

Refractive Errors in Children

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(I have no financial interest or other relationship with any manufacturer/s of any commercial product/s which may be discussed at the symposium)

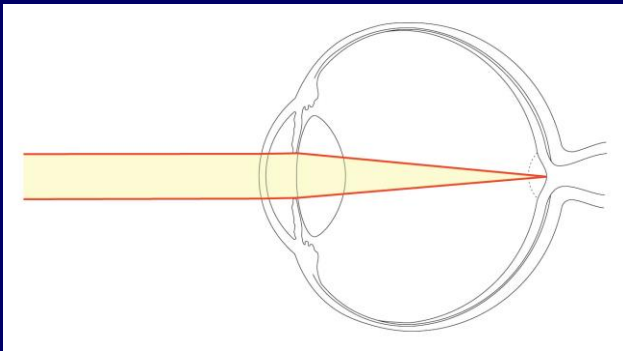
Refractive Error

Definition: Distant objects do not focus on the retina.

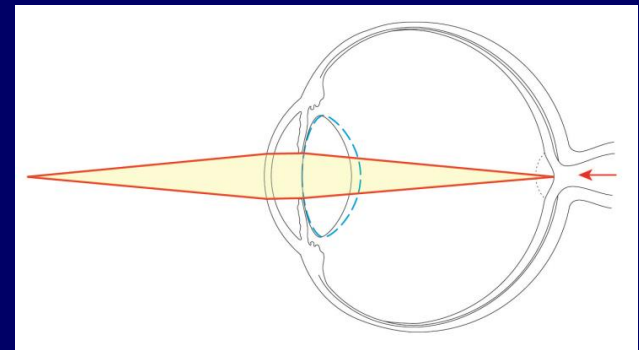
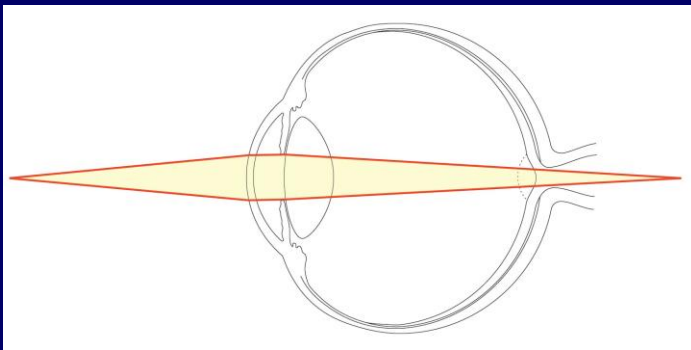
∴ one's refraction is the lens (glasses) necessary to make the object fall on the retina

Emmetropia – No refractive error

- Parallel rays focus on retina when lens in non-accommodative state (must use cycloplegic in children).



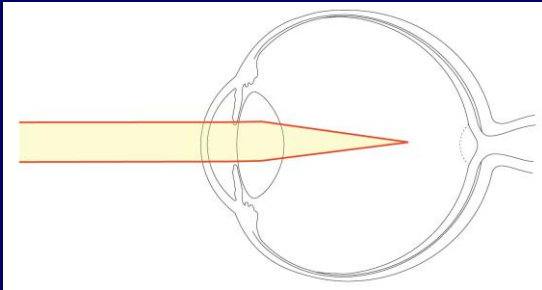
- With accommodation (for distance and near) image moves on retina



Myopia

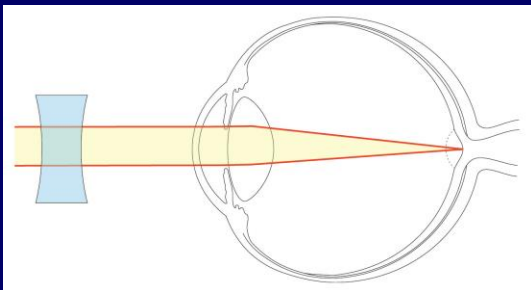
Symptom: distant objects blurred (nearsightedness)

