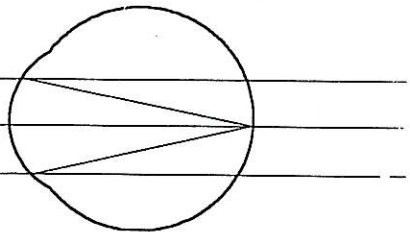
ABO PREPARATION

Week

1

Overview Of Field



Anatomy & Physiology

ABO PREPARATION COURSE

1: An Overview Of The Field Anatomy & Physiology

Published By:

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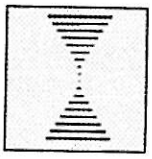
I: An Overview Of The Field

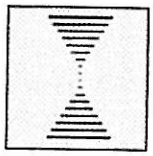


Eyecare Industry Booming

The eyecare industry in America is booming. The rapid growth, fueled by the ageing "baby boom" generation, has created what is becoming a critical shortage of trained opticians nationwide. That large segment of the population, born between 1946 and 1963, have now begun to enter their fortieth year. As we will see in Part 1 of the ABO Preparation Course, *Anatomy & Physiology,* at approximately age 40 corrective lenses for reading and other near vision activities are commonly prescribed. This condition, known as *presbyopia,* is a normal function of the ageing process and effects nearly the entire population. The result: an increasing number of people are requiring the services of eyecare professionals each year, a trend which is likely to continue well into the next century. The field of professional ophthalmic opticianry is destined to play a vital role throughout this exciting period of unprecedented growth.

But what exactly is an optician? One definition is found in the table below, and there are certainly others. Some say the optician is similar to a pharmicist, functioning to fill the doctor's prescription, a sort of ophthalmic technician. Then there are others perceive the optician as an eyecare professional, crucial to the success the general system of eyecare delivery in this country. On the following pages, using as a guide some highlights from the optician's *Job Analysis* published by the Opticians Association of America (OAA), we will attempt to define the field of opticianry and to distinguish between those who "just fill prescriptions" and those who may rightfully be regarded as ophthalmic professionals.

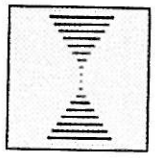
The Three "O's" Defined	
Ophthalmologist:	A medical physician who is a specialist in the diseases and defects of the eye and appendages and in the medical and surgical treatment of these diseases.
Optometrist:	One who engages in the profession or occupation of measuring vision and prescribing corrective lenses to compensate for visual defects.
Optician:	One who makes or deals in eyeglasses or other optical instruments and who fills prescriptions for glasses or contact lenses.



What Is An Optician?

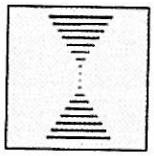
The *Job Analysis* for dispensing opticianry has been developed by the Opticians Association of America (OAA) and the American Board of Opticianry's Job Analysis Task Force in cooperation with the Professional Examination Service. The *Job Analysis* represents the basis from which the National Opticianry Competency Exam (ABO Exam) was constructed. Here, in an effort to define the term "optician," we will highlight a few of the key points found in the *Job Analysis*. A complete copy may be ordered directly from the OAA whose address is found on page 5.

Some Highlights	
PATIENT WITH PRESCRIPTION	
Gather patient eye use data	Get to know your patient's work and recreational needs. Observe condition of current or previous glasses. What did they like or dislike. In general, ascertain their needs and use professional knowledge to fill those needs.
Determine relationship between prescription and frame design	Certain prescriptions are better suited for particular frame designs. Frame material and dimensions, lens power in the various meridians, and lens material are some of the considerations.
Advise patient on frame selection	Nature of prescription, bridge design, temple length and cosmetics all require professional assistance.
Select multifocal segment style and width	Large variety of modern bifocal, trifocal, and occupational lenses require insight into patient's occupational and recreational visual needs.



