

# *Refractive errors in children*

Dr.Zhale Rajavi

Shahid Beheshti University of Medical Science

2022

## *Significant Emotropization from 1 to 6 yrs due to defocus image*

Cornea power	52 to 42	dif	10
--------------	----------	-----	----

Corneal diameter	9.5 to 12	dif	2.5
------------------	-----------	-----	-----

Lens power	40 to 20	dif	20
------------	----------	-----	----

AP length	17 to 24	dif	7
-----------	----------	-----	---

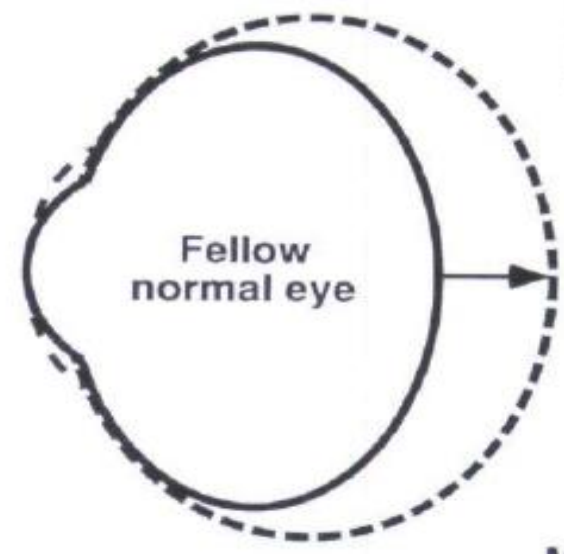
0 to 6 m = 4 mm

6m to 2 y = 2 mm

2 to 5 y = 1mm

5 to 13y = 1mm

Less Em in Aniso > 3D, VA < 20/100, ST, HRE



## *Why Glasses Prescription in Children is Challenging?*

Limited *cooperation*

*Emetropization*

Risk of *amblyopia*

Strong *accommodative power*

Less possibility of *VA assessment*

Different *visual needs* according to *age*

*Accompanying factors* :ST, ROP ,Glaucoma, Cat, ptosis



# *When Does a Child Need Glasses*

Reduced VA

Anisometropia

Strabismus

Asthenopia ,Headache

Protection(trauma ,UV )

Learning problems

Cosmetic



## *Which Qs Should Be Considered Before Prescription of Glasses?*

- ▶ Is refractive error in **normal** range?
- ▶ Can this refractive error **reduce** VA?
- ▶ Will this prescription **improve** VA?

# *Normal Refractive Error & Emotropization at:*

*birth to 3m*

**H:**  $+2 \pm 2$  (  $< 4$  D )

**M:** rare ( -5 )

**AS:**  $> 1$  (70%)

**Aniso:**  $> 1$  (30%)

*3m to 12 m*

***Fast Em***

**SE:**  $+2.16$  to  $+1.36$

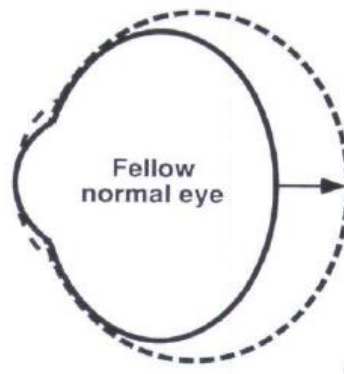
**dif** = 1.7 D

*12 m to 6 yr*

***Slow Em***

**SE:**  $+1$  to  $+0.7$

**dif** = 0.3 D



# Hyperopia Definitions

*Low H* :  $\leq 2 D$

*Mod.H* : 2 to 5 (more acc, more ET)

*High H* :  $> 5$  (less acc, more Amb)

*Simple H*: short Axial Length

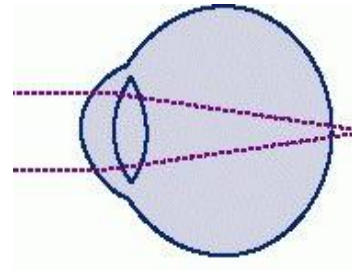
*Pathologic H*: Cornea plana , cataract

*Functional H*: 3<sup>rd</sup> Np: acc lag , CB disorders

*New H*: Orbital tumors (hemangioma)

