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Eye Defects.

1.Near-sightedness, also known as **short-sightedness** and **myopia:**
is an eye disorder where light focuses in front of, instead of on, the retina. This causes distant objects to be blurry while close objects appear normal. Other symptoms may include headaches and eye strain. Severe near-sightedness is associated with an increased risk of retinal detachment, cataracts, and glaucoma. The underlying cause is believed to be a combination of genetic and environmental factors. Risk factors include doing work that involves focusing on close objects, greater time spent indoors, and a family history of the condition. It is also associated with a high socioeconomic class. The underlying mechanism involves the length of the eyeball growing too long or less commonly the lens being too strong. It is a type of refractive error.[1] Diagnosis is by eye examination.

Tentative evidence indicates that the risk of near-sightedness can be decreased by having young children spend more time outside. This may be related to natural light exposure. Near-sightedness can be corrected with eyeglasses, contact lenses, or surgery. Eyeglasses are the easiest and safest method of correction. Contact lenses can provide a wider field of vision, but are associated with a risk of infection. Refractive surgery permanently changes the shape of the cornea.

Near-sightedness is the most common eye problem and is estimated to affect 1.5 billion people (22% of the population). Rates vary significantly in different areas of the world. Rates among adults are between 15% to 49%. Rates are similar in females and males. Among children, it affects 1% of rural Nepalese, 4% of South Africans, 12% of Americans, and 37% in some large Chinese cities. Rates have increased since the 1950s. Uncorrected near-sightedness is one of the most common causes of vision impairment globally along with cataracts, macular degeneration, and vitamin A deficiency.

SIGNS AND SYMPTOMS.

A myopic individual can see clearly out to a certain distance (called far point), but everything further becomes blurry. If the extent of the myopia is great enough, even standard reading distances can be affected. Upon routine examination of the eyes, the vast majority of myopic eyes appear structurally identical to nonmyopic eyes.

Onset is often in school children, with worsening between the ages of 8 and 15.

CAUSES.

The underlying cause is believed to be a combination of genetic and environmental factorsqq. Risk factors include doing work that involves focusing on close objects, greater time spent indoors, and a family history of the condition. It is also associated with a high socioeconomic class.

A 2012 review could not find strong evidence for any single cause, although many theories have discredited 1Identical twins are more likely to be affected than non identical twins which indicates at least some genetic factors are involved. Myopia has been increasing rapidly throughout the developed world, suggesting environmental factors are involved.

Genetics.

A risk for myopia may be inherited from one's parents. Genetic linkage studies have identified 18 possible loci on 15 different chromosomes that are associated with myopia, but none of these loci is part of the candidate genes that cause myopia. Instead of a simple one-gene locus controlling the onset of myopia, a complex interaction of many mutated proteins acting in concert may be the cause. Instead of myopia being caused by a defect in a structural protein, defects in the control of these structural proteins might be the actual cause of myopia. A collaboration of all myopia studies worldwide identified 16 new loci for refractive error in individuals of European ancestry, of which 8 were shared with Asians. The new loci include candidate genes with functions in neurotransmission, ion transport, retinoic acid metabolism, extracellular matrix remodeling and eye development. The carriers of the high-risk genes have a tenfold increased risk of myopia.

Human population studies suggest that contribution of genetic factors accounts for 60–90% of variance in refraction. However, the currently identified variants account for only a small fraction of myopia cases, suggesting the existence of a large number of yet unidentified low-frequency or small-effect variants, which underlie the majority of myopia cases.

Environmental factors.

Environmental factors which increase the risk of nearsightedness include insufficient light exposure, low physical activity, near work, and increased year of education.

One hypothesis is that a lack of normal visual stimuli causes improper development of the eyeball. Under this hypothesis, "normal" refers to the environmental stimuli that the eyeball evolved to. Modern humans who spend most of their time indoors, in dimly or fluorescently lit buildings which may contribute to the development of myopia.

People, and children especially, who spend more time doing physical exercise and outdoor play have lower rates of myopia, suggesting the increased magnitude and complexity of the visual stimuli encountered during these types of activities decrease myopic progression. There is preliminary evidence that the protective effect of outdoor activities on the development of myopia is due, at least in part, to the effect of long hours of exposure to daylight on the production and the release of retinal dopamine.

The near work hypothesis, also referred to as the "use-abuse theory" states that spending time involved in near work strains the intraocular and extraocular muscles. Some studies support the hypothesis, while other studies do not. While an association is present, it is not clearly causal.

Nearsightedness is also more common in children with diabetes, Childhood arthritis, uveitis, and systemic lupus erythematosus.

Prevention.

Some suggest that more time spent outdoors during childhood is effective for prevention.