- Image focused in vitreous



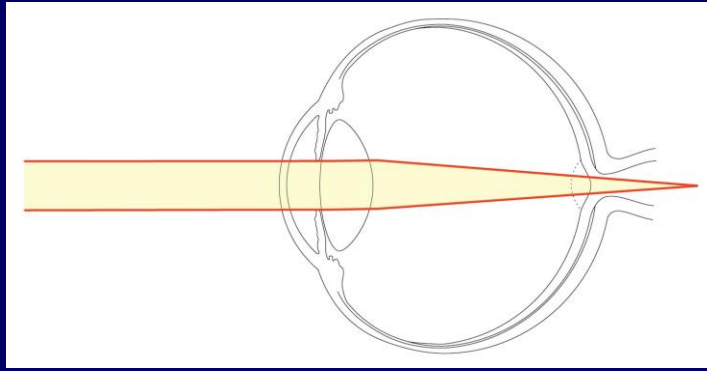
e.g., -3 D child

- With Concave lens in glasses

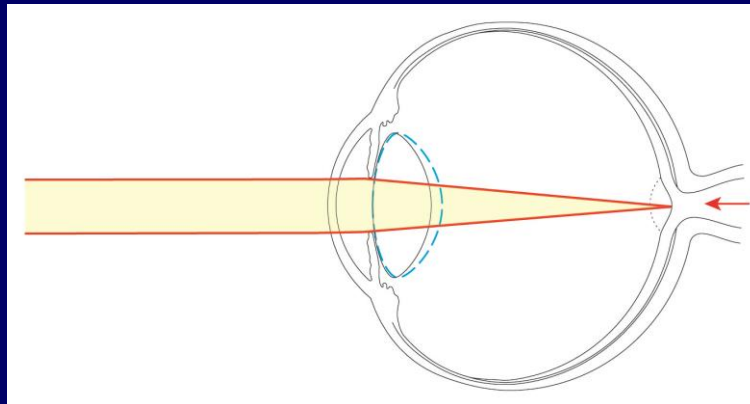


Hyperopia

- Parallel rays focus behind retina → blurred image

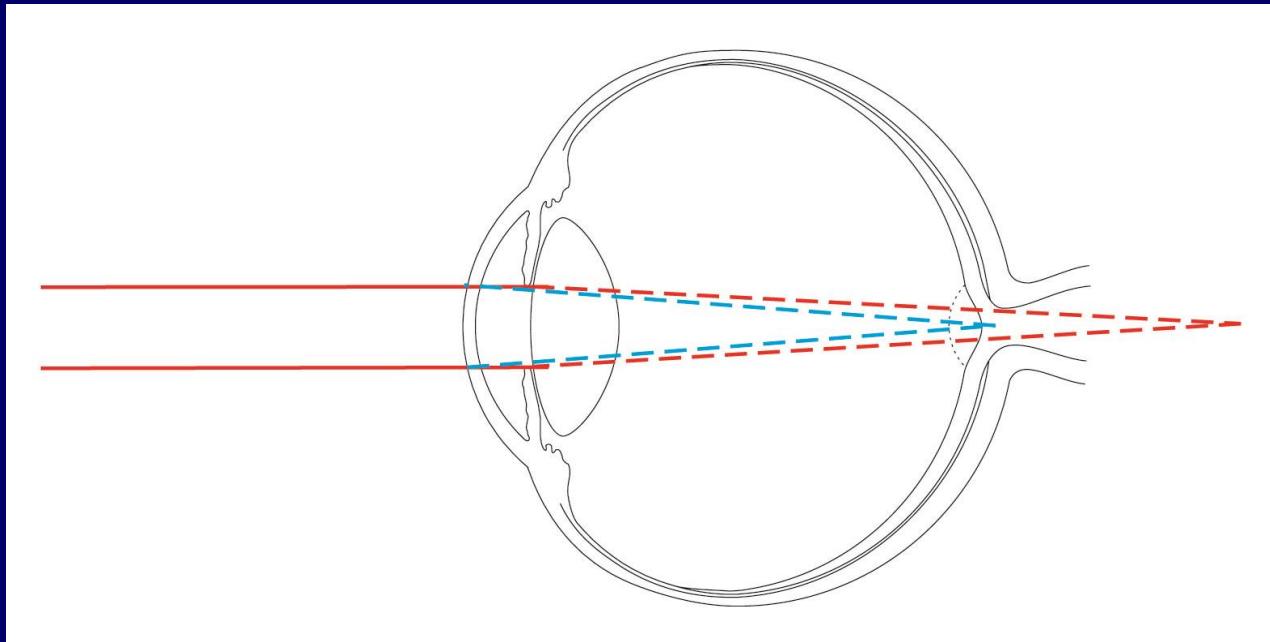


- With accommodation (for distance and near) image moves on retina