*Isometropic H*:

*Anisometropic H*: SE or S or C dif= 1.5 (clinically  $>0.5$ )

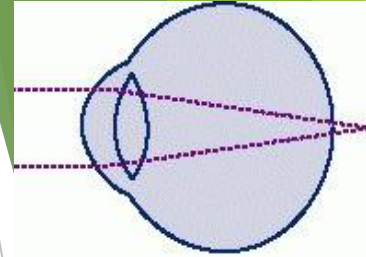


# *Hyperopia correction in children*

- ▶ **Low H : No glasses** : sym cut plus : from high to low , f up
- ▶ **Glasses: Reduced VA** ( as an absolute or facultative H)
  - ▶ **Asthenopia** or headache or blinking ....
- ▶ **Low H + large ET** : OP ( $1y < +2$ ,  $2y < +1.5$  )
- ▶ **Med. H + ET**: FCR (VA is sig) **full or partially correction of deviation** (op?)
- ▶ **H + ET+ High AC/A** : FCR +bifocal or PALs ( op?)
- ▶ **Low & Med H + XT**: no glasses or Min H + BCVA + f up
- ▶ **HH+XT**: symmetric under correction + BCVA +/- operation



# *Hyperopia correction in children*



**As a rule :** More age , more H should be corrected

More acc : more possibility of **ET**

Acc. lag : amblyopia , orthophoria

More acc or H over correction: **Pseudo myopia**

Age 10 ,headache , VA: 20/25 , Manifest :  $-0.5$  , FCR: +5

Symmetric cut plus to simulate **Emetropization**

Age		<1y	<2 y	<3 y	<4y
Isoametropia					
H		6	5	4	3
Anisometropia					
H		2.5	2	1.5	1.5

---

<i>OD</i>	<i>OS</i>				
2	2	-	-	-	-
4	4	-	-	+	+
6	6.5	+	+	+	+
4	2	+/-	+dif	+ dif	+dif
6	3	+dif	+dif	+ dif	+dif
6	-2	+	+	+	+antemetropia

# Myopia Definitions

*Low M :  $\leq 3-5 D$*

*High M :  $> 5$*

*Congenital : rare*

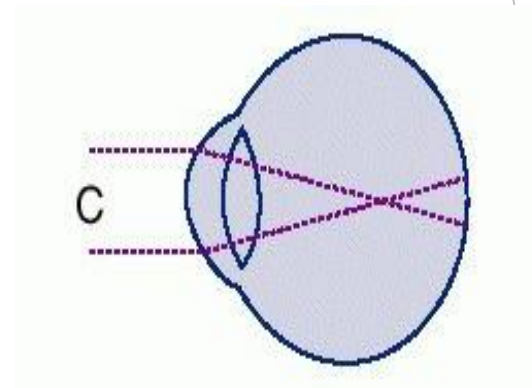
*Juvenile : school age , simple myopia*

*Early adult : 20-40*

*Late adult :  $>40$  (cataract)*

*Iso myopia*

*Anisomyopia : dif of 3,2,1 according to ages of 1,3,6 respectively*



# Myopia correction in children

**Low M:** No glasses up to 3–4 yrs old ( no risk of amblyopia )

it should be prescribed at preschool ages

**High M :** prescribe glasses to avoid amblyopia , lowest M with BCVA (Em)

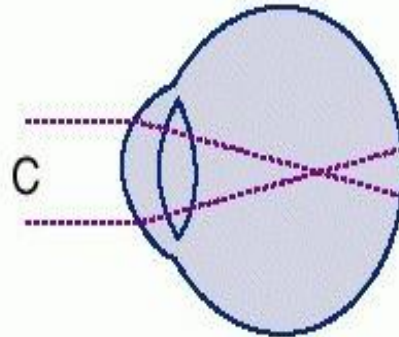
**High M :** other etiologies of HM should be eliminated( ROP, cong. glaucoma)