Various methods have been employed in an attempt to decrease the progression of myopia, although studies show mixed results. Many myopia treatment studies have a number of design drawbacks: small numbers, lack of adequate control group, and failure to mask examiners from knowledge of treatments used. Among myopia specialists, mydriatic eyedrops are the most favored approach, applied by almost 75% in North America and more than 80% in Australia. Behavioral intervention (counseling to spend more time outdoors and less time with near-work) is favored by 25% of specialists, usually in addition to the medications.

Glasses and contacts.

The use of reading glasses when doing close work may improve vision by reducing or eliminating the need to accommodate. Altering the use of eyeglasses between full-time, part-time, and not at all does not appear to alter myopia progression. The American Optometric Association's Clinical Practice Guidelines found evidence of effectiveness of bifocal lenses and recommends it as the method for "myopia control".In some studies, bifocal and progressive lenses have not shown differences in altering the progression of myopia.

In 2019 contact lenses to prevent the worsening of nearsightedness in children were approved for use in the United States.

Medication.

topical medications in children under 18 years of age may slow the worsening of myopia. These treatments include pirenzepine gel, cyclopentolate eye drops, and atropine eye drops. While these treatments were shown to be effective in slowing the progression of myopia, side effects included light sensitivity and near blur.

Other Methods.

Scleral reinforcement surgery is aimed to cover the thinning posterior pole with a supportive material to withstand intraocular pressure and prevent further progression of the posterior staphyloma. The strain is reduced, although damage from the pathological process cannot be reversed. By stopping the progression of the disease, vision may be maintained or improved.

Treatments.

The National Institutes of Health says there is no known way of preventing myopia, and the use of glasses or contact lenses does not affect its progression.

There is no universally accepted method of preventing myopia and proposed methods need additional study to determine their effectiveness. Optical correction using glasses or contact lenses is the most common treatment; other approaches include orthokeratology, and refractive surgery. 21–26 Medications (mostly atropine) and vision therapy can be effective in addressing the various forms of pseudomyopia.

Corrective lenses bend the light entering the eye in a way that places a focused image accurately onto the retina. The power of any lens system can be expressed in diopters, the reciprocal of its focal length in meters. Corrective lenses for myopia have negative powers because a divergent lens is required to move the far point of focus out to the distance. More severe myopia needs lens powers further from zero (more negative). However, strong eyeglass prescriptions create distortions such as prismatic movement and chromatic aberration. Strongly near-sighted wearers of contact lenses do not experience these distortions because the lens moves with the cornea, keeping the optic axis in line with the visual axis and because the vertex distance has been reduced to zero.

Surgery.

Refractive surgery includes procedures which alter the corneal curvature of some structure of the eye or which add additional refractive means inside the eye.

Photorefractive keratectomy.

Photorefractive keratectomy (PRK) involves ablation of corneal tissue from the corneal surface using an excimer laser. The amount of tissue ablation corresponds to the amount of myopia. While PRK is a relatively safe procedure for up to 6 dioptres of myopia, the recovery phase post-surgery is usually painful.

LASIK

In a LASIK pre-procedure, a corneal flap is cut into the cornea and lifted to allow the excimer laser beam access to the exposed corneal tissue. After that, the excimer laser ablates the tissue according to the required correction. When the flap again covers the cornea, the change in curvature generated by the laser ablation proceeds to the corneal surface. Though LASIK is usually painless and involves a short rehabilitation period post-surgery, it can potentially result in flap complications and loss of corneal stability (post-LASIK keratectasia).

Phakic intra-ocular lens.

Instead of modifying the corneal surface, as in laser vision correction (LVC), this procedure involves implanting an additional lens inside the eye (i.e., in addition to the already existing natural lens). While it usually results in good control of the refractive change, it can induce potential serious long-term complications such as glaucoma, cataract and endothelial decompensation.

Orthokeratology.

Orthokeratology or simply Ortho-K is a temporary corneal reshaping process using rigid gas permeable (RGP) contact lenses. Overnight wearing of specially designed contact lenses will temporarily reshape cornea, so patients may see clearly without any lenses in daytime. Orthokeratology can correct myopia upto -6D. several studies shown that Ortho-K can reduce myopia progression also. Risk factors of using Ortho-K lenses include microbial keratitis, corneal edema, etc. Other contact lens related complications like corneal aberration, photophobia, pain, irritation, redness etc. are usually temporary conditions,which may be eliminated by proper usage of lenses.

Intrastromal corneal ring segment.

The Intrastromal corneal ring segment (ICRS), commonly used in keratoconus treatment now, was originally designed to correct mild to moderate myopia. The thickness is directly related to flattening and the diameter of the ring is proportionally inverse to the flattening of cornea. So, if diameter is smaller or thickness is greater, resulting myopia correction will be greater.

Alternative medicine.