Astigmatism

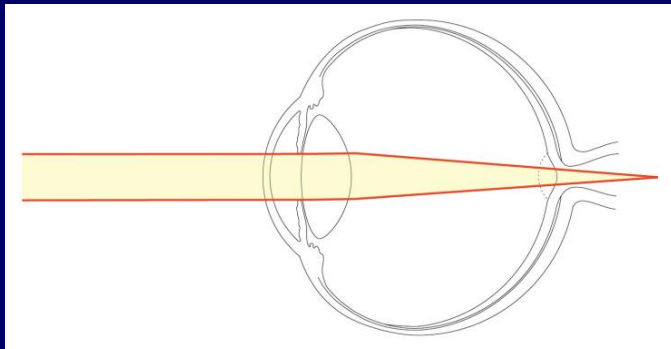
- Two major meridians with different focal points



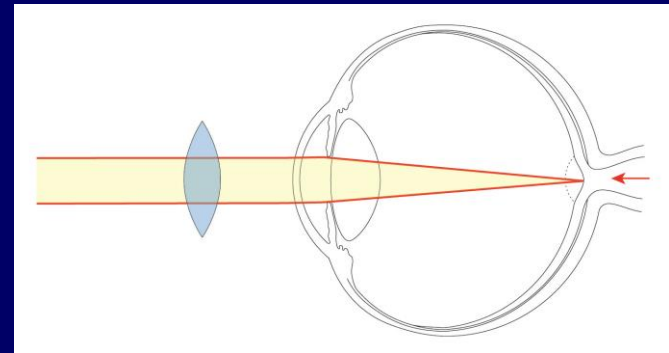
Refractive Error

Measurement of refractive state in “*diopters*” (D)

- +1 D (convex lens) bends light to focus at 1 meter;
+2 D bends to $\frac{1}{2}$ meter