Essential Tasks

Determine lens material, tint, and coating	Wide range of options require insight into patient's occupational and recreational visual needs.
CHECK NEW GLASSES RETURNED FROM LAB	
Visual exam of glasses for frame style, color, size, tint, coating, type of multifocal, general quality of workmanship.	All phases of final inspection are an integral part of professional ophthalmic dispensing. Knowledge of sphere and cylinder power, base curves, axis, prism, reading addition and ANSI tolerances is crucial. The optician is responsible for the services, products, and information dispensed to the public.
Lensometer check for optical correctness	
Mark lens and determine decentration	
Determine total decentration	
DISPENSING GLASSES TO PATIENT	
Adjust as necessary to satisfy patient	A careful frame adjustment is one of the most important phases of dispensing opticianry. An excellent refraction, precisely ground lenses, and cosmetically appealing frame will only benefit the patient when the final frame fitting is done with care and precision.



Associations In Opticianry

American Board of Opticianry (ABO):
10341 Democracy Lane
P.O. Box 10110
Fairfax, Virginia 22030-8010
(703) 691-8356

An independent corporaton for voluntary certification of dispensing opticians which, through the Professional Examination Service, administers the National Opticianry Competency Exam (NOCE).

Commission On Opticianry Accreditation (COA):
10111 Martin Luther King, Jr. Highway
Suite 110
Bowie, Maryland 20715-4299
(301) 577-4829

A nonprofit corporation. Its sole purpose is for the accrediting of ophthalmic dispensing and ophthalmic laboratory technology programs. Recognized by the U.S. Department of Education

Contact Lens Society of America (CLSA):
P.O. Box 10115
Fairfax, Virginia 22030
(703) 385-5898

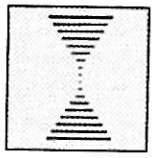
A not-for-profit national volunteer organization of individual contact lens technicians. Functions to advance the educational level of fitters in an effort to better serve the public.

Guild of Prescription Opticians of America:
10341 Democracy Lane
P.O. Box 10110
Fairfax, Virginia 22030
(703) 691-8355

Founded in 1925, and the forerunner of the Opticians Association of America, its members are independent optical firms who concentrate on dispensing and fitting eyewear and pledge to maintain high standards of quality.

National Academy of Opticianry (NAO):
10111 Martin Luther King Jr. Hwy.
Suite 112
Bowie, Maryland 20715-4299
(301) 511-4828

An independent non-profit educational organization with the sole objective to improve the educational qualifications of ophthalmic professionals who serve the public.



National Committee of State Opticianry Licensing Boards (NCSOLB):

10341 Democracy Lane
Fairfax, Virginia 22030
(703) 691-8355

Membership consists of representatives of state licensing boards. Meets annually to address issues affecting licensing of opticianry in the respective states.

National Contact Lens Examiners (NCLE):

10341 Democracy Lane
P.O. Box 10110
Fairfax, Virginia 22030-8010
(703) 691-8356

An independent corporation which, through the Professional Examination Service, administers the Contact Lens Registry Examination (CLRE) for contact lens fitters who wish to establish their credentials to serve the public. The NCLE is a member of the National Commission for Health Certifying Agencies.

National Federation of Opticianry Schools (NFOS):

10111 Martin Luther King Jr. Highway
Suite 112
Bowie, Maryland 20715-4299
(301) 577-4828

An association of opticianry schools dedicated to upgrading the standards of opticianry education.

Opticians Association of America (OAA):

10341 Democracy Lane
P.O. Box 10110
Fairfax, Virginia 22030
(703) 691-8355

The national volunteer trade and political association of retail opticianry. Promotes the business intersts of opticianry in the legislative and regulatory areas.

