

Anatomy of Sclera

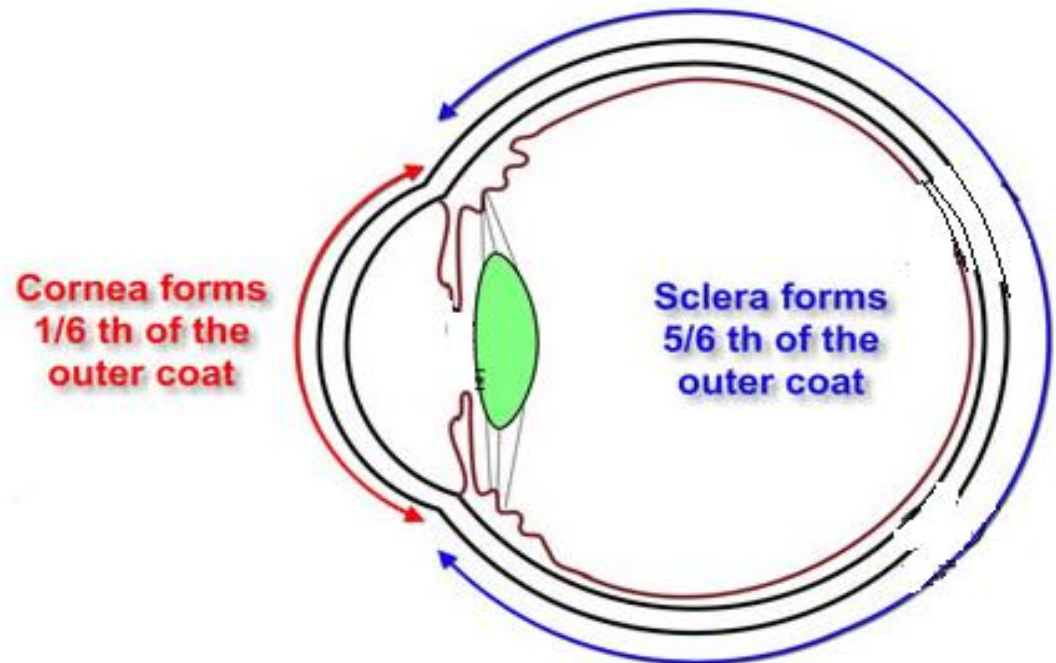
Assist.Prof.Sourav

Introduction

- The term sclera is derived from Greek word scleros meaning "hard".
- Sclera is an opaque, elastic, and resilient tissue of the eye.
- It can be compared with an incomplete shell comprising approximately 90% (five-sixths) of the outer coat of the eye.
- Anteriorly it begins at the limbus and terminates at the optic nerve canal posteriorly.

Function

- The primary function of the sclera is to protect the eye and maintain the shape of the eye ball.



