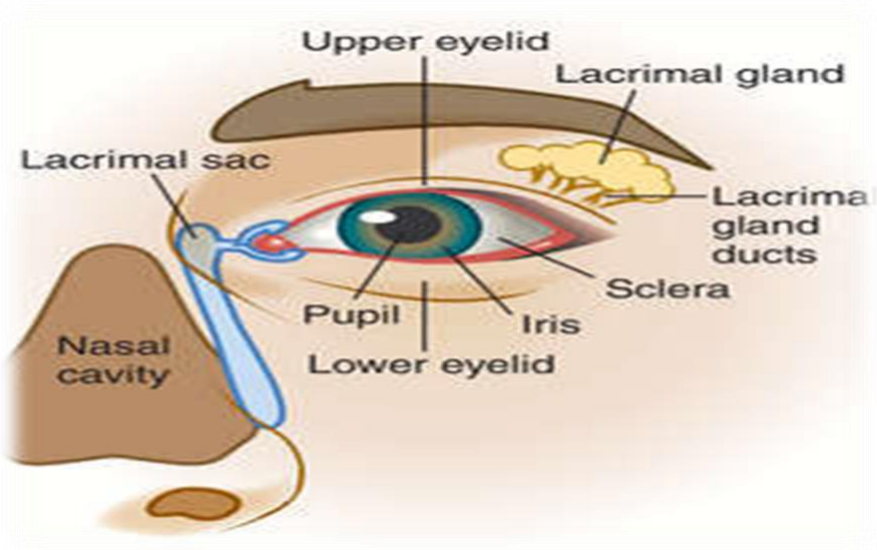
1-Lacrimal punctum: There are two opening in the internal margin of upper and lower eye lids, and we can see it clearly in old age as a small swelling called (lacrimal papillae).

2- Lacrimal canaliculus: It starts from the lacrimal punctum ,its about 1cm length , it runs with the margin of eye lids down ward and opened into lacrimal sac through a fold called Maier sinus.

3- Lacrimal sac: This sac lie in the lacrimal groove ,it about 1cm length, its upper end blind while the lower one is continuous with naso-lacrimal duct .Its cover by lacrimal fascia.

4- Nasolacrimal duct: Its about 1.5 cm length and 0.5 cm wide. Its begin at anteromedial corner of the floor of the orbit and pass down word to end in the inferior meatus of nasal cavity.

The lacrimal fluid flaw down wards over the eye ball and a lot of it evaporated and some carried by orbicularis oculi muscle so the fluid spread over the cornea.



المحاضرة الرابعة

The Conjunctiva

It's a thin transparent mucous layer, it covers the eye ball anteriorly (sclera) and lining the eye lids so the eye lids connected to eye ball by conjunctiva.

There are two parts :

1- Palpebral part which lining the eye lids internally.

2- Ocular part which cover the eye ball (sclera).

Histology of the conjunctiva

The conjunctiva consist of two layers

1- Superficial layer: Its about (3-4)layers of columnar cells at the margin of the eye lid and in between these cells there are Goblet cells which secreted mucus material.

2- Stroma: It contain two layers

a- Adenoid layer or superior layer which contain lymphocytic monocyte cells .

b- Elastic fibers layer or inferior layer which is contain a fibrous tissue.

The function of the conjunctiva is for defense mechanism of the eye ball.

Optic nerve

The optic nerve, also known as cranial nerve II, is a paired nerve that transmits visual information from the retina to the brain. In humans, the optic nerve extends from the optic disc to the optic chiasm and continues as the optic tract. The optic nerve is the second of twelve paired cranial nerves and is technically part of the central nervous system the fibers of the optic nerve are covered with myelin produced by oligodendrocytes, rather than Schwann cells of the peripheral nervous system, and are encased within the meninges.

Lengths of the optic nerve:

- 1 mm in the eye ball.

- 24 mm in the orbit.

-9 mm in the optic canal.

- 16 mm in the cranial space before joining the optic chiasm.