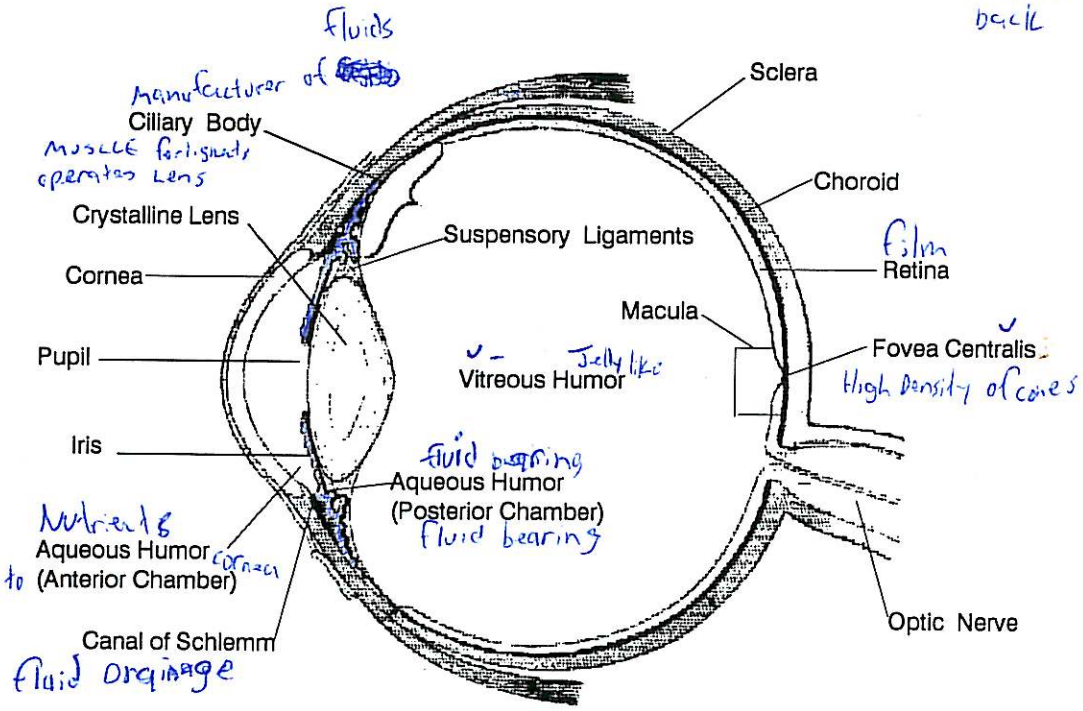
California State Board of Medical Quality Assurance (BMQ):

Division of Allied Health Professionals
1430 Howe Ave.
Sacramento, California 95825
(916) 924-2612

The California state board responsible for the registration of spectacle lens and contact lens dispensers (RSLD & RCLD).

