Fact Sheet

Refractive Errors

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Information found at:
http://www.kellogg.umich.edu/patientcare/conditions/refractive.errors.html

How the Eye Sees: The process of vision begins when light rays that reflect off objects and travel through the eye's optical system are refracted and focused into a point of sharp focus. For good vision, this focus point must be on the retina. The retina is the tissue that lines the inside of the back of the eye, where light-sensitive cells (photoreceptors) capture images in much the same way that film in a camera does when exposed to light. These images then are transmitted through the eye's optic nerve to the brain for interpretation.

Just as a camera's aperture is used to adjust the amount of light needed to expose film in just the right way, the eye's pupil widens or constricts to control the amount of light that reaches the retina. In dark conditions, the pupil widens. In bright conditions, the pupil constricts.

What is a Refractive Error? Refractive errors are disorders, not diseases. A refractive error means that the shape of your eye does not bend light correctly, resulting in a blurred image. Light has to be refracted or bent by the cornea and the lens to the retina in order for us to see. The common refractive disorders are described below.

Myopia (distant objects are blurry): Another term for myopia is nearsightedness. Nearsightedness is inherited and is often discovered in childhood. Myopia often progresses throughout the teenage years, when the body is growing rapidly. People with high degrees of myopia have a higher risk of detached retina which can be repaired with surgery. The internal lens of the eye cannot correct a child’s nearsightedness and this is why it is critical these learners have glasses. Notice in the picture how the boys are in focus, but the background is not in focus. Photo credit to the National Eye Institute
Hyperopia (close objects are blurry): Another term for hyperopia is farsightedness. Farsightedness is usually inherited. Children are often hyperopic which may lessen as an adult. The plasticity of lens can help to accommodate farsightedness to some extent in young children. Because of this condition, farsightedness is usually identified during an eye exam. Notice in the picture how the boys are not in focus but the background is in focus. Photo credit to the National Eye Institute

Presbyopia (aging of the lens in the eye): After age 40, the lens of the eye becomes more rigid and does not flex as easily. The result is that it is more difficult to read at close range. This normal aging process of the lens can also be combined with myopia, hyperopia or astigmatism.

Astigmatism (blurred vision at all distances): Astigmatism usually occurs when the front surface of the eye, the cornea, has an irregular curvature. Normally the cornea is smooth and equally curved in all directions and light entering the cornea is focused equally on all planes, or in all directions. In astigmatism, the front surface of the cornea is curved more in one direction than in the other. This abnormality may result in vision that is much like looking into a distorted, wavy mirror. Usually, astigmatism causes blurred vision at all distances.

Causes of Refractive Errors: The eye's ability to refract or focus light sharply on the retina primarily is based on three eye anatomy features: 1) the overall length of the eye, 2) the curvature of the cornea and 3) the curvature of the lens inside the eye.

- **Eye Length**: If the eye is too long, light is focused before it reaches the retina, causing nearsightedness. If the eye is too short, light is not focused by the time it reaches the retina. This causes farsightedness or hyperopia.

- **Curvature of the Cornea**: If the cornea is not perfectly spherical, then the image is refracted or focused irregularly to create a condition called astigmatism. A person can be nearsighted or farsighted with or without astigmatism.

- **Curvature of the Lens**: If the lens is too steeply curved in relation to the length of the eye and the curvature of the cornea, this causes nearsightedness. If the lens is too flat, the result is farsightedness.

Detection and Treatment of Refractive Errors: An eye doctor determines the type and degree of refractive error you have by performing a test called a refraction. This can be done with a computerized instrument (automated refraction) or with a mechanical instrument called a phoropter that allows your eye doctor to show you one lens at a time (manual refraction). Often, an automated refraction will be performed by a member of the doctor's staff, and then the eye care practitioner will refine and verify the results with a manual refraction. Caption for left picture: An eye care practitioner performs a manual refraction. (Photo: National Eye Institute)
What are the Treatments for Refractive Errors? Refractive disorders are commonly treated using corrective lenses, such as eyeglasses or contact lenses. Refractive surgery can also be used to correct some refractive disorder.

Can a Child with a Visual Impairment Have a Refractive Error?: Yes! In fact many children with low vision or permanent vision loss due to an uncorrectable problem with the eye(s) can also be nearsighted or farsighted and/or have astigmatism. This means that these learners will benefit from glasses or contact lenses for these latter conditions even though prescriptive lenses will not improve the visual loss due to the cause of the permanent eye loss condition. For example, children who are born early and have Retinopathy of Prematurity or those diagnosed with albinism very often need glasses for a refractive error. All children with diagnosed vision impairment should be seen on a regular basis by an eye doctor to determine if there is an accompanying refractive error that may respond to corrective lenses. The rare exception is students who are totally blind.

Resources

To see an active illustration of an eye with a refractive error, go to http://www.allaboutvision.com/eye-exam/refraction.htm

For more information about the CO Services for Children and Youth with Combined Vision and Hearing Loss Project and the project’s services specific to Colorado children who are deafblind, please contact:

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Fact Sheets from the Colorado Services to Children and Youth with Combined Vision and Hearing Loss Project are to be used by both families and professionals serving individuals with vision and hearing loss. The information applies to children, birth through 21 years of age. The purpose of the Fact Sheet is to give general information on a specific topic. More specific information for an individual student can be provided through personalized technical assistance available from the project. For more information call (303) 866-6681 or (303) 866-6605. Updated: 10/10