Parts of optic nerve: the optic nerve may be divided in the four parts

1. the optic head (which is where it begins in the eyeball with fibers from the retina.

2. orbital part (which is the part within the orbit).

3. intra canlicular part (which is the part within a bony canal known as the optic canal.

4. cranial part (the part within the cranial cavity, which ends at the optic chiasm.

Function

The optic nerve transmits all visual information including

1-Brightness perception,

2- color perception.

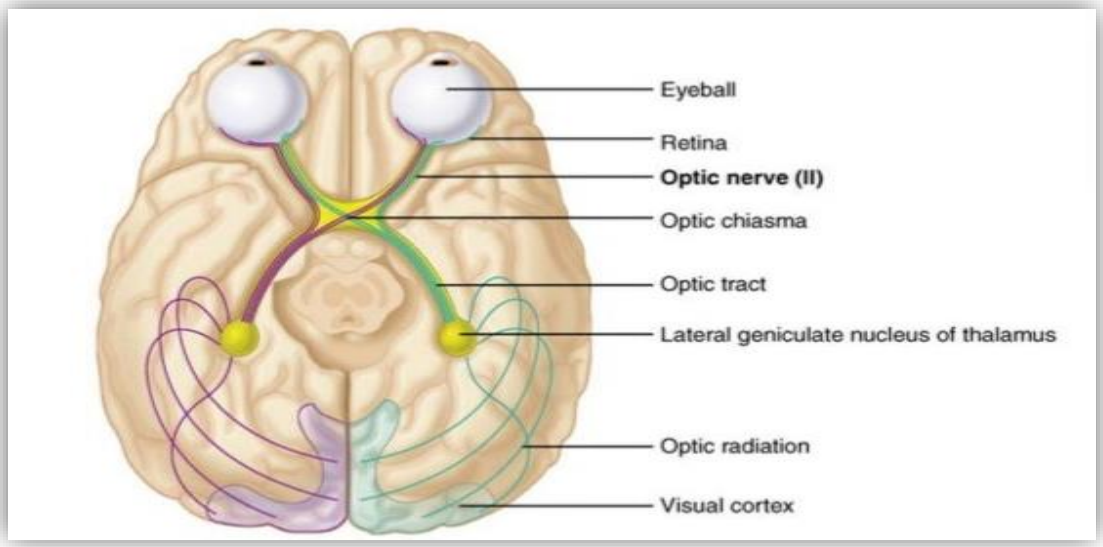
3-contrast (visual acuity).

It also conducts the visual impulses that are responsible for two important neurological reflexes:

1-light reflex. the light reflex----- refers to the constriction of both pupils that occurs when light is shone into eye.

2-The accommodation reflex.

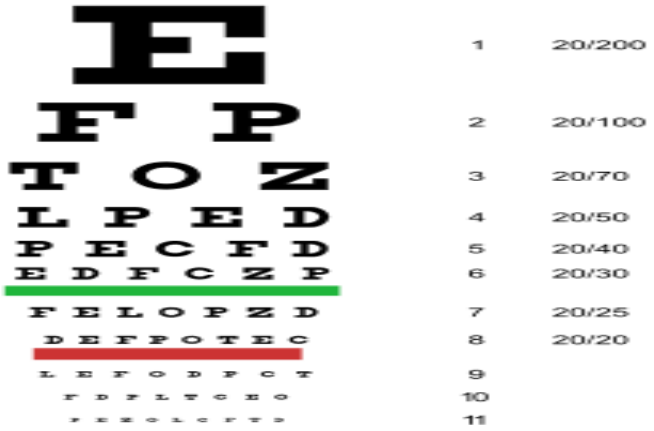
the accommodation reflex---- refers to the swelling of the lens of eye that occurs when one looks at a near object as in reading (lens adjusts to near vision).



المحاضرة السادسة

Visual acuity

Visual acuity: is the shortest distance by which two lines can be separated and still be perceived as two lines. It is measured by using Snellen's test type, which is a series of letters of different sizes, the top letter is visible to the normal eye.The letters are in lines, each line has types of same size. The top row of types contains large letters and succeeding rows contain gradually smaller and smaller letters.