e.g., 1 D hyperopic child

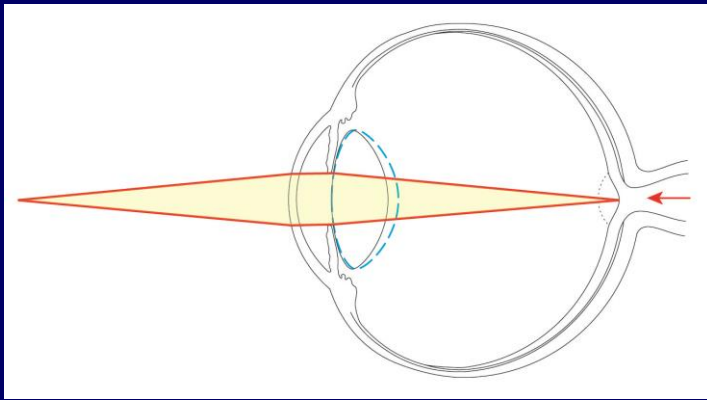


\bar{c} +1.0 lens

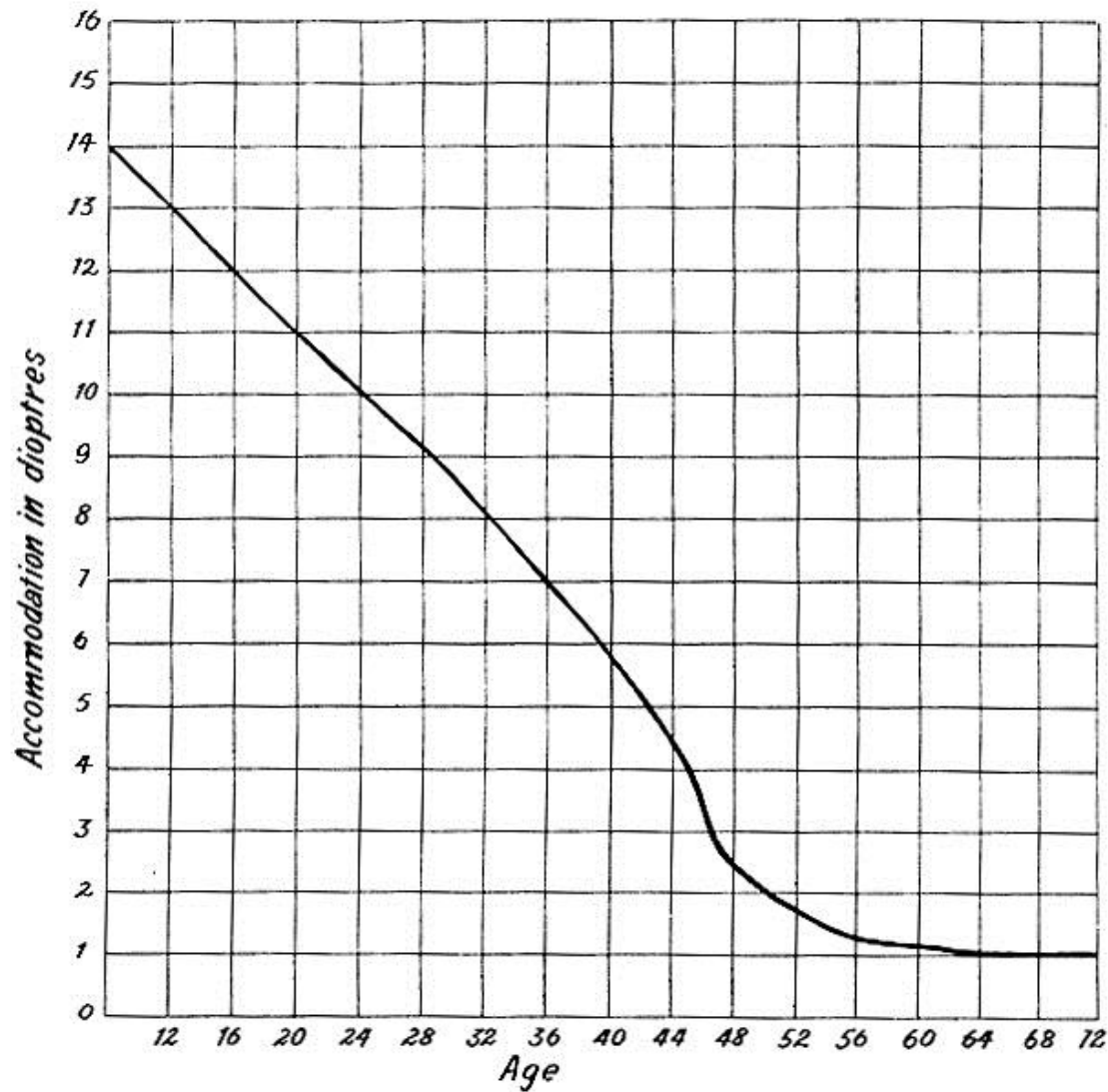
Refractive Error

Accommodation

- Accommodation measured in diopters
∴ at $\frac{1}{3}$ m, need 3 D accommodation