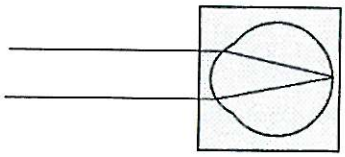
1: Anatomy & Physiology

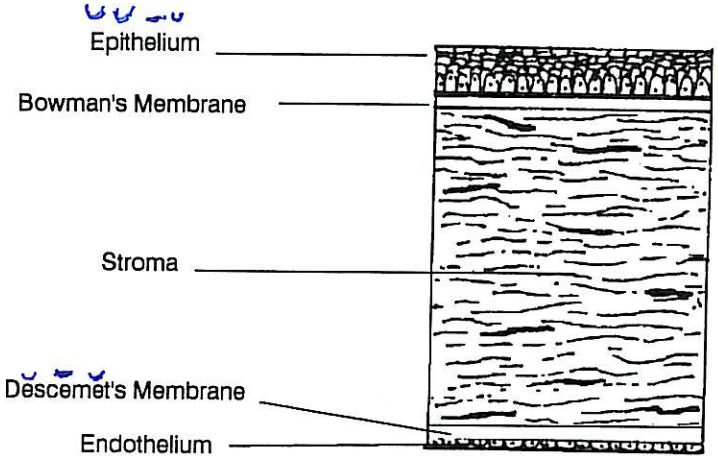
Major Ocular Structures



The eye is very much like a camera. The camera produces an image by focusing light through a system of lenses to a sharp focus upon the film. In the eye, the retina is like the film of a camera and the cornea and crystalline lens are the lenses which focus the light. The refractive power of the average cornea is equal to about 43.00 diopters while that of the crystalline lens is 17.00 diopters. The combination of these two results in a total refractive power of a full 60.00 diopters. The transparent living structures through which light passes are the tear layer, cornea, aqueous humor, crystalline lens, and vitreous humor. The term "miracle of sight" takes on new meaning when one considers how living transparent tissue, devoid of blood vessels, can focus 60 diopters of power precisely on the retina. Combined with the variable power of the crystalline lens, and the ability of the retina to adjust its sensitivity to light under variable conditions makes this optical instrument, the human eye, the most sophisticated and exquisite of all.

The eye can be divided into three spaces or chambers: the space between the back of the cornea and the iris is called the *anterior chamber;* the space between the iris and the lens is called the *posterior chamber;* the largest space between the lens and the retina is called the *vitreous chamber.*

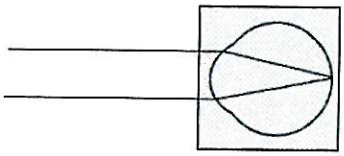




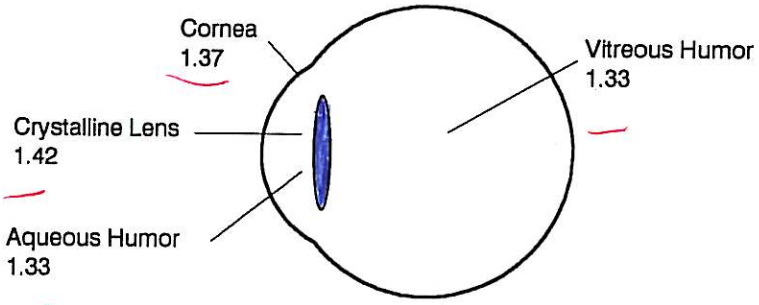
The cornea consists of five distinct layers. These include the Epithelium, Bowman's Membrane, Stroma, Desemet's Membrane, Endothelium. The corneal epithelium is highly regenerative. The cells reproduce so rapidly that a mild scratch or abrasion of the cornea can heal itself within 24 hours. This is not true of the other corneal layers. Overall, the cornea is about 0.5mm thick at its center with the stroma comprising 90% of the total thickness. Knowledge of corneal physiology becomes especially important when dealing with contact lenses.

CONES	RODS
Day Vision	Night Vision
Detail	Peripheral Vision
Color	Black and White

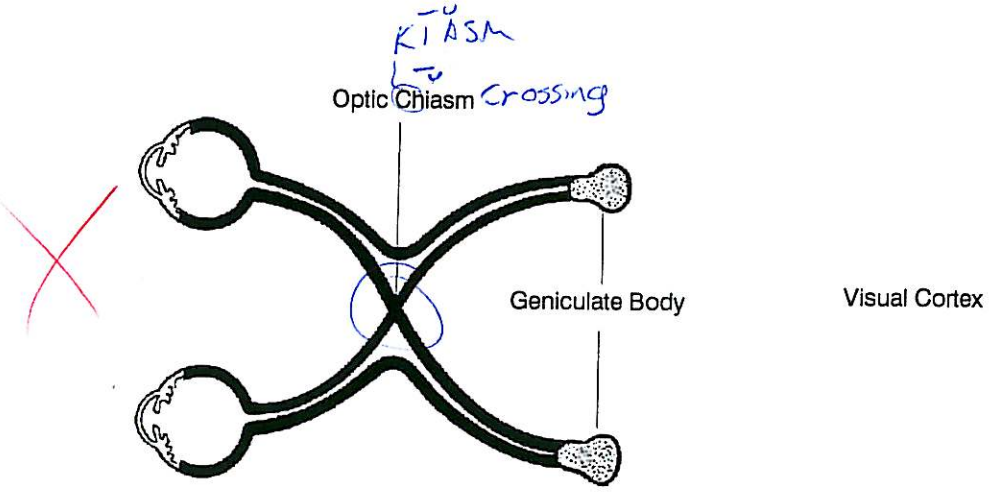
Each retina contains about 120 million rods and 6 million cones. The greatest density of cones are found in the fovea. Radiating outwardly from the fovea, the population of cones gradually decreases while the population of rods increases. The chart above summarizes the function of each of these types of receptors.



