

NCLE Basic Exam Review
Domain I - Ocular Anatomy,
Physiology and Pathology;
Domain II – Refractive Errors



Developed by the National Federation of
Opticianry Schools

Mr. Steven B. Indelicato

7:15 AM – 8:15 AM



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Mr. Steven B. Indelicato has no financial interests to disclose.

NCLE Basic Exam Review
Domain I - Ocular Anatomy, Physiology and Pathology (10%)
Domain II – Refractive Errors (8%)
7:15 AM – 8:15 AM
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I. Knowledge of Ocular Anatomy, Physiology and Pathology

A. Adnexa Oculi:

- a. Accessory structures that are considered part of the eye, but not the eyeball itself: eyelids, eyelashes, tears, lacrimal apparatus, accessory glands and extrinsic muscles and orbit

B. Glands of the eyelids:

- a. **Meibomian Glands** – sebaceous gland in the eyelid behind the gray line
- b. **Glands of Zeiss-** sebaceous oily gland and is located around the eyelid cilia and follicles of the eyelashes
- c. **Glands of Moll** – are sweat glands
- d. **Glands of Wolfring and Krause** – located inside the lids near the fornix and are accessory glands of the lacrimal gland
- e. **Lacrimal gland** – secretes tears
- f. **Goblet Cells** – secrete mucin and are found in the lid conjunctiva

C. Conjunctiva:

- a) Lines the inside of the eyelids and covers the sclera
- b) 3 parts: **Palpebral, Bulbar & Fornix**
- c) Helps lubricate the eye by producing tears and mucus

D. Tear Film:

- a) Functions
- b) 3 Layers (Sebaceous/Lipid, Aqueous/Lacrimal, Mucoïd/Mucin)
- c) **Break-up time (BUT)** – Interval between a complete blink and the first randomly distributed dry spot (10-40 seconds in normal).
- d) **Schirmer Test-** Determines if eye produces enough tears via placing a strip in the lower eyelid.
- e) **Rose Bengal-** Reddish-purple dye used to detect damaged superficial corneal and conjunctival cells
- f) **Jones Test-** Evaluates tear drainage system function. This test measures the length of time for fluorescein dye to appear inside the nose after being instilled in the cornea.

E. **Eyelids:**

- a) **Palpebral fissure** is 30 mm H / 10 mm V
- b) Upper lashes are longer and curl up and there about 100 – 150 lashes
- c) Bottom lashes turn downward and number about 50 - 75

F. **Corneal Topography:**

- a) Transparent and Avascular
- b) Main Refracting Surface of the eye
- c) Convex, aspheric and smooth and tends to flatten toward the periphery.
- d) The average refractive power of the cornea is about **+43.00 D**
- e) The Average corneal thickness is about .52mm
- f) **Horizontal Visible Iris Diameter** = 11.5 mm x 10.5 mm

G. **Zones of the Cornea:**

a) **Apical Zone**

- a. Regular in shape
- b. Referred to as Corneal Cap
- c. Displaced up and in nasally
- d. Points: Visual Center, Apex & Geometric Center of the Cornea

b) **Transition Zone**

- a. Area between the Apical zone and the limbus
- b. Area of the cornea with the greatest aspheric curvature
- c. In this zone the cornea flattens out more temporally than nasally

c) **Limbal Zone**

- a. Area near the periphery of the cornea about 1 mm adjacent to the sclera
- b. Area is not well defined and blends into the Transition Zone of the cornea

H. **Sulcus:**

- a. Depression or “ditch” around the cornea and is divides the cornea from the sclera. Usually referred to as the external boundary of the cornea

I. **Layers of the Cornea (5):**

- a. **Epithelium**- Outermost layer of the cornea and is 5-6 layers thick (has 3 cell layers)
- b. **Bowman’s Membrane**- Thin elastic acellular membrane of stromal collagen; if damaged will scar. Cannot be separated from the stroma
- c. **Stroma**- middle layer of the cornea and makes up about 90% of total corneal thickness. If damaged, the stroma will leave a scar.

- d. **Descemet's Membrane**- Elastic membrane secreted by the endothelium. Will reform is damaged.
- e. **Endothelium**- innermost layer of the cornea. Cells are “hexagonal” in shape.
Disorders: Polymegethism – variation in cell size
Polymorphism – variation in cell shape
Endothelial Guttata- deposits

J. Corneal Transparency and Metabolism:

- a. Osmosis
- b. Endothelial or Metabolic Pump
- c. *Corneal Deturgescence* – State of dehydration, 25% - 30% dehydration

K. Metabolic Pump:

- a) **Glucose** – form of energy is supplied to the endothelium by the aqueous humor
- b) **ATP** (Adenosine tri-phosphate) is formed when glucose breaks down into the nucleus of the cells creating a pumping action, therefore maintains the proper water balance in the cornea

L. Edema:

- a) Swelling of corneal tissue and results when forces normally dehydrating the cornea are overcome by forces driving water into the cornea.
- b) Instrumentation: Pachometer, Keratometry, Slit Lamp
- c) Gross Edema: reversible form of edema, swelling of epithelial cells
- d) Microcystic Edema: Non-reversible edema that involves cell death at the epithelium. Caused by OWS

M. Anterior Chamber:

- a) Posterior to cornea and anterior to iris
- b) Contains aqueous humor
- c) Trabecular Meshwork- Provides an exit for the aqueous humor
- d) Canal of Schlemm- After aqueous flows through the trabecular meshwork, excess aqueous flows to the Canal of Schlemm

N. Posterior Chamber:

- a) Behind the iris and bounded by the posterior iris surface the lens the anterior vitreous and the ciliary body

O. Important Anatomy:

- b) **Aqueous Humor:** Provides oxygen and glucose to cornea and lens

- c) **Sclera** (Fibrous Tunic)- Outermost tunic made up of fibrous connective tissue. Known as the white of the eye
- d) **The Iris:** Filters light and UV rays due to pigmentation. Controls light by dilating and constricting pupil
- e) **Pupil size:** Varies with individual (average adult – 3-4 mm.). Changes size with intensity of illumination
- f) **Choroid:** posterior portion of the Uveal tract. Composed of blood vessels and lies between the sclera and retina. It provides blood supply for the outer cells of the retina.
- g) **Crystalline Lens:** located immediately behind the iris. Clear, membrane-like structure that is quite elastic
- h) **Ciliary Muscle:** band like structure that encircles the inside of the eye from the iris root to the anterior edge of the retina attached to the ora serrata (accommodation process).

P. Retina:

- a) innermost layer of the eye
- b) converts light entering the eye via nerve impulses
- c) **Layers:** photoreceptors: Rods (Night Vision) & Cones (Day/Color Vision)

Q. Ocular Pathology: eye care professional must be aware of medications, diseases and viruses that can affect the fitting of contact lens.

- a) Considerations: Alcohol, Diabetes, Arthritis, HIV
- b) **Hordeolum** (Stye): Blocked Zeiss gland
- c) **Chalazion:** Blocked meibomian gland
- d) **Blepharitis:** Inflammation of eyelid margins
- e) **Herpes Zoster Ophthalmicus** (Shingles): Adult chicken pox
- f) **Ectropion:** Outward turning of the eyelid
- g) **Entropion:** Inward turning of the eyelid
- h) **Blepharoptosis:** Paralysis of levator muscle
- i) **Dacryocystitis:** Inflammation of the lacrimal sac
- j) **Subconjunctival Hemorrhage:** Blood behind bulbar conjunctiva
- k) **Pinguecula** Benign, yellowish tumor of bulbar conjunctiva
- l) **Pterygium:** Triangular overgrowth of bulbar conjunctiva
- m) **Conjunctivitis:** Inflammation of conjunctiva
- n) **Giant Papillary Conjunctivitis** (GPC): Papillae form over tarsal region of upper lid
- o) **Vernal Keratoconjunctivitis** (VKC): recurrent ocular inflammatory disease that occurs seasonally.
- p) **Episcleritis:** benign, self-limiting inflammatory disease
- q) **Arcus Senilis-** old age syndrome where there is a white, grey, or blue opaque ring in the corneal margin (peripheral corneal opacity), or white ring in front of the periphery of the iris

- r) **Bullous Keratopathy**- small vesicles, or bullae, are formed in the cornea due to endothelial dysfunction.
- s) **Aniridia**- absence of the iris
- t) **Congenital Coloboma**- missing pieces of tissue in structures that form the eye
- u) **Nevus**- birthmark
- v) **Fuch's Dystrophy**- innermost layer of cells in the cornea undergoes degenerative changes(endothelium)

II. Domain II: Refractive Errors

- a) **Emmetropia**- no refractive error is present when accommodation is at rest
- b) **Myopia**- focusing defect created by over powered eye.
- c) **Hyperopia**- condition in which the eye is underpowered
- d) **Astigmatism**- Condition in which rays of light are not refracted equally in all directions so that a point focus on the retina is not attained.
- e) **Simple Hyperopic Astigmatism**- Plano sphere and plus cylinder
- f) **Simple Myopic Astigmatism**- Plano sphere and minus cylinder
- g) **Compound Hyperopic Astigmatism**- Both rays of light focus behind the retina
- h) **Compound Myopic Astigmatism**- Both rays of light focus before the retina
- i) **Mixed Astigmatism**- One ray focused in front of retina and one behind the retina
- j) **Presbyopia**- natural lens can no longer control the eye's way of changing its focusing distance (accommodation).
- k) **Anisometropia**- Very different correction needed in eyes
- l) **Antimetropia**- Very different correction needed in eyes and one eye is minus and the other the eye is plus
- m) **Aniseikonia**- Unequal size and/or shape of retinal images
- n) **Amblyopia**- Loss of vision due to other than normal refractive error
- o) **Suppression**- When the image on one retina interferes with the message from the other retina of the straight eye. does not enter consciousness
- p) **Aphakia**- Crystalline lens not in place