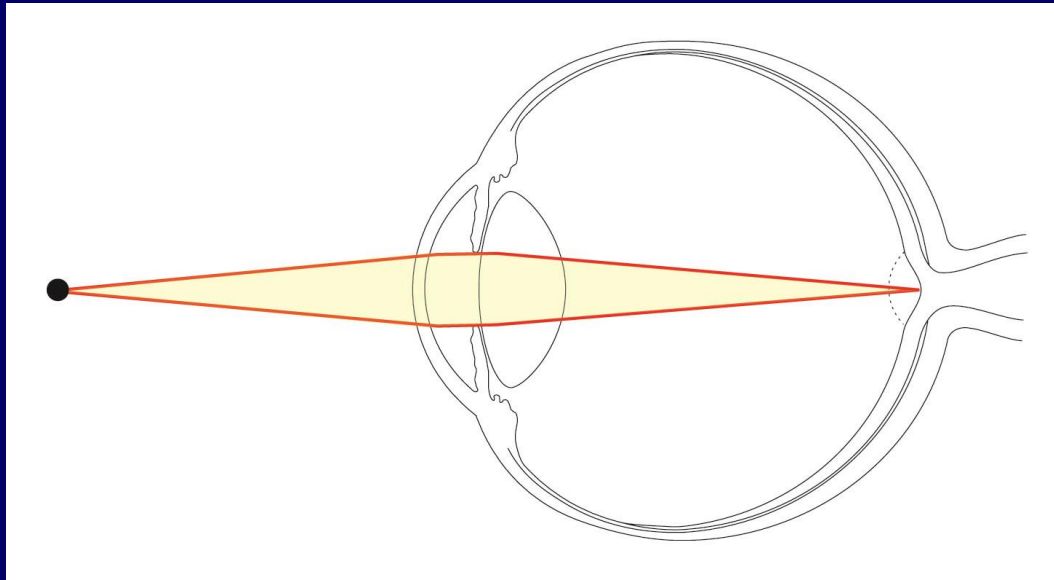
- Presbyopia: A reduced ability to focus on near objects caused by loss of elasticity of the crystalline lens. It is a normal aging process and usually symptoms start in early to mid 40's.



Amplitude of Accommodation with Age
(Duane 1923)

Myopia

∴ near images often in focus at some distant so
can read \bar{s} glasses if not high myopia.



e.g., -3 D child focus in at 1/3 meter with no accommodation

Examples of Eye Glass Prescription

Rx

Translation

1. OD: -3.00
OS: -2.75
Myopia corrected by -3 D concave lens in right eye (OD) and -2.75D lens in left eye (OS)
2. OD: +2.00
OS: +2.00
Hyperopia corrected fully (or partially) +2D convex lens in both eyes (OU) or reading correction emmetropia (50s)
3. OD: -3.00+2.00x90°
OS: -2.75+2.00x90°
Astigmatism with designation of strength and axis of astigmatism

Refraction Issues in Children

Natural History

- Mean refraction in infants about +2.00 (Banks 1980)
- Hyperopia increases for 5-7 years (Banks 1938)
- Myopia increases 8-13 years
- Myopia/astigmatism and anisometropia more frequent in premature infants

Cycloplegic Refraction

- Always some systemic absorption and possible systemic reaction
- Premature babies need careful monitoring and weaker drops (cyclomydril)
- Cycloplegic has 2 effects:
 - 1) prevent accommodation
 - 2) dilate
- Mydriacyl (tropicamide) fast, short acting; good for primary care physicians

Refraction Issues in Children

Accommodation

- Infants near 16 D
- 8-year-old about 14 D (Duane 1922)
- Therefore, small to moderate degrees of isolated hyperopia may not require glasses

Refraction in Children

Symptoms

1. Hyperopia – often have none unless high amount then reading problems primarily
2. Myopia – difficulty with distant objects; holds things close, “squints”
3. Astigmatism – “squints” eyes when looking at things, fatigue problems

Goals of Therapy in Prescribing

- Improved visual acuity and function
- Treatment of strabismus
- Treatment of amblyopia
- Relief of visual symptoms
(rare in children)

Visual Acuity Screening by Pediatricians?

Initially (early infancy)

- Good, symmetric red reflex
→ may require 1 drop tropicamide (mydryacil)
- Looking for cataracts, retinoblastoma, asymmetry
(may be due to anisometropia: difference in refraction between two eyes)

Visual Acuity Screening by Pediatricians

Pre-school

- To identify amblyopia or significant refractive error

Visual Acuity Screening by Pediatricians:

Grade School

- Identify child who has become myopic for referral and glasses

Thank you for your attention!