

DEFINITION

1. Myopia is short-sightedness. Individuals with this abnormality are able to see near objects clearly but distant objects are blurred.
2. In the myopic eye light from a distant object is focused at a point in front of, rather than on the retina. The excessive convergent power causing this may be due to a steeply curved cornea, an abnormally spherical lens or an increase in the index of refraction of the lens, as in nuclear sclerosis. Usually, however, myopia is due to axial elongation of the eye.
3. Myopia is the most common ocular abnormality and occurs more frequently in women than in men. Prevalence varies considerably between ethnic groups; in northern European countries and the United States it is about 25%, but in some Asian countries it may be as high as 70%-90%. It is rare in those of African origin and is virtually unknown in the Australian aboriginal population.

CLINICAL FEATURES

4. The condition is usually categorised as “simple” or “physiological” myopia, which is considered a normal physiological variation with a refractive error of up to -6 dioptres, and “pathological” myopia – so-called “high myopia” in which the refractive error is greater than -6 dioptres. The two are not distinct conditions and can be considered as a continuum.
5. The only symptom of uncorrected myopia is blurred distant vision. When the onset is in the childhood years affected individuals may be unaware that they are unable to see a school blackboard clearly, unlike their peers. When the onset is later the first symptom may be blurring of distance vision following prolonged near work.
6. A variety of clinical signs accompany myopia, including tilting of the optic discs and outpouching of the posterior globe (posterior staphyloma). As the eye elongates the sclera and choroid begin to show at the edge of the optic nerve and a “myopic crescent” may be seen. Large floaters are often visible on examination.
7. A wide variety of visual disabilities may occur in myopia - the greater the degree of myopia the higher their incidence. They include image minification, amblyopia, visual field defects, impaired dark adaptation and abnormal colour discrimination. Complications of pathological myopia include retinal detachment, glaucoma and premature cataract.

AETIOLOGY

8. The prevalence of myopia is increasing in many parts of the world. This has led to escalating research into the condition and in turn, a growing understanding of its aetiology.

9. Most infants, even those who subsequently become myopic, are born hypermetropic, and the eye undergoes gradual architectural change until optimal shape is attained and a distant image is focused precisely on the retina. This process (emmetropisation) is achieved by modulation of axial elongation of the eye by feedback from retinal image clarity and is complete between the ages of 5 and 8 years. The mechanism is under endogenous ocular control and may be disturbed by both genetic and environmental factors. In addition, myopia may be associated with a number of genetically-determined systemic and optical disorders.
10. **Genetic influences:** The importance of genetic factors in the development of myopia has been clearly demonstrated by epidemiological research and is supported by the wide variation in the prevalence of myopia between different ethnic groups. Children with myopic parents, although not yet myopic themselves, tend to have longer eyes than children with non-myopic parents, resulting in a predisposition to becoming myopic later in life. The precise mechanism of inheritance has yet to be elucidated however and in familial studies both dominant and recessive modes of inheritance have been found.
11. The results of this research indicate a high heritability for ocular refraction and those anatomical and physiological factors that determine it. It is probable that the schoolchild who has a familial predisposition to the condition may develop myopia which can persist and progress through the second, third and fourth decades of life.
12. **Genetically-determined systemic disorders:** High myopia is one of the manifestations of a wide variety of genetically-determined systemic disorders. These include the following:
- **Marfan's syndrome.** In this autosomal dominant abnormality there is increased height and lower body/upper body ratio, long thin extremities, and cardiovascular abnormalities are frequent. Ocular effects include iris and ciliary body abnormalities.
 - **Stickler's syndrome.** This connective tissue disease is inherited as an autosomal dominant condition characterised by skull abnormalities and premature degenerative joint changes. Myopia is congenital and progressive.
 - **Downs syndrome.** As well as the characteristic changes of this condition, subjects commonly suffer from high myopia.
 - **Other systemic disorders** frequently associated with myopia include Ehlers-Danlos syndrome, albinism, Cornelia de Lange's syndrome, and homocystinuria.
 - **Genetically-determined optical disorders.** A number of genetically-determined diseases with primarily optical manifestations are frequently associated with myopia. They include:
 - **Stargardt's disease.** This is an autosomal recessive condition in which a proportion of subjects have macular degeneration and myopia.

- **Choroideraemia.** In this x-linked recessive disorder there is retinal degeneration, causing loss of peripheral vision and night-blindness. It first manifests itself in males from 5-20 years of age. Vision loss is insidious and most subjects are myopic.
- **Ectopia lentis.** This autosomal condition usually presents at birth and is typified by superotemporal lens displacement. Myopia is usual.

There are numerous other instances of this group, including gyrate atrophy, chromatopsia, familial exudative vitreoretinopathy, microcornea and keratoconus.

13. Environmental factors

- **Prematurity.** In premature infants there may be peripheral retinal neovascularisation (retinopathy of prematurity), with ensuing cicatrisation and high myopia which characteristically stabilises at 5 years of age.
- **Excessive light exposure.** A proposal that excess ambient illumination in early childhood might be implicated in the development of myopia has now largely been discounted.
- **Close work.** There is a correlation between the level of academic achievement and the prevalence and progress of myopia. Research into the epidemiological association between academic work and myopia strongly suggests that some individuals are genetically liable to develop myopia with the passage of time if they undertake prolonged close work. Current UK Health and Safety legislation imposes very strict requirements upon employers and the Armed Forces alike in respect of requirements for workstations, equipment, illumination of the workplace, daily work routine of users, eye testing and training.
- **Drugs.** A wide variety of drugs have been reported to cause temporary myopia. A number of different mechanisms have been postulated, including ciliary body oedema with forward displacement of the lens, lenticular swelling and ciliary spasm. The drugs implicated include acetazolamide, arsenicals, digitalis derivatives, morphine, prednisolone and prochlorperazine. Withdrawal of the agent results in recovery.
- **Diet.** Recent research proposes that a western diet high in refined cereals and sugars may, by inducing chronic hyperinsulinaemia and reducing the choroidal synthesis of retinoic acid, increase scleral growth and so provoke elongation of the eye, with resulting myopia. The research awaits corroborative studies.

14. **Miscellaneous causes.** Other causes of reversible myopia include electrolyte disturbances, influenza, jaundice, and systemic oedema. The commonest cause of reversible myopia is found in osmotic swelling of the lens in diabetes mellitus.

CONCLUSION

Myopia or short-sightedness in its milder form is considered to be physiological. The majority of cases of myopia are due to interlinked hereditary and environmental factors. While close work may be an important environmental factor it appears to lead to myopia only when associated with a familial predisposition to the disorder.

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