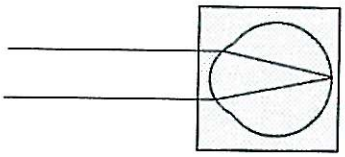
Visual Pathway



The diagram above illustrates the index of refraction of the various transparent structures of the eye. The meaning and significance of index of refraction will become apparent when we cover that subject in Part 2 of the course. For now, simply memorize the numbers associated with each structure.



Once the optic nerves leave the eye they cross at an X-like structure called the *optic chiasm.* At this point the fibers within the optic nerves undergo a rearrangement resulting in the right field of vision from each eye being represented in the left side of the brain and the field of vision from the left field of vision in each eye being represented in the right side of the brain. The optic nerve fibres end at the *geniculate body.* The information is then transmitted to the visual cortex of the occipital lobe (a portion of the brain) where the conscious recognition of visual impulses takes place.



Accommodation & Convergence

TUNICS	
Fibrous Tunic:	Outer protective coat of the eye. Consists of the Sclera and Cornea.
Vascular Tunic:	Also known as the uveal tract. Consists of three parts: The iris, ciliary body and the choroid.
Neural Tunic:	Consists of the retina.

Certain structures of the eye may be grouped together to form what are called *tunics* or coverings. These are outlined in the above table.

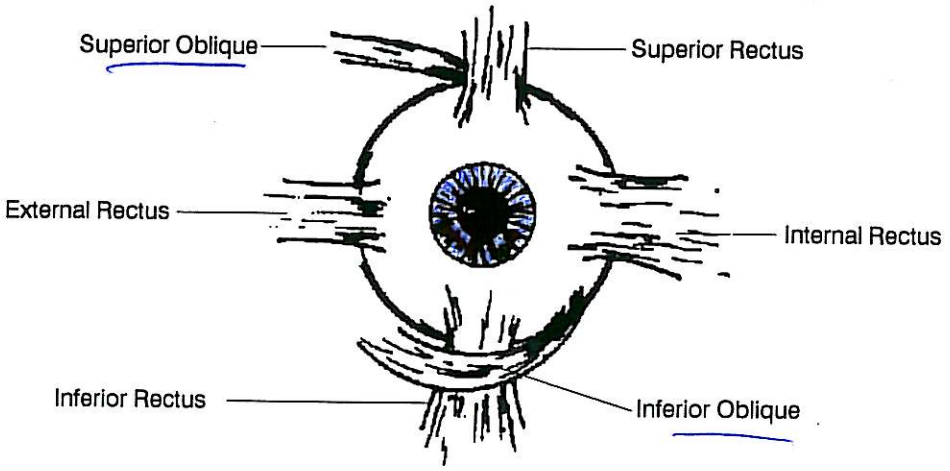
ACCOMMODATION	
1)	The ciliary muscle relaxes allowing for a thickening of the crystalline lens.
2)	The eyes converge.
3)	The pupils constrict.

During accommodation, the eye adjusts for viewing objects at various distances. This is accomplished by the crystalline lens changing shape through the action of the ciliary muscle. Associated with accomodation is convergence and the constricting of the pupils.

Distance PD	Subtract for Near
Less than 62 mm	2 mm
62–66 mm	3 mm
More than 66 mm	4 mm

Since the eyes converge when viewing an object at a near distance as when reading, the pupillary distance for near vision is narrower than that for distance viewing. The amount the eyes will converge for near will vary from one individual to another and for complete accuracy both the distance and near PD should be physically measured. However, as a general "rule-of-thumb" eyes with wider distance PD's will converge more for reading than those with narrower distance PD's.

