

# Refractive errors of the eye

For correct vision, apart from the intact state of the retina and optic nerve pathways, it is a condition that the optical system is able to create a sharp image of the observed object on the retina, while it is necessary that the image of the point is again a point and that the image is formed on the retina. We refer to a normal eye as emmetropic. An eye (biophysics) that does not meet any of the above conditions is an ametropic eye.

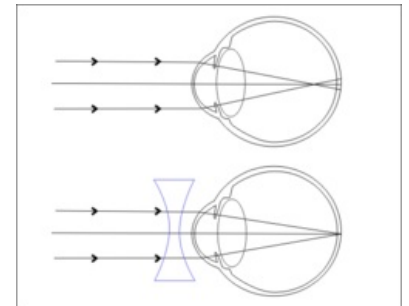
## Myopia (nearsightedness)

Nearsightedness, also known as *myopia*, is a condition where the short-sighted eye has a distant point, *the punctum remotum*, at a finite distance **in front** of the eye. Parallel rays entering the eye are refracted to a focal point **in front** of the retina. The main manifestation is poor visibility of distant objects.

**Correction** is done with glasses with a **dispersion lens**, which has a negative dioptric value.

There are two causes that lead to myopia:

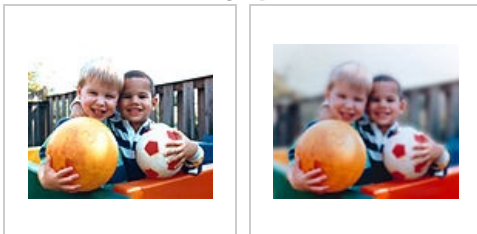
- **axial** - the eyeball is too long (it is a congenital defect, it is explained by fluctuations in the dimensions of the eye arising during embryonic development);
- **refractive** - the eyeball has a normal length, but greater refraction of optical media. This cause of myopia is not so common.



Myopic eye, correction with a dispersion lens

**Presbyopia** occurs **later** in myopes and is not as pronounced because the loss of accommodation is partly compensated by the **refractive error**.

### Myopia



Normal vision

Vision in myopia

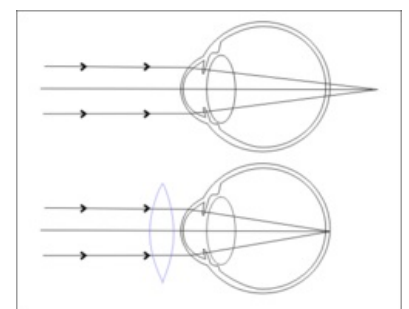
## Hypermetropia (farsightedness)

Farsightedness (hypermetropia). The far point is at a finite distance behind the eye. Parallel rays entering the eye are refracted to the focus, which is behind the eyeball. This is because:

- the eyeball is too short (a more common defect, created during embryonic development);
- the eye has less refraction of the optical system than a healthy eye.

In farsightedness, presbyopia manifests itself much earlier. With decreasing accommodative ability, hypermetropia eventually needs distance glasses. A special case of hypermetropia is aphakia, which is a defect caused by removing the lens, for example for a *cloudiness*.

The defect is corrected with a *coupling lens*.



Hypermetropic eye, correction with a coupling lens

-	<i>Punctum remotum</i>	<i>Punctum proximum</i>	<i>Accommodation width</i>	<i>Correction</i>
Emetropic - 20yo	0D; in infinity	10D; 10cm	10	No correction
Myopic - 20yo	2D; 0,5m	12D; 0,08m	10	-2D
Hypermetropic - 20yo	-2D; -0,5m	8D; 0,125m	10	+2D
Emetropic - 40yo	0D; in infinity	4D; 0,25m	4	No correction

# Links

## Related articles

- Biochemistry of vision
- Eye (biophysics)
- Oculomotor muscles

## References

- KYMPLOVÁ, Jaroslava. *Katalog metod v biofyzice* [online]. [cit. 2012-09-20]. <<https://portal.lf1.cuni.cz/clanek-793-katalog-metod-v-biofyzice>>.