**M + Acc lag:** prescribe bifocal or PAL since blurred near vision &  
image at the back of retina, stimulate MP

**M+ O :** min of M + BCVA

**M +XT:** max of M ,even over minus (op?)

**M+ ET:** min of M + BCVA (OP?)



Age	<1y	<2 y	<3y	<4y
Isoametropia				
M	5	4	3	2.5
Anisometropia				
M	4	3	3	2.5

---

<i>DD</i>	<i>DS</i>				
-4	-4	-	+	+	+
-5	-5.5	+	+	+	+
-2	-3.5	-	-	-	-
-7	-5	-	-	-	+/-
-8	-5	-	+	+	+
-6	+2.5	+	+	+	+(CLENS)

# Astigmatism Definitions

Low AS:  $<1.5 - 2$  D

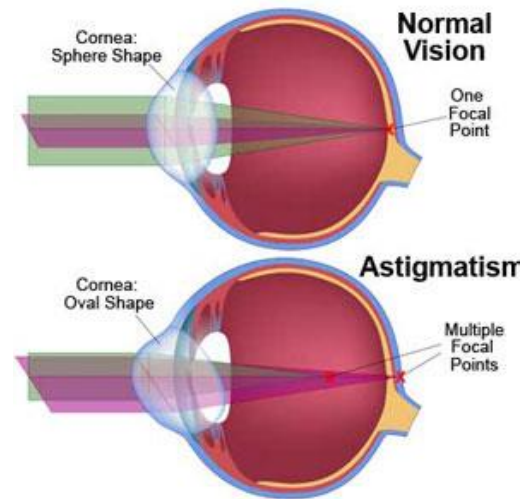
High AS :  $>1.5 - 2$

**WTR** : axis from 30 – 150 to 150–30  
more power in vertical meridian

**ATR** : axis from 60 to 120  
more power in horizontal meridian

**Oblique** : axis 30 to 60 & 120 to 150  
more power in 90 degrees beyond

AS affects on alignment according to it's SE , no change is needed



# Astigmatism correction in children

- **Low AS** : prescribe in **older** children or if there are **less VA**, asthenopia, headache or with **H or M** glasses
- **ATR & Oblique AS** have more risk of **amblyopia**
- **High AS** should be given **earlier**
- **Total of AS** should be given at 1<sup>st</sup> glasses
- Consider the **Exact axis of AS** according to **manifest** refraction not on cyclorefraction
- **6 to 8 wks later VA will improve**



Age		<1Y	<2 Y	<3Y	<4Y
Isoametropia					
AS		3	2.5	2	1.5
Anisometropia					
AS		2.5	2	2	1.5

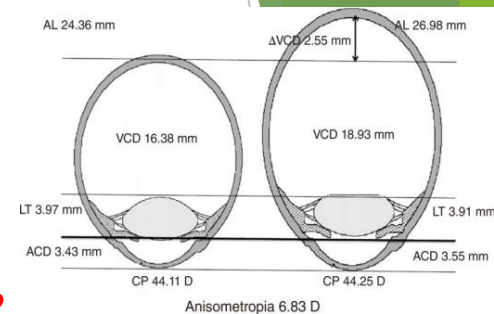
---

<i>OD</i>	<i>OS</i>				
<i>+1-2*170</i>	<i>+1-2*170</i>	-	-	+	+
<i>+1-2* 90</i>	<i>+2 -2*90</i>	-	+	+	+
<i>+4-1* 180</i>	<i>+4-1* 180</i>	-	-	+	+
<i>P-2 * 60</i>	<i>P-2 * 60</i>	-	+	+	+
<i>+2</i>	<i>+2-2*180</i>	-	+	+	+
<i>-2-3*180</i>	<i>-2-3*180</i>	+	+	+	+

- Sometimes the difference of 1 or even 0.5 is amblyogenic



# Anisometropia Definitions



- ▶ **Aniso H** > 1.5      **Aniso M** > 3      **Aniso AS** > 1.5 -2

Sometimes even 0.5 D difference of H or AS is sig in clinic

- ▶ **Simple Aniso**      1 eye plano      1 eye H or M
- ▶ **Compound H Aniso**      both eyes H
- ▶ **Compound M Aniso**      both eyes M
- ▶ **Mixed or Antemetropia Aniso**      1 eye H      1 eye M

Rule out **Secodary etiologies**

# Aphakia

- ▶ Bilateral                   glasses, clens ,IOL
- ▶ Unilateral                clens ,IOL
- ▶ Add 2 to 3 D for near work up to 2 -3 yrs ,  
then change it to bifocal or PALs
- ▶ UV protection glasses or IOLs



# Indications of Prism Glasses

Diplopia : paralytic , restrictive

Abnormal Head posture : Nystagmus (both prism apex to null),

Measurement

Postop residual deviation

Visual field scotoma

Cosmetic : reverse prism

Anti suppression therapy

Orthoptic exercise



# General Rules

- ▶ Mag/Min : Each 1D of glasses = 2% , c lens = 0.75% , IOL = 0.125%
- ▶ Anisokonia can be tolerateable only up to 6 to 8 %
- ▶ So obey max dif of glasses = 3 D , c lens = 9-10 D , IOL = 50 D
- ▶ Start Amblyopia treating 4 months after glasses wearing
- ▶ VA will improve only with glasses (30%)
- ▶ High AC/A ratio in Gradient method  $> 5$  , Phoria method  $> 10$  is significant
- ▶ High AC/A : 30% better , 30% worse , 40% no change
- ▶  $ACC = 15 - 0.25 \times \text{Age}$



# Cycloplegia



- ▶ **Atropine** 1% drop or pomade
- ▶ **Cyclopentolate** 1% + **Tropicamide** 1% + **Neophrine** 5% drops ,  
5 min apart , refraction 45 min later
- ▶ **Infants**: as above with 0.5% , repeat 1 mon later
- ▶ **Indication** : 1<sup>st</sup> time , HH , Aniso , ST, Pseudo Myopia
- ▶ **Allergic events** : **Physostigmin**, 0.25mg, subcutaneous

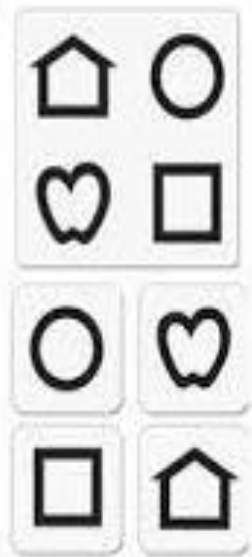
# VA assessment according to age

- ▶ **Preverbal < 2.5 yrs** : PLT , Fixation , GCM , Following
- 2.5 to 4 yrs** : Lea , Allen ,HOVT symbols
- ▶ **Verbal > 4 yrs** : Snellen chart

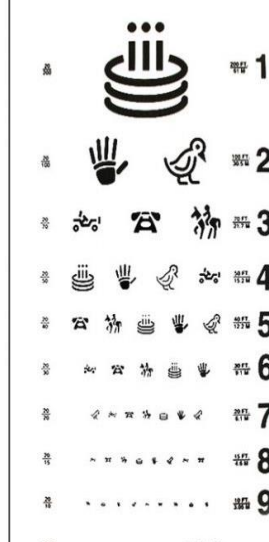
PLT



LEA



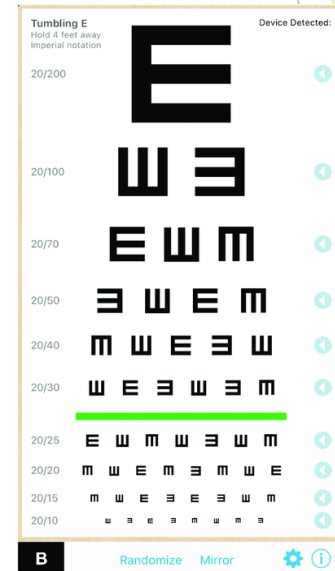
ALLEN



HOVT



Snellen



# Frame characteristics

- ▶ **Size** : Small : HH or HM : less weight , less Aberrations
- ▶ Large : protective glasses
- ▶ **Frame Material** : Plastic : weight , allergy
- ▶ **Bridge** : boys : 2 rows , Girls : 1 row
- ▶ **Temple** : Skull ( regular ) , Strap ( head ) , Cable (ear )
- ▶ **Spring hinge** :
- ▶ **Lens material** : Polycarbonate (less weight ,anti scratch ,resistant )
  - Plastic