Extra-Ocular Muscles

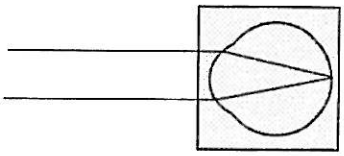


Phoria: A constant *tendency* for the eyes to turn from the normal position for binocular vision.

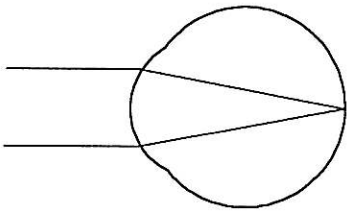
Tropia: A *definate and obvious turning* of the eyes from the normal position for binocular vision.

		Examples	
Exo:	Out	*Right exophoria:*	A tendency of the right eye to turn outward
Eso:	In	*Left esotropia:*	A definate turning inward of the left eye
Hyper:	Up	*Right hyperphoria*	A tendency of the right eye to turn upward
Hypo:	Down	*Left hypotropia*	A definate turning downward of the left eye

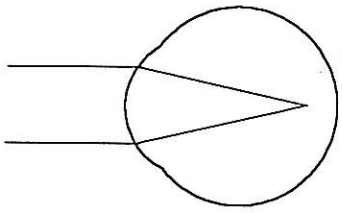
The extra-ocular muscles are inserted into the sclera and cause each eye to rotate in all possible directions. There are six of these muscles in each eye. These are: the temporal rectus, nasal rectus, superior rectus, inferior rectus, superior oblique, and inferior oblique. When the muscles are working properly the two eyes can work together, enabling the brain to fuse the two images it receives into one. If one or more of these muscles is weaker or stronger than normal, the eyes may not be able to move in perfect unison. The resulting imbalance can make fusion difficult or even impossible, resulting in diplopia (double vision). Very often an element in the prescription called prism will be prescribed to help alleviate this problem. We will cover prism in some detail in the next session.



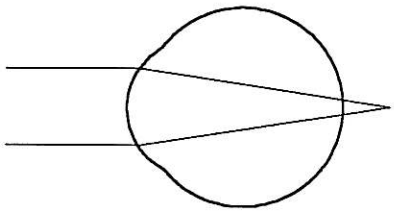
Emmetropia & Ametropia



Emmetropia
Light comes to focus directly on the retina when accommodation is relaxed. No corrective lenses are need for distance viewing.

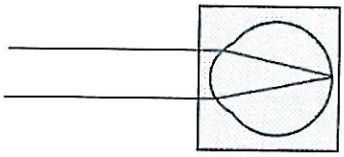


Myopia
Or "nearsighted." Light comes to focus in front of the retina requiring corrective lenses.

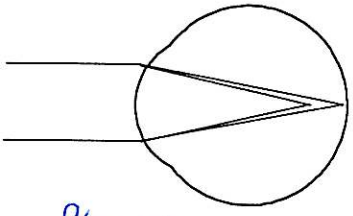


Hyperopia
Or "farsighted". Light comes to focus in behind the retina often requiring corrective lenses.

When accommodation is at rest, the emmetropic eye is capable of bringing images of a distant object to focus on the retina. In optics, a distant object is one which is twenty feet or more from the eye (optical infinity). All the other conditions shown on this page are forms of ametropia. A relatively young hyperope with a mild correction may be capable of bringing light to focus on the retina without eyeglasses or contact lenses. The additional plus power needed can be acquired through accommodation. In the case of the myope, however, even the slightest refractive error needs to be corrected with spectacles or contact lenses in order to achieve sharp vision under all lighting conditions.

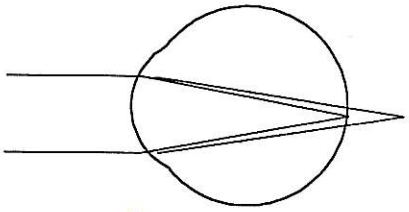


SIMPLE – PLANO CYL. LENS.



