

DEFINITIONS AND GENERAL CONSIDERATIONS

1. The structures of the eye, particularly the cornea and lens, serve to focus light onto the light-sensitive retina. The normal condition of the eye in which, with no accommodation, parallel light is focused on the retina by the optic apparatus is called **emmetropia**. **Accommodation** is the ability of the eye to change the refraction of light as it passes through the eye by changing the curvature of the lens of the eye.
2. Any abnormality in the optic apparatus will prevent correct focusing of images upon the retina and produce an **error of refraction** or **ametropia**.
3. Errors of refraction are divided into: **hypermetropia**, **myopia**, **presbyopia**, **anisometropia** and **astigmatism**.
4. 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. Myopia is the subject of a separate medical appendix: **Myopia – January 2004**.
5. Although refractive errors can be compensated for by the provision of spectacle lenses which assist the refraction of light, refractive errors cannot be remedied or their progress curbed by medication, diet or exercise, and it must be emphasised that the eyes themselves can never be damaged by uncorrected or wrongly-corrected refractive errors.

HYPERMETROPIA

6. Hypermetropia occurs when the rays of light entering the eye are brought to focus behind the retina because the eye is too short from front to back. Only objects in the distance can be focused, so this is commonly called **long-sightedness**.
7. Symptoms vary with the age of the patient. In the young there may be no symptoms at all since the accommodative power of the eye is such that they can overcome the defect and bring the image into focus. With increasing age and stiffening of the lens, accommodative power is reduced and this ability to focus is lost. Thus, the presence of hypermetropia may only become apparent in adult life. Individuals complain of blurring or mistiness of near vision, and close work is difficult. In high degrees of hypermetropia the effort to accommodate to focus may cause symptoms of "eyestrain" or headaches. The hypermetropic eye is predisposed to the development of primary angle-closure glaucoma.

8. The condition is developmentally determined and present from birth. It is physiological in childhood and, since the eye grows with the rest of the body, the condition has a tendency to correct itself. Occasionally hypermetropia may be pathological due to lesions which push the retina or the back of the eye forward. Trauma (blunt or penetrating injury), surgery to the eye and disease of the eye, which result in flattening of the cornea and thus reduce the diameter of the eyeball, may lead to hypermetropia, as may conditions which alter the refractive index or position of the lens.
9. The term **aphakia** denotes an eye in which the lens has been removed. Such eyes are markedly hypermetropic and have also lost the ability to accommodate. **Pseudophakia** is the term used when an artificial lens has been placed in the eye following lens extraction.

MYOPIA

10. Myopia is the converse of hypermetropia. The rays of light entering the eye are brought to focus in front of the retina because the eye is too long. Only close objects can be seen clearly and so this condition is commonly caused **short-sightedness**.
11. 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.
12. 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.
13. 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

14. See the separate medical appendix, **Myopia – January 2004**.

PRESBYOPIA

15. Presbyopia is a physiological condition due to sclerosis or stiffening of the lens which progresses throughout life but becomes apparent only when it reaches a stage which prevents accurate focusing, through the loss of the accommodative power of the lens. This is usually in the mid-forties. Early

symptoms are related to difficulties in altering the focus (accommodation) when changing from viewing far objects to near objects or vice-versa. Eventually near objects become increasingly difficult to focus on and the individual often extends reading matter to arm's length to be able to read.

ANISOMETROPIA

16. Any combination of the above errors of refraction may be present.

Anisometropia is the term used when there is a big difference in the refractive state between the two eyes. Minor differences are almost the rule but, when large differences occur, vision is usually unocular and there is sometimes amblyopia and a divergent strabismus in these cases.

ASTIGMATISM

17. Alterations in the curvature of the refractive surfaces of the eye, particularly the cornea, cause an error of refraction known as **astigmatism**. The surface of the cornea is normally nearly spherical. Regular astigmatism results when the curvature of one meridian is greater than that of the meridian at right angles to it. The commonest form is where the horizontal meridian is flatter than the vertical. Irregular astigmatism results from an irregular surface of the cornea which refracts the light in several different planes.

18. Astigmatism can be myopic, hypermetropic or mixed. Blurring of vision is a common symptom. Accommodation cannot completely correct astigmatism and attempts by the eye to accommodate to overcome the astigmatism may give rise to symptoms of tiredness of the eyes.

19. Astigmatism may be congenital or acquired. The latter is commonly due to trauma, particularly surgery for cataract extraction. Diseases of the cornea, such as keratoconus and keratitis (causing scarring), may also cause astigmatism, as may encroachment of a pterygium onto the cornea.

CONCLUSION

20. Errors of refraction, other than when they occur as a result of trauma to, or disease of the eye, are presently considered to be predominantly the result of constitution or predisposition. Certain types of injury to, or disease of, the eye may increase an existing error of refraction. The prevalence of myopia is increasing in many parts of the world. This has led to increased research interest and a more detailed understanding of its causes.

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