Embryologically

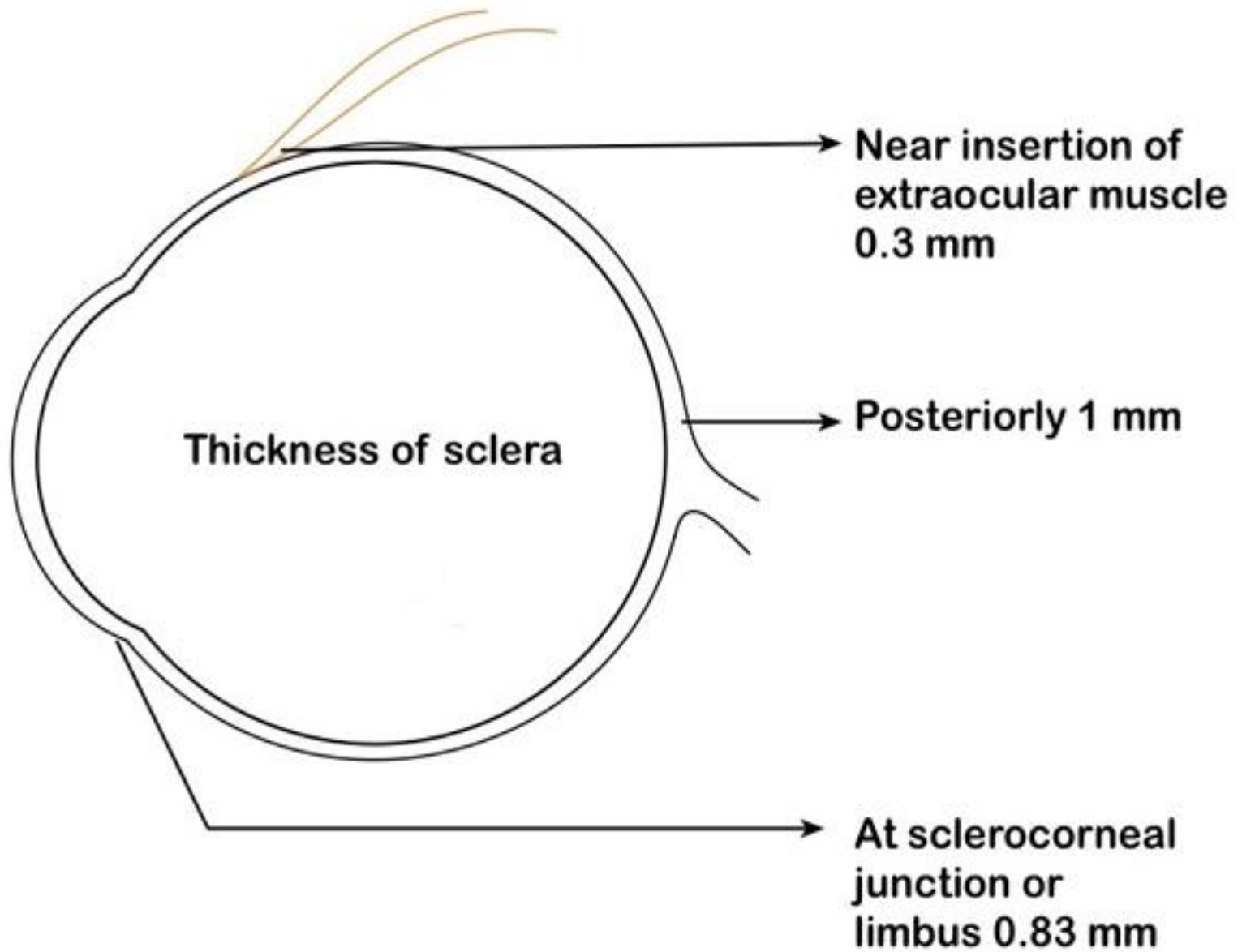
- Embryologically like corneal stroma and endothelium, sclera originates from mesoderm.
- The human sclera is white in colour. This white appearance is because of the scattering of all wavelengths of light by dense irregular bundles of collagen in sclera.

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- In children, a bluish hue is observed because of the extremely thin sclera which allows the visibility of underlying choroid. In older age the sclera may appear slightly yellowish because of the deposition of fat

Thickness of sclera

- Sclera is thicker in males than in females.
- Human sclera is thickest near the optic nerve, where it is approximately 1 mm in thickness and thinnest at the insertion of extra ocular muscles (0.3 mm).
- The tendon of the extra ocular muscles are of same thickness here at this point of insertion, so with merging of these tendons, the collective thickness of sclera reaches to 0.6 mm here.
- Sclera gradually thickens towards cornea and at limbus the thickness of sclera is 0.83 mm.



Parts

- Ultra-structurally, Sclera can be divided into three parts:
 1. Episclera
 2. Sclera proper
 3. Lamina Fusca

Episclera

- The episclera is the thin densely vascularized layer of connective tissue overlying the sclera and situated below the tenon's capsule.
- Apart from the vessels and unmyelinated nerve fibres, it contains bundles of collagen and also cells like fibroblast and occasional melanocytes.

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- Anteriorly episclera blends with subconjunctival tissues and tenon's capsule 1 to 3 mm behind the limbus.
- It becomes very thin and indistinct posterior to the equator.
- Episcleral is supplied by anterior ciliary arteries anteriorly where as posterior ciliary artery supplies the posterior part of episclera.

