Image Forming Process [1]

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The human eye contains a biconvex lens that performs two important functions – refraction of light and focusing of images to the retina. The lens and retina are crucial structures of the human visual system that work hand-in-hand to execute the image forming process.

Refraction

The eyes lens system functions like a biconvex lens, as it is curved in both sides but flat only at the center part of the lens. When light rays enter the human eye, the curved surfaces bend them. This process is called refraction. Bending the light rays is necessary in order to focus an external object's image and emit the light just behind the lens, at an area called the focal point. The image is then focused on the retina. The image formed is left-right reversed and inverted. Also, the image looks smaller than the external object in view.

When the image is inverted, the superior half portion of the visual field of each eye undergoes a process of projection towards the inferior half portion of the retina. Also, the reversed image produced by the lens causes the temporal half portion of an eye's visual field to be projected on half of the nasal area of the retina. These relationships between the retinal areas and the visual field help health professionals describe visual field defects in the neuroscience point-of-view.

Accommodation

Accommodation is the ability of the lens system to change refractive properties in order to recognize nearby and distant objects by focusing their images on the retina. Distant objects, defined as more than 9 meters or 30 feet away from the eye), typically reflect or emit light that can enter the normal eye (at rest) and be focused on the retina. Nearby objects (i.e. less than 30 feet away) reflect or emit light that can be focused on the retina only after entering the cornea in greater "angle of incidence" than a distant object. The nearer the object, the greater refractive power is needed. Accommodation helps boost the refractive power of the eye by increasing the curvature of the lens. Images formed on the retina are clearer and more refined with proper lens accommodation.

Disorders

Clinical disorders related to refraction are commonly known as refractive errors [3]. One of these is astigmatism, in which the cornea forms an oval shape rather than a spherical one. In this condition, images of both near and distant objects cannot be focused on the retina, since the cornea's fixed refractive power is affected. Cylindrical lenses are used to correct astigmatism. Another is presbyopia, in which distance vision is normal, but lens accommodation is decreased. This is usually due to aging, as the lens' elasticity reduces as we age. Convex lenses are used to treat presbyopia, as they tend to increase refractive power.

Another refractive error is hyperopia, which results from either the short structure of the eyeball, or the weakness of the lens system. In this case, the images of objects located more than 30 feet from the eye cannot be focused on the retina. Uncorrected hyperopia is known as far-sightedness. Hyperopia often leads to presbyopia as the patient ages, so convex lenses are used as corrective treatment.

Lastly, myopia is a refractive error that emerges either because the eyeball is too long or the refractive power is too strong. Uncorrected myopia is referred to as near-sightedness. Concave lenses are used for myopic eyes in order to focus distant objects' images on the retina.

Links
[1] https://explorable.com/image-forming-process [2] https://explorable.com/users/sarah [3] http://www.memorialeyecenter.com/disordersrefractive.shtml