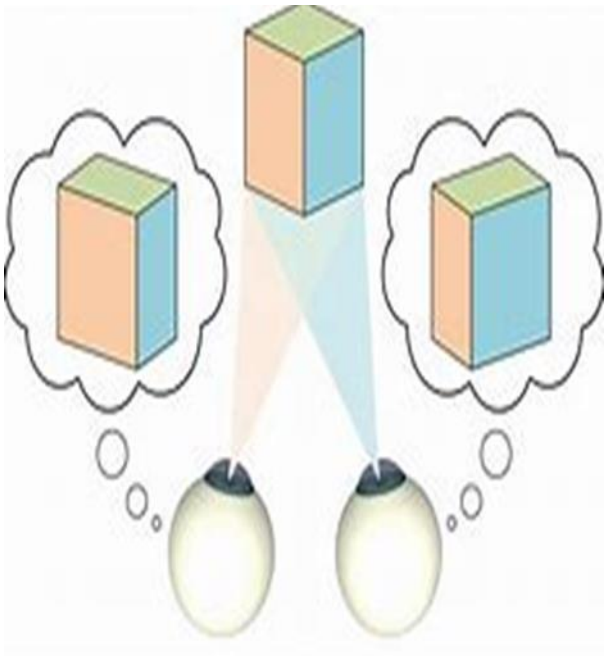


Snell's chart

Hyperopia: The eye ball is shorter than normal one; the rays of light are brought to focus behind. the retina. The defect can be corrected by using glasses with convex lenses.

Myopia: The antero-posterior diameter of the eye ball is too long. Myopia is said to be genetic in origin. In young adult humans the extensive close work involved in activities such as studying accelerates the development of myopia. This defect can be corrected by glasses with biconcave lenses.

Binocular vision: is one of the hallmarks of the human race that has bestowed on it the supremacy in the hierarchy of the animal kingdom. It is an asset with normal alignment of the two eyes, but becomes a liability when the alignment is lost.



Binocular vision

The advantages of a Binocular vision are:

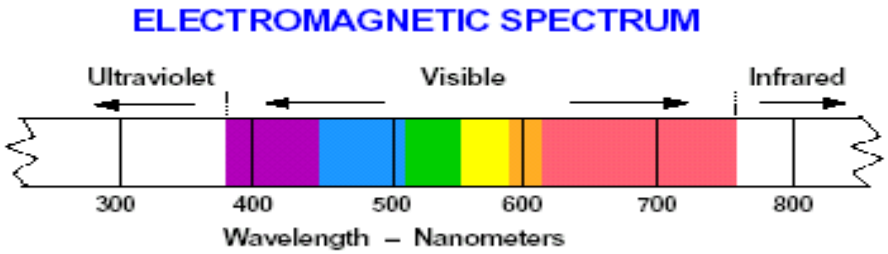
1. The first and the foremost advantage of a binocular vision is single vision.
2. In addition to single vision it results in stereo sis – the most precise kind of depth perception.
3. Enlargement of the field of vision.
4. Compensation for blind spot and other differences.

المحاضرة السابعة

Effect of light on the eye

The human eye is exquisitely sensitive to light (i.e., visible radiant energy), and when dark-adapted, the retina can detect a few photons of blue-green light. It is therefore not at all surprising that ocular tissues are also more vulnerable to ultraviolet (UV) and light damage than the skin. For this reason, humans have evolved with certain anatomical, physiological, and behavioral traits that protect this critical organ from the UV damage that would otherwise be certain from the intense bath of overhead solar ultraviolet radiation (UVR) when we are outdoors during daylight. For example, the UV exposure threshold dose for photokeratitis if measured as falling on a horizontal ground surface would be reached in less than 10 minutes around mid- day in the summer sun. There are three critical ocular structures that could be affected by UV exposure: the cornea, the lens, and the retina. The cornea transmits radiant energy only at 295 nm and above. The crystalline lens absorbs almost all incident energy to wavelengths of nearly 400 nm. In youth, a very small amount of UV-A reaches the retina, but the lens becomes more absorbing with age.