PL –

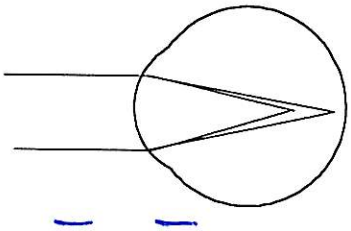
Simple Myopic Astigmatism
One point comes to focus on the retina and one point comes to focus in front of the retina.



PL +

Simple Hyperopic Astigmatism
One point comes to focus on the retina and one point comes to focus behind the retina.

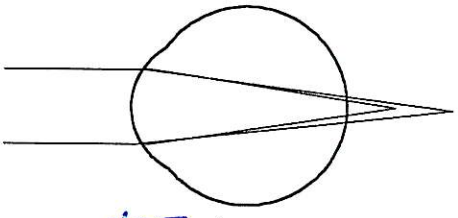
– –



– –

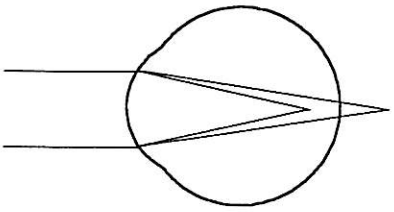
Compound Myopic Astigmatism
Both points of light come to focus in front of the retina.

+ –



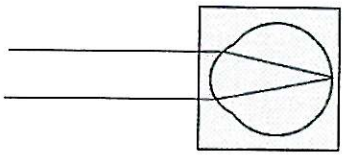
+ –

Compound Hyperopic Astigmatism
Both points of light come to focus behind the retina.



+50 –100

Mixed Astigmatism
One point of light comes to focus in front of the retina, while the other comes to focus behind the retina.



Glossary

Accommodation: Focusing of the eye on a near object through relaxation of the ciliary muscle and thickening of the lens.

Amblyopia: The loss of vision without any aparent disease of the eye.
→ lazy eye - patch

Ametropia: A refractive error in which the eye, when in a state of rest, does not focus the image of an object upon the retina; includes hyperopia, myopia, and astigmatism.

Anisekonia

Aniseikonia: A condition in which the ocular image of an object as seen by one eye differs so much in size or shape from that seen by the other eye that the two images cannot be fused into a single impression.

Anisometropia: A condition in which the refractive error of one eye significantly differs from that of the other; each eye must have the same sign, i.e. both eyes are myopic or hyperopic.

opposite

Antimetropia: The refractive condition whereby the signs in each eye are opposite; one eye is hyperopic while the other is myopic.

Aphakia: An absence of the crystalline lens of the eye.

Aqueous humor: The clear watery fluid that fills the anterior and posterior chambers within the front part of the eye.

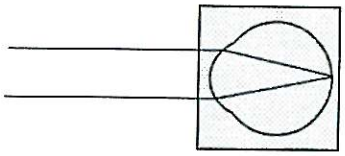
Astigmatism: A refractive error that prevents the light rays from coming to a single focus on the retina because of different degrees of refraction in the various meridians of the eye.

Cataract: A condition in which the crystalline lens of the eye, or its capsule, or both, become opaque, with consequent loss of visual acuity.

Choroid: The vascular intermediate coat that furnishes nourishment to other parts of the eyeball.

Ciliary body: That portion of the vascular coat between the iris and the choroid. It consists of ciliary processes and the ciliary muscle.

Compound hyperopic astigmatism: The refractive error which results in two points of focus falling behind the retina.



Glossary

Compound myopic astigmatism: The refractive error which results in two points of focus falling in front of the retina.

Cornea: The clear transparent portion of the outer coat of the eyeball forming the covering of the aqueous chamber.

Crystalline Lens: A transparent colorless body suspended in the front part of the eyeball, between the aqueous and the vitreous, the function of which is to bring the rays of light to a focus on the retina.

Diplopia: The seeing of one object as two.

Emmetropia: The refractive condition of the normal eye—when the eye is at rest, the image of distant objects is brought to a focus on the retina.

Fovea: A small depression in the retina at the back of the eye; the part of themacula adapted for most acute vision.