A number of alternative therapies have been claimed to improve myopia, including vision therapy, "behavioural optometry", various eye exercises and relaxation techniques, and the Bates method. Scientific reviews have concluded that there was "no clear scientific evidence" that eye exercises are effective in treating near-sightedness[81] and as such they "cannot be advocated".

2. Astigmatism:

–**Astigmatism** is a type of refractive error in which the eye does not focus light evenly on the retina. This results in distorted or blurred vision at any distance. Other symptoms can include eyestrain, headaches, and trouble driving at night. If it occurs in early life, it can later result in amblyopia.

SIGNS AND SYMPTOMS.

Although astigmatism may be asymptomatic, higher degrees of astigmatism may cause symptoms such as blurred vision, double vision, squinting, eye strain, fatigue, or headaches. Some research has pointed to the link between astigmatism and higher prevalence of migraine headaches.

Causes

The cause of astigmatism is unclear, however it is believed to be partly related to genetic factors.

Genetics.

Genetics, based on twin studies, appear to play only a small role in astigmatism as of 2007. Genome-wide association study (GWAS) have been used to investigate the genetic foundation of astigmatism. Although no conclusive result has been shown, various candidates have been identified. In a study conducted in 2011 on various Asian populations, variants in the PDGFRA gene on chromosome 4q12 were identified to be associated with corneal astigmatism. A follow-up study in 2013 on the European population, however, found no variant significantly associated with corneal astigmatism at the genome-wide level (single-nucleotide polymorphism rs7677751 at PDGFRA). Facing the inconsistency, a study by Shah and colleagues in 2018 included both populations with Asian and Northern European ancestry. They successfully replicated the previously identified genome-wide significant locus for corneal astigmatism near the PDGFRA gene, with a further success of identifying three novel candidate genes: CLDN7, ACP2, and TNFAIP8L3. Other GWAS studies also provided inconclusive results: Lopes and colleagues identified a susceptibility locus with lead single nucleotide polymorphism rs3771395 on chromosome in the VAX2 gene (VAX2 plays an important role in the development of the dorsoventral axis of the eye); Li and associates, however, found no consistent or strong genetic signals for refractive astigmatism while suggesting a possibility of widespread genetic co-susceptibility for spherical and astigmatic refractive errors. They also found that the TOX gene region previously identified for spherical equivalent refractive error was the second most strongly associated region. Another recent follow-up study again had identified four novel loci for corneal astigmatism, with two also being novel loci for astigmatism: ZC3H11B (associated with axial length), NPLOC4 (associated with myopia), LINC00340 (associated with spherical equivalent refractive error) and HERC2 (associated with eye color).

Diagnosis.

A number of tests are used during eye examinations to determine the presence of astigmatism and to quantify its amount and axis. A Snellen chart or other eye charts may initially reveal reduced visual acuity. A keratometer may be used to measure the curvature of the steepest and flattest meridians in the cornea's front surface. Corneal topography may also be used to obtain a more accurate representation of the cornea's shape.

An autorefractor or retinoscopy may provide an objective estimate of the eye's refractive error and the use of Jackson cross cylinders in a phoropter or trial frame may be used to subjectively refine those measurements. An alternative technique with the phoropter requires the use of a "clock dial" or "sunburst" chart to determine the astigmatic axis and power. A keratometer may also be used to estimate astigmatism by finding the difference in power between the two primary meridians of the cornea. Javal's rule can then be used to compute the estimate of astigmatism.

A method of astigmatism analysis by Alpins may be used to determine both how much surgical change of the cornea is needed and after surgery to determine how close treatment was to the goal.

Another rarely used refraction technique involves the use of a stenopaeic slit (a thin slit aperture) where the refraction is determined in specific meridians – this technique is particularly useful in cases where the patient has a high degree of astigmatism or in refracting patients with irregular astigmatism.

Classification.

There are three primary types of astigmatism: myopic astigmatism, hyperopic astigmatism, and mixed astigmatism. Cases can be classified further, such as regular or irregular and lenticular or corneal.

Treatment.

Astigmatism may be corrected with eyeglasses, contact lenses, or refractive surgery. Glasses are the simplest and safest, although contact lenses can provide a wider field of vision. Refractive surgery can eliminate the need to wear corrective lenses altogether by permanently changing the shape of the eye but, like all elective surgery, comes with both greater risk and expense than the non-invasive options. Various considerations involving eye health, refractive status, and lifestyle determine whether one option may be better than another. In those with keratoconus, certain contact lenses often enable patients to achieve better visual acuity than eyeglasses. Once only available in a rigid, gas-permeable form, toric lenses are now also available as soft lenses.

In older people, astigmatism can also be corrected during cataract surgery. This can either be done by inserting a toric intraocular lens or by performing special incisions (limbal relaxing incisions). Toric intraocular lenses probably provide a better outcome with respect to astigmatism in theses cases than limbal relaxing incisions.