

GUIDELINES

<i>Academic discipline</i>	HUMAN ANATOMY
Module №	2
Content module №	5
The theme of the lesson	Anatomy of eye, its structures and conduction path of the visual sensory system
Course	I
The number of hours	3

1. The relevance of the topic:

By means of vision man receives 75-80% of the information from the outside environment. By means of vision human orients himself in the environment, performs his professional duties. Visual sensory system consists of two visual organ's parts – peripheral part and central part. Subcortical centers and cortical end are included into the central part of the visual sensory system. By means of cortical end the visual sensory system analyzes and conducts synthesis of visual objects. Knowledge of the normal eye pattern and its structures is necessary for ophthalmologist. Many internal diseases may affect the eyeball (hypertension, diabetes). Congenital deformities of the eyeball and auxiliary apparatus of eye are determined frequently enough.

2. Specific objectives:

- to determine eye structures
- to explain external structure of the eyeball
- to analyze structure and function of each layer of the eyeball
- to analyze structure and function of the intraocular core
- to explain optic nerve structure
- to analyze conduction path of the visual sensory system
- to draw the scheme of the visual sensory system conduction path
- to classify additional structures of eye
- to analyze external muscles of the eye globe
- to classify eye's protective system, analyze its structure and function
- to analyze structure and function of the lacrimal apparatus
- to explain the eyeball's development
- to analyze congenital defects of the eyeball

3. Basic knowledge and skills

Previous courses of study	Acquired skills
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1. Medical physics	To describe physical basis of light transmitting through refractive mediums of the eyeball
2. Anatomy divisions	
- osteology	To describe anatomy structure of the eye socket on the skull. To determine and demonstrate eye socket's fenestrations
- central nervous system	To determine and demonstrate subcortical centers of vision on the mount of the cerebrum and cortical end of the visual analyzer.

4. Tasks for independent work during preparation to practical classes.

4.1. A list of the main terms, parameters, characteristics that need to be learned by the student during the preparation for the lesson.

term	definition
<p>Eyeball (anterior pole of eyeball, posterior pole of eyeball, equator of eyeball, outer axis, inner axis, optic axis).</p> <p>Fibrous tunic of the eyeball (cornea, sclera)</p> <p>Uveal tract (choroid, ciliary body, iris).</p> <p>Ciliary body (ciliary wreath, ciliary processes, ciliary ring, ciliary muscle).</p> <p>Iris (pupil, constrictor pupillae, dilator pupillae muscle).</p> <p>Retina (blind part, visual part). Visual retina (pigmented layer, nervous layer).</p> <p>Neurons of visual retina's nervous layer (bacillary layer (rods and cones), bipolar neurons, and ganglionic neurons).</p> <p>Optic nerve.</p> <p>Inner core of the eyeball (crystalline lens, chambers of the eyeball – anterior chamber, posterior chamber,</p>	

<p>vitreous chamber). Auxiliary apparatus of eye. External muscles of the eyeball. Protective structures of eye (brows, palpebrae, conjunctiva). Lacrimal apparatus (lacrimal gland, lacrimal duct, lacrimal lake, lacrimal papilla, lacrimal canaliculi, lacrimal sac, nasolacrimal duct).</p>	
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4.2. Theoretical questions for the lesson:

1. To specify eye parts and structures.
2. Name eyeball's layers.
3. Name parts of the fibrous tunic of the eyeball, determine their functions.
4. Name parts of the uveal tract; determine their structure and functions briefly.
5. Name parts of the retina, determine their functions.
6. Name components of the inner core of the eyeball.
7. Describe structures and functions of the crystalline lens.
8. Name chambers of the eyeball and describe their borders.
9. Describe structures and aqueous humor's circulation tract.
10. Name refractive mediums of the eyeball one by one.
11. Name auxiliary apparatus of eye, determine its functions.
12. Name external muscles of the eyeball, determine their functions.
13. Name parts of the lacrimal apparatus, determine ways of the tears' outflow pathway.
14. Describe structures and duct of the second pair of cranial nerves
15. Determine bodies of the first, second and third neurons of the conduction tract of the the visual sensory system, call subcortical centers of vision and location of the cortical end of the the visual sensory system.