Sclera proper

- sclera proper or scleral stroma is also called substantia propria. Ultrastructurally, sclera is composed of collagen bundles, elastic fibres, fibroblasts and ground substances.
- These ground substances are proteoglycans and glycoproteins.

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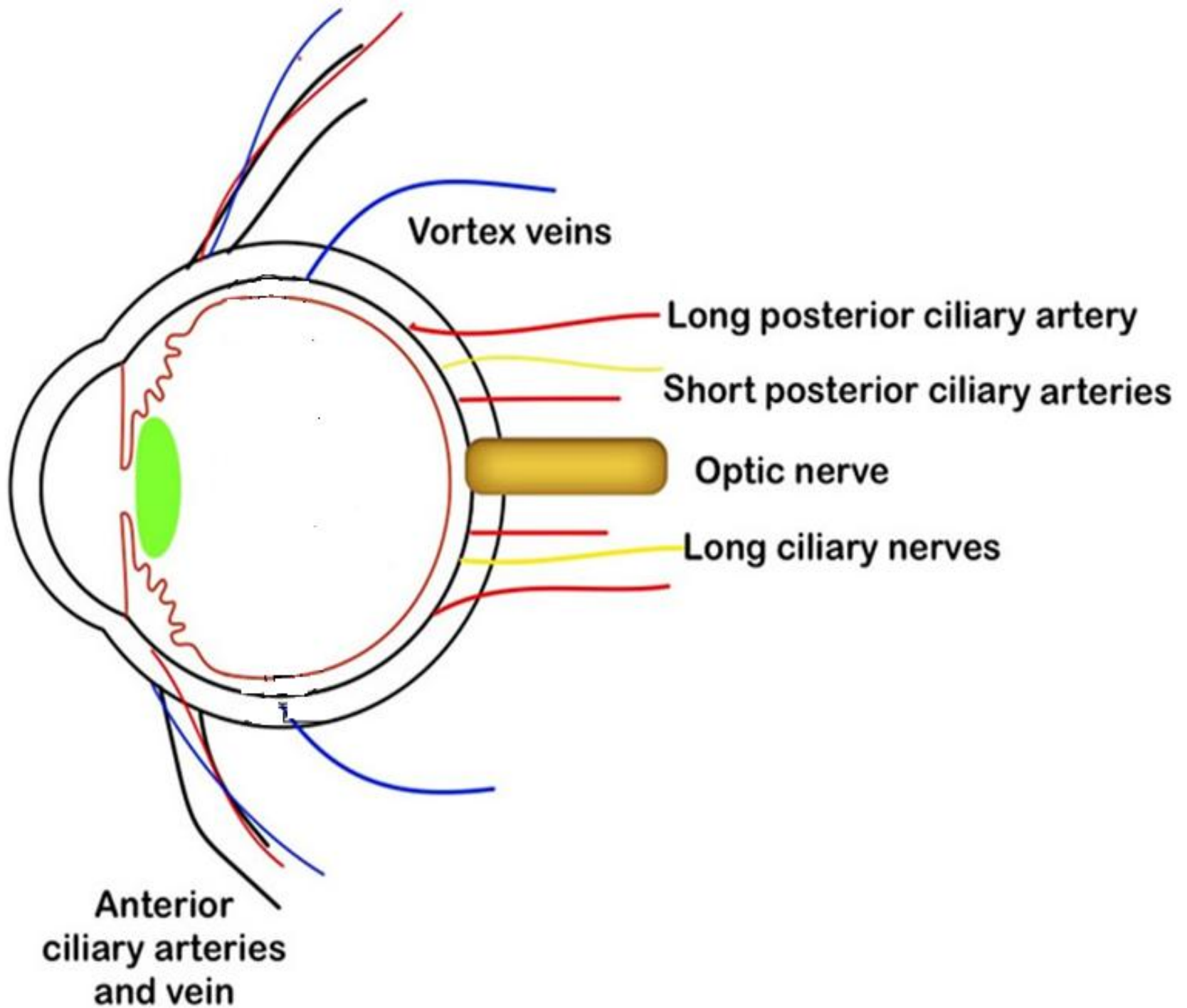
- Collagen bundles in sclera are of varying sizes and are irregularly arranged the reason why sclera is not transparent like cornea.
- These variation in scleral collagen fibres are more marked in mid-sclera, where the diameter of the fibres range from 50 to 400 nm.
- The scleral fibroblasts play an important role in synthesis and organisation of collagen, proteoglycans and glycoproteins .

