***AL- Mustaqbal University***

**Optometry Department**

**Lec.1**

Optical Instruments

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MCS

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**Introduction**

Optical instruments are the devices that process light waves to enhance an image for a more clear view. The use of optical instruments, such as a magnifying lens or any complicated device like a microscope or telescope, usually makes things bigger and helps us see in a more detailed manner. The use of converging lenses makes things appear larger, and on the other hand, diverging lenses always give smaller images.

While using a converging lens, it’s important to remember that if an object is at a larger distance then the image is diminished and will be very nearer to the focal point. While the object keeps on moving in the direction of the lens, the image moves beyond the focal point and enlarges. When the object is placed at 2F, which is two times the focal distance from the lens, the image and object become of the same size. When the object moves from 2F towards the focal point (F), its image keeps moving out of the lens and enlarges till it goes to infinity when the object reaches the focal point, F. As the object moves closer to the lens, the image moves in the direction of the lens from negative infinity and gets smaller when the object gets closer to the lens.

**Applications of Optical Instruments:**

There are many devices like telescopes and microscopes, which use multiple lenses to create images. Analyzing any system having multiple lenses shows that it works in stages where each lens forms an image of the object. The original object will work as the object for the first lens and creates an image. This new image will be the object for the second lens and so on. You can see this with these examples.

1. Retinal camera

Eye doctors use the retinal camera to take pictures of the inside of the eyes, specifically the [retina](https://www.mouqy.com/blog/retina/). It works by shining a light into your eye and taking high-resolution photos for detailed images.  
   
This will help detect any signs of damage or disease. It is quick, painless, and gives an accurate look at what’s happening inside your eyes for better diagnosis from your optometrist.

2. Phoropter

The [phoropter](https://www.mouqy.com/blog/phoropter/) determines the appropriate [lens prescription](https://www.mouqy.com/prescription-lenses/) for their patients. During an eye exam, the patient will look at an eye chart while the optometrist switches between different lenses on the phoropter.  
   
The optometrist will use the information gathered from the patient, who identifies the lens combination that provides the clearest vision, to determine the appropriate prescription.

3. Ophthalmoscope

The ophthalmoscope examines the inside of the eye.  
   
It has a light and a lens that helps the doctor see inside your eyes, akin to using a flashlight in the dark. Your optometrist may use it to detect any signs of damage or disease affecting vision, such as retinal detachment, or eye diseases, such as glaucoma.

4. Manual keratometer

The manual keratometer measures the curve of a person’s cornea. The cornea is located in the front part of the eye and helps focus light onto the retina. Its shape impacts how light enters the eye and is processed by the retina. In cases where the cornea is differently shaped, it can lead to a visual condition called [astigmatism](https://www.mouqy.com/blog/glasses-for-astigmatism/).  
   
To check for astigmatism, the keratometer shines light into the eye and measures how it reflects off two mirrors inside the instrument.

5. Tonometer

The tonometer measures the pressure inside the eye to check for any signs of conditions like glaucoma. The “puff” tonometer is the most common type, which works by puffing air into your eye and measuring how it changes shape to check for pressure levels.  
   
High pressure can damage the optic nerve, so this test helps detect early signs of glaucoma or other issues that could affect your [vision health](https://www.mouqy.com/blog/keep-eyes-healthy/).

6. Slit lamp

The slit lamp examines the front and back of the eye in detail. It combines a microscope and special light that shines into your eyes, allowing the doctor to see different parts like the cornea, iris, lens, retina, and optic nerve. Your optometrist may use it to detect issues such as scratches on your cornea, damage to your retina, and conditions like cataracts or glaucoma

7. Snellen chart

The Snellen chart measures visual acuity. Visual acuity determines how well one can see at different distances, and is recorded in the form of a fraction. For instance, having a [20/30 visual acuity](https://www.mouqy.com/blog/20-30-vision/) means they can see the chart as clearly at 20 feet away as someone with “normal” vision would see it from 30 feet away.  
   
The chart consists of rows of letters or symbols that get smaller as you move down the chart. Your eye doctor will ask you to read each row from a distance away and record your results.

8. Retinoscope

The retinoscope measures prescriptions for glasses or contacts. It shines a light into your eye and then looks at the reflection of that light on a nearby surface.  
   
This helps figure out how the light enters your eye and focuses on your retina, then calculates an accurate prescription for glasses or contacts from there. Additionally, the retinoscope can help make necessary adjustments to existing prescriptions.

THANK YOU