4.3. The list of standard practical skills:

Eyeball

Fibrous tunic of the eyeball

Sclera

Cornea

Uveal tract

Choroid

Ciliary body

Iris

Pupil

Retina

Crystalline lens

Vitreous body

Auxiliary structure of eye

External muscles of the eyeball

Lateral rectus muscle

Superior rectus muscle

Medial rectus muscle

Inferior rectus muscle

Superior oblique muscle

Inferior oblique muscle

Brow

Upper palpebral

Lower palpebra

Conjunctiva

Upper conjunctival fornix

Lower conjunctival fornix

Lacrimal gland

The content of the topic:

Among eye structures there are eyeball, optical nerve, and auxiliary structures of eye. Eyeball realizes visual function. Auxiliary structures of eye carry out protective, supporting and motion function. Eyeball is situated in the eye socket (orbit), it has irregular round shape with a convex front part. The weight of the eyeball is 7,5 g, its volume is 7,2 cm.

Eyeball has 3 layers – fibrous tunic, uveal tract and retina.

Fibrous tunic is the external layer, it has 2 parts: front – cornea and back – sclera. Cornea occupies 1/5th of the fibrous tunic, it is transparent. Sclera is not transparent, it realizes protective function.

Uveal tract is formed by 3 parts: choroid, ciliary body and iris. Choroid forms back 2/3^d of the uveal tract, it contains numerous vessels, which provide retina's trophism. Ciliary body (corpus ciliare) – occupies the middle part of the uveal tract. There are 2 parts in it – ciliary ring (back) and ciliary end (front). Ciliary body contains unstriated ciliary muscle, which provides accommodation. Ciliary end contains 70 ciliary processes, which evolve aqueous humor. Iris forms the frontal part of the uvea coat. In the center of iris there is pupil, through which ray of light gets to retina. Diameter of the pupil regulates by 2 unstriated muscles – constrictor pupillae and dilator pupillae, which are buried in a layer of iris. In a connective tissue stroma of iris there are pigmented cells, which determine color of iris.

Retina is the inner coat of the eyeball; it consists of 2 parts – blind and visual. Visual part of retina is formed by 2 layers – external pigmented and internal nervous. External pigmented layer absorbs excessive light. Inner nervous coat is formed by layers of neurons, external by photoreceptor nervous cells, which conceive light quanta. By external shape photoreceptor cells are divided into rods and cones

Rods are in charge of twilight black and white vision; their number is about 130 million. Cones are in charge of color day vision; their number is about 7 million. Cones are concentrated in the center of retina, in yellow spot. Under the influence of light quanta the special pigment is ruined in rods and cones and nervous impulse is generated, which is transmitted to another layer of

retina's neurons, which is formed by bipolar neurons. Impulses from bipolar neurons go to ganglionic neurons, which form the inner layer of retina. Processes of ganglionic neurons form the optic nerve (2nd pair of cranial nerves), which transmits impulses to CNS.

Eyeball holds inner core, the crystalline lens and other light-refracting structures are included to its structure, which fill the chambers of eyeball (anterior chamber, posterior chamber, vitreous chamber). Cornea, aqueous humor, crystalline lens and vitreous body are light-refracting structures of eye. The vitreous body is situated between crystalline lens and retina and fills vitreous chamber. The vitreous body is transparent jelly-like substance, which executes trophic and plastic function; it is light-refracting structure. The crystalline lens is transparent concavo-convex lens; it is situated in a transparent capsule. The contraction or relaxation of ciliary muscle determines diameter of crystalline lens, which provides accommodation – changing of its refracting power. The aqueous humor, synthesized by processes of the ciliary body, gets to the back chamber, then through the pupil it flows to the front chamber and through the space of iridocorneal angle gets to venous sinus of sclera, and then to veins of sclera.

To auxiliary structures of eye belong connective tissue structures of eye socket: periosteum of eye socket, orbital septum, sheath of eyeball, adipose body of orbit, muscular fascia, episcleral space, performing protective and plastic function.

External muscles of eyeball – superior, medial, inferior, lateral rectus muscle, superior and inferior oblique muscles provide eyeball's movements. Levator muscle of the eyelid also belongs to external eyeball's muscles.

To protective apparatus of eye belong brows palpebrae and connective coat – conjunctiva. Brows and palpebrae (lower and upper) provide protective function. Conjunctiva covers eyeball from outside and inlays inner surface of palpebrae, provides protective function.

Lacrimal apparatus includes lacrimal gland and lacrimal passages, which divert tears (lacrimal canal, lacrimal lake, lacrimal papilla, puncta lacrimalia, lacrimal canaliculi, lacrimal sac, nasolacrimal duct).

Scheme of the conduction tract of the visual sensory system: nerve cell body I – photoreceptor cells of retina (rods and cones), nerve cell body II – bipolar cells of retina, nerve cell body III – ganglionic retina's cells, its

processes form optic nerve. The optic nerve through optic canal gets to the cranial cavity. Right and left optic nerve form optic chiasma: fibers of the optic nerve from the external part of retina do not cross and continue to the optic tract of its side, and fibers of the optic nerve from the inner part of retina cross, they are included to the optic tract of the opposite side. Every optic tract is divided into 2 roots – lateral and medial. Lateral roots end in the subcortical center of vision – on the upper tuberosity of the quadrigeminal plate of the mesencephalon's tectum. Lateral roots end in subcortical centers of vision – lateral geniculate body and partly in thalamus' pulvinar - nerve cell body IV. Processes of the nerve cell body pass through posterior crus of the inner capsule, and as a part of optic radiation get to Brodmann areas 17, 18, 19 in the occipital lobe of neencephalon's hemisphere.

Anatomy of eye, its structures

and conduction path of the visual sensory system

1. Patient, 28 y.o., at manufacturing site, suffered chemical burn of the face, the liquid hit his eye. The patient lost his vision. Which structure of his eyeball was damaged by chemical burn?

- A. Crystalline lens
- B. Cornea
- C. Vitreous body
- D. Retina
- E. Iris

2. The patient after stroke lost the ability to recognize familiar faces, letters, words (alexia), there is a disorientation in environment, cannot imagine ward's planning and location of bed, table (visual-spatial agnosia), all subjects seem small to him (micropsia), the vision is kept, in which section of cerebrum's cortex pathological process is located?

- A. Gyrus frontalis medius.
- B. Gyrus frontalis superior.
- C. Gyrus angularis.
- D. Gyrus supramarginalis.
- E. Gyrus precentralis.

3. Festering of soft tissues of eye socket appeared after injury. Through which anatomic structure purulent process may spread to the pterygopalatine fossa?

- A. fissura orbitalis inferior
- B. foramen rotundum

- C. fissura orbitalis superior
- D. foramen sphenopalatinum
- E. superior orbital fissure
- F. foramen zygomaticoorbitale

4. The hemorrhage occurred in occipital part of posthippocampal area. What body functions were disturbed?

- A. no movement
- B. no hearing
- C. no olfaction
- D. no vision
- E. no sensitivity

5. The palpebral fissure of the patient on the right is larger, than left. Function of which muscles of facial expression is damaged?

- A. M. orbicularis oculi.
- B. M. procerus.
- C. M. corrugator supercilii.
- D. M. occipitofrontalis (venter frontalis).
- E. M. zygomaticus major.

6. suffers from paralysis of eye muscles, pupils' deformation, and pain along the trigeminal nerve? Which venous sinus is disturbed?

- A. Sinus transversus.
- B. Sinus sagittalis superior.
- C. Sinus cavernosus.
- D. Sinus petrosus superior.
- E. Sinus occipitalis.

7. A patient's papillary reflex is disturbed. Pupils are wide; a patient cannot watch the light. Function of which eyeball's muscle is disturbed?

- A. M. sphincter pupillae.
- B. M. dilatator pupillae.
- C. M. ciliaris.
- D. M. obliquus superior.
- E. M. obliquus inferior.

8. A person after 40, the accommodation is defective due to aging changes. Which muscle of the eyeball provides the process of accommodative tension during the near vision?

- A. M. constrictor pupillae.
- B. M. ciliaris.
- C. M. dilator pupillae.
- D. M. rectus superior.

E. M. rectus inferior.

9. Patient's nasal bones and orbit's wall were broken after facial injury. The doctor determined that the right eyeball could not turn laterally down. Which eye muscle is damaged?

A. M. rectus medialis.

B. M. rectus lateralis.

C. M. obliquus superior.

D. M. obliquus inferior.

E. M. rectus inferior.

10. A man has recurrent inflammation of the eyelid cartilage glands, which produce sebaceous humor. Where glandulae tarsales open?

A. Caruncula lacrimalis.

B. Raphe palpebralis lateralis.

C. Free palpebra's border near limbus palpebralis posterior.

D. Free palpebra's border near limbus palpebralis anterior.

E. Canalis nasolacrimalis.

Answers:

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
<u>B</u>	<u>C</u>	<u>A</u>	<u>D</u>	<u>A</u>	<u>C</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>C</u>