Lamina Fusca

- Lamina fusca is the innermost layer of sclera. It is characterised by abundance of pigmented cells or melanocytes, mostly migrated from choroid.
- The connective tissue of this layer is loosely arranged than rest of the sclera.
- Lamina fusca is separated from choroid by a thin potential space known as suprachoroidal or perichoroidal space.

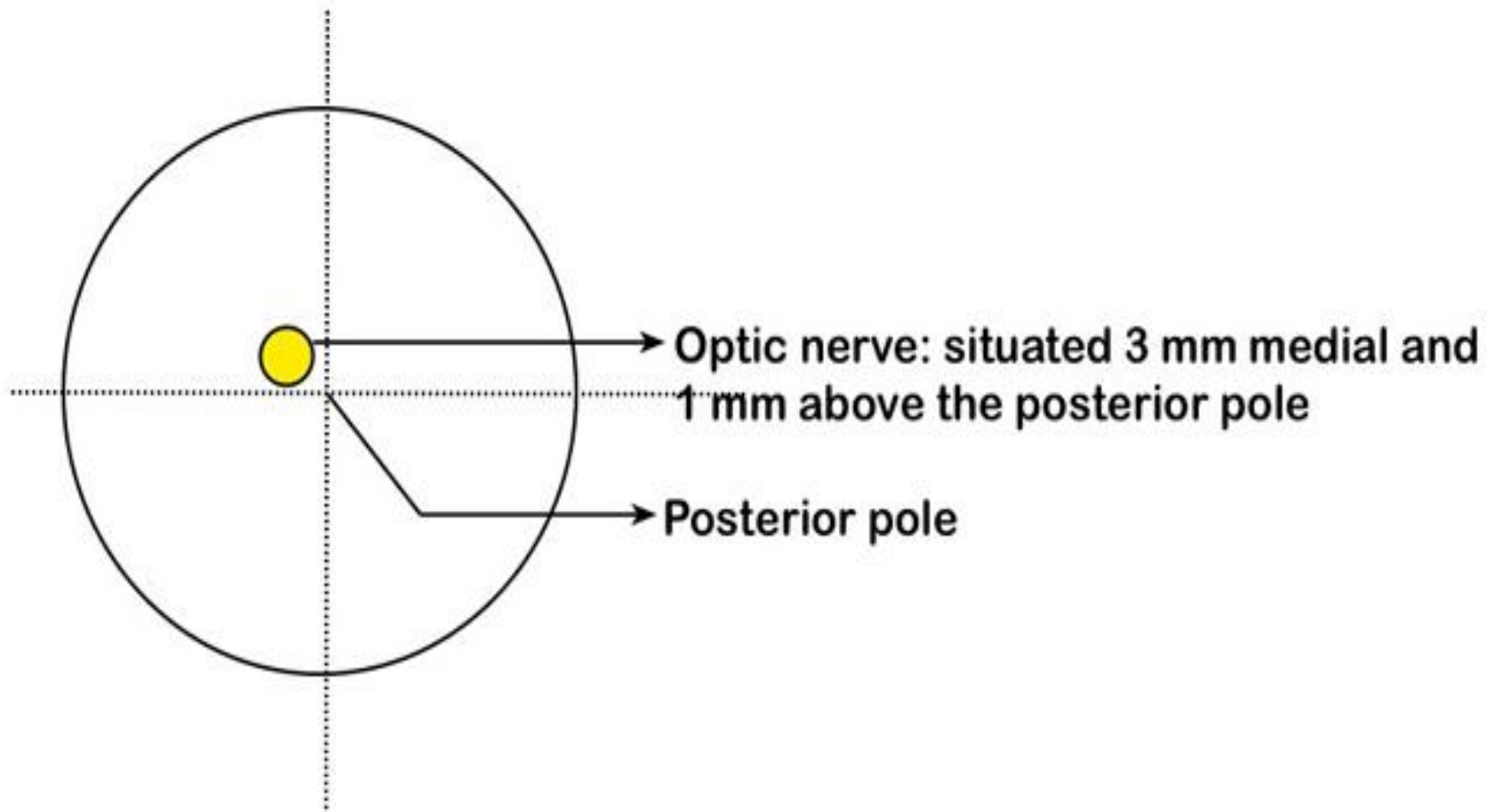
Scleral apertures

- Sclera is penetrated by various arteries and nerves in many places. We will call such penetrations as aperture and can be discussed as :
 1. Posterior scleral apertures
 2. Middle scleral aperture
 3. Anterior scleral apertures



Posterior scleral apertures

- Posteriorly sclera is pierced by many structures and can be sub divided into
Posterior scleral foramen: Sclera is perforated by optic nerve posteriorly, 3 mm medial and 1 mm superior to the posterior pole.
- At this point of optic nerve exit sclera blends with dural and arachnoid coverings of optic nerve and becomes a sieve like membrane internally
- Sclera is also penetrated by central retinal artery and veins.



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- **Other posterior apertures :**
- sclera is pierced by 8 to 20 short posterior ciliary arteries in a ring (circle of Zinn). They are often accompanied by short ciliary nerves. Little anterior to these, long posterior ciliary arteries(two in numbers) and nerves also enter the eyeball by piercing sclera.

Middle scleral aperture

- These apertures are situated approximately 4 mm behind or posterior to the equator and represent the exit of the four (occasionally 5) vortex veins. Vortex veins drain the veins of choroid, ciliary body, and iris.

Anterior scleral apertures

- these are located near the insertions of the recti muscles and allow entry of anterior ciliary arteries.

Few special landmark zones of sclera:

- **Scleral sulcus and Scleral spur** : Discussed in anatomy of angle of anterior chamber.
- **Sclerocorneal junction or limbus** : Discussed in anatomy of cornea