The spectrum of light ranges from Ultraviolet (UV) to Visible Light and on to Infrared (IR) light. The UV and IR light is invisible to the human eye, but can none the less have dangerous effects. The visible light, that provides us with color vision represents just a small, part of the electromagnetic spectrum.

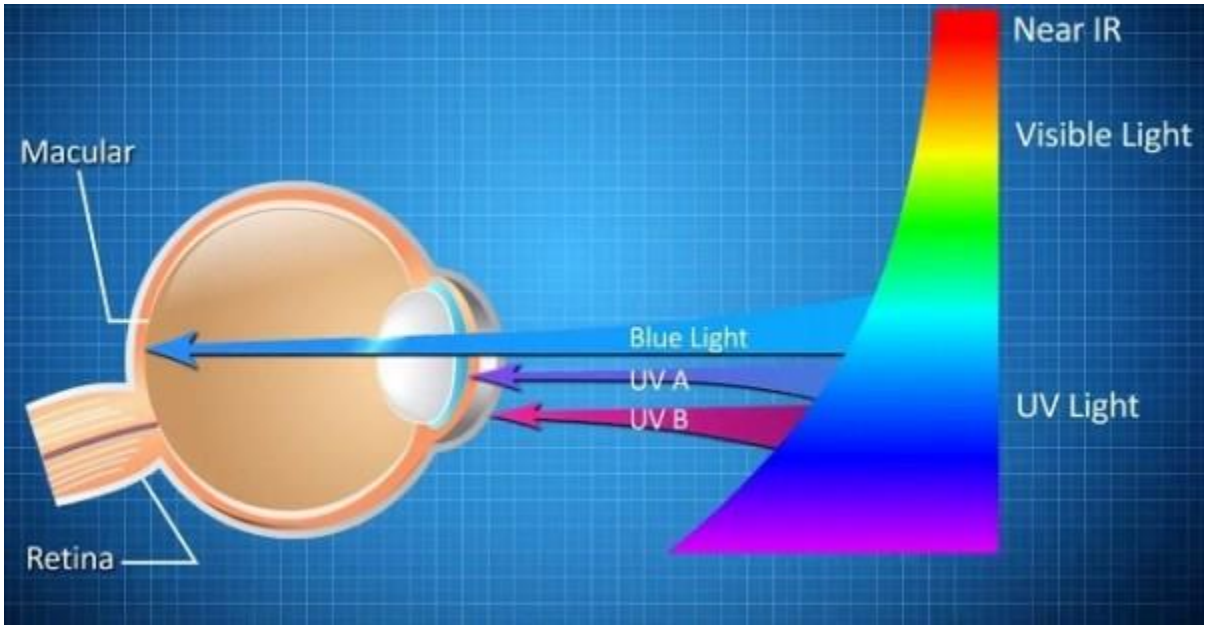


Ultraviolet Light

Ultraviolet or UV light can damage the eyes in several ways. Excessive exposure to the lowest wavelengths of UV light, also called UV-C, (180-290 nm) can cause damage to the Cornea as well as the Lens. These wavelengths are not common in nature, since they are absorbed by the atmosphere, but are present in in some industrial environments, such as electric arch welding. The mid UV wavelengths, also called UV-B, (290-320 nm) can cause damage to the Lens as well as cause welders eye (feels like sand in the eye). Mid UV light is present both in sunlight and in some industrial environments. The high UV wavelengths, also called UV-A, (320-380 nm) are present in all outdoor environments. Excessive exposure can cause fatigue or snow blindness.

High UV and Blue Light

Blue light (380-480 nm) can cause damage to the Retina (the back of the eye). Blue light is present in regular sun light, as well as in office environments (computer screens generate Blue light) and in select industrial applications.



High UV and Blue Light