

Physics of Medical Devices

Fourth lecture

Ophthalmic System

Msc. Eman Ahmed

Third Stage

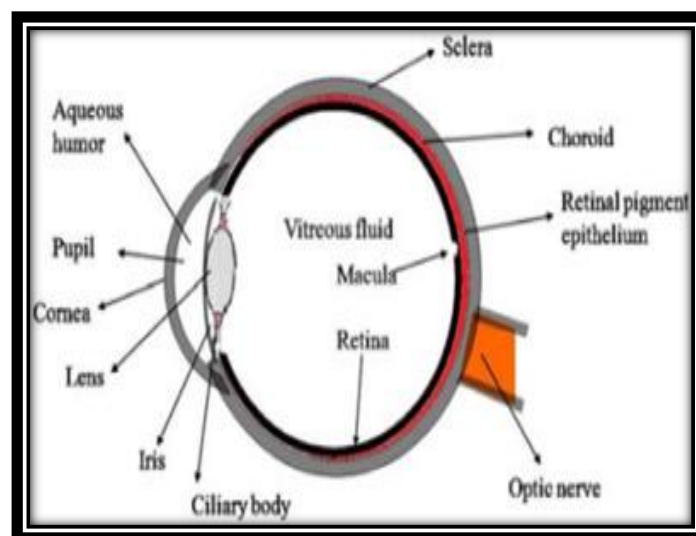
Department of medical physics

Al-Mustaqbal University-College

2021- 2022

The Ophthalmic System

Ophthalmology is a branch of medicine that deals with the diagnosis and treatment of eye disorders. An ophthalmologist is a physician who specializes in eye care. The credentials include a degree in medicine, followed by additional four to five years of residency training in ophthalmology. Residency training programs for ophthalmology may require a one-year internship with training in internal medicine, pediatrics, or general surgery. Additional specialty training (or fellowship) may be sought in a particular aspect of eye pathology. Ophthalmologists are allowed to prescribe medications to treat eye diseases, implement laser therapy, and perform surgery when needed. Ophthalmologists typically provide specialty eye care - medical and surgical and they may participate in academic research on eye disorders.



The eye is a composite organ comprised of unique structures with distinct structure and functions that work together for the perception of sight. Structures like the cornea, the crystalline lens, and the vitreous humor are avascular structures, while the uveal tract is primarily the vascular layer of the eye. The retinal neuro-circuitry is complex and situated deep inside the eye and is a derivative of neuroectoderm. Similar to the blood-brain

barrier, there is the blood–retina barrier in the eye. The limited external surface area and the deep isolated location of the different structures of the eye along with a vascularity of some of the structures and the blood–retina barrier pose unique challenges for delivery of drugs to intraocular structures.

Diseases

A partial list of the most common diseases treated by ophthalmologists include

- Cataract
- Excessive tearing (tear duct obstruction)
- Proptosis (bulged eyes)
- Eye tumors
- Diabetic retinopathy
- Dry eye syndrome
- Glaucoma
- Macular degeneration
- Refractive errors
- Strabismus (misalignment or deviation of eyes)
- Uveitis

Diagnosis

Eye examination

Following are examples of examination methods performed during an eye examination that enables diagnosis

- Ocular tonometry to determine intraocular pressure
- Refraction assessment
- Retina examination
- Slit lamp examination
- Visual acuity

Specialized tests

Optical coherence tomography (OCT) is a medical technological platform used to assess ocular structures. The information is then used by physicians to assess staging of pathological processes and confirm clinical diagnoses. Subsequent OCT scans are used to assess the efficacy of managing diabetic retinopathy, age-related macular degeneration, and glaucoma. Ultrasonography of the eyes may be performed by an ophthalmologist.

Ophthalmic surgery

For a comprehensive list of surgeries performed by ophthalmologists, see eye surgery.

Eye surgery, also known as ocular surgery, is surgery performed on the eye or its adnexa by an ophthalmologist. The eye is a fragile organ, and requires extreme care before, during, and after a surgical procedure. An eye surgeon is responsible for selecting the appropriate surgical procedure for the patient and for taking the necessary safety precautions.

Slit lamp

A **slit lamp** is an instrument consisting of a high-intensity light source that can be focused to shine a thin sheet of light into the eye. It is used in conjunction with a biomicroscope. The lamp facilitates an examination of the anterior segment and posterior segment of the human eye, which includes the eyelid, sclera, conjunctiva, iris, natural crystalline lens, and cornea. The binocular slit-lamp examination provides a stereoscopic magnified view of the eye structures in detail, enabling anatomical diagnoses to be made for a variety of eye conditions. A second, hand-held lens is used to examine the retina.





The Illuminations system

various methods of slitlamp illumination are required to obtain full advantage of slit-lamp biomicroscope. There are mainly six type of illuminating options:

1. Diffuse illumination,
2. Direct focal illumination,
3. Specular reflection,
4. Transillumination or retroillumination,
5. Indirect lateral illumination or Indirect proximal illumination and
6. Sclerotic scatter.

Oscillatory Illumination is sometimes considered an illumination technique. Observation with an optical section or direct focal illumination is the most frequently applied method of examination with the slit lamp. With this method, the axes of illuminating and viewing path intersect in

the area of the anterior eye media to be examined, for example, the individual corneal layers.

Diffuse illumination

If media, especially that of the cornea, are opaque, optical section images are often impossible depending on severity. In these cases, diffuse illumination may be used to advantage. For this, the slit is opened very wide and a diffuse, attenuated survey illumination is produced by inserting a ground glass screen or diffuser in the illuminating path. "Wide beam" illumination is the only type that has the light source set wide open. Its main purpose is to illuminate as much of the eye and its [adnexa](#) at once for general observation.



Direct focal illumination

Observation with an optical section or direct focal illumination is the most frequently applied method. It is achieved by directing a full-height, hairline to medium width, medium-bright beam obliquely into the eye and focusing it on the cornea so that a quadrilateral block of light illuminates the transparent medias of eye. Viewing arm and illuminating arm are kept

parfocal. This type of illumination is useful for depth localization. Direct focal illumination is used for grading cells and flare in anterior chamber by shortening height of beam to 2–1 mm.