- **Canal of Schlemm**: Discussed in anatomy of anterior chamber

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- **Lamina cribrosa:** Sclera is thinned with a sieve like appearance where the optic nerve fibres pierce and this region of sclera is called lamina cribrosa. However through one of these sieves, which is comparatively larger than the others, the central retinal artery and vein enter the eye .

Blood supply

- The episclera receives its blood supply from the anterior ciliary arteries, anterior to the insertions of the rectus muscles and the long and short posterior ciliary arteries.
- Scleral stroma is relatively avascular and receives its nutrition mainly from episcleral vascular bed and, to some extent from the underlying choroidal vasculatures.
- The sclera contains numerous channels or passages through which the arteries, veins and nerves pass. These channels or passages are known as emissary canals.

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Vascular plexuses	Locations	Vessels	Mobility of vessels	Colour (when inflammaed)	Clinical importance
Conjunctival plexus	Most superficial	Arteries are tortuos and veins are straight.	Freely mobile	Bright red	Congested in conjunctivitis. Blanched with topical vasoconstrictor.
Superficial episcleral plexus	Lies at the level of Tenon's capsule	Vessels are straight with radial configuration.	Mobile over deeper layers	Salmon pink	Congested in episcleritis. Blanched with topical vasoconstrictor.
Deep vascular plexus	Lies deep to the Tenon's capsule and over sclera	Vessels are arranged in criss cross pattern.	Immobile	Violeaceous	Congested in scleritis. Does not blanch with topical vasoconstrictor.

Nerves supply

- Sclera is richly supplied with nerves. The posterior ciliary nerves enters the sclera near the optic nerve. **The anterior part** of sclera is mainly innervated by the two long posterior ciliary nerves and **posterior part** receives nerve supply from numerous short posterior ciliary nerves.

- Thank you