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

8:30 AM - 9:30 AM

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VISION EXPO

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%)
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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 Cell**s – 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, Mucoid/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 acelluar 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 Schlemn- After aqueous flows through the trabecular meshwork, excess aqueous flows to the Canal of Schlemn

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