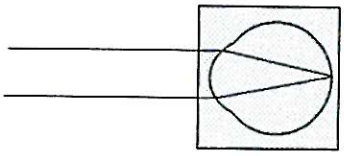
Fusion: The power of coordination by which the images received by the two eyes become a single image. BY THE BRAIN

Glaucoma: An ocular disease having as its primary characteristic a sustained increase in intraocular pressure that the eye cannot withstand without damage to its structure or impairment of its function.

Hyperopia: A refractive error in which, because the eyeball is short or the refractive power of the lens is weak, the point of focus for rays of light from distant objects falls behind the retina; accommodation to increase the refractive power of the lens is necessary for distance vision as well as near vision.

Iris: The colored circular membrane suspended behind the cornea and immediately in front of the lens. The iris regulates the amount of light entering the eye by changing the size of the pupil.

Irregular Astigmatism: A refractive condition caused by a cornea which is damaged and irregular so that rays of light come to many focal points on the retina; is not correctable by cylinders.



I sikonic

Glossary

Iseikonic Lenses: Spectacle lenses specially designed to manipulate image size when dissimilar sizes makes it difficult or impossible for fusion to occur; such as in aniseikonia.

Macula: The small area of the retina that surrounds the fovea and that with the fovea, comprises the area of the retina that gives distinct vision.

Mixed Astigmatism: The refractive condition in which light comes to two points of focus where one point is in front of the retina, and the other is behind the retina.

Myopia (nearsightedness): A refractive error in which the eyeball is too long in relation to its focusing power; thus the point of focus for rays of light from distant objects is in front of the retina.

Oculus Dexter (O.D.): The right eye.

Oculus Sinister (O.S.): The left eye.

Oculus Uterque (O.U.): Each eye.

Optic Nerve: The special nerve of the sense of sight that carries impulses from the retina to the brain.

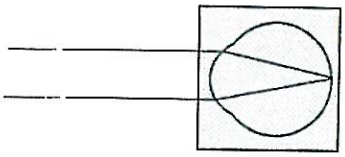
Phoria: A root word denoting a latent deviation in which the eyes have a constant tendency to turn from the normal position for binocular vision; used with a prefix to indicate the direction of such deviation (for example, hyperphoria, esophoria, exophoria).

Presbyopia: A gradual lessening of the power of accommodation due to a physiologic change that becomes noticeable about the age of 40 years.

Muellers Muscle

Ptosis Crutch: A small spring wire attached nasally to a spectacle frame to lift a drooping lid.

Pupil: The central opening of the iris through which light is permitted to enter the eye.



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Regular Astigmatism: A refractive condition in which rays of light come to two focal points and is correctable by cylinders.

Retina: Innermost coat of the eye, formed of sensitive nerve elements and connected with the optic nerve.

Rods and Cones: Two different kinds of cells that form a layer of the retina and act as light-receiving media.
Cones are concerned with visual acuity and color discrimination; whereas rods are employed for motion and vision at low degrees of illumination (night vision).

Sclera: The white part of the eye—a tough covering which, with the cornea, forms the external protective coat of the eye.

Scotoma: A blind area of reduced vision in the visual field.

Simple hyperopic astigmatism: The refractive condition where one point of focus falls on the retina and the other point of focus falls behind the retina.

Simple myopic astigmatism: The refractive condition where one point of focus falls on the retina and the other point of focus falls in front of the retina.

Strabismus: Failure of the two eyes to simultaneously direct their gaze at the same object because of muscle imbalance. Also known as squint.

Suspensory Ligaments: The suspensory apparatus of the lens. Numerous fine tissue strands that stretch from the ciliary processes to the lens equator and support the lens in place.

Tropia: A root word denoting an obvious deviation from normal of the axis of the eyes; used with a prefix to denote the type of strabismus (for example, heterotropia, esotropia, exotropia).

Vitreous Humor: The transparent, colorless mass of soft, gelatinous material filling the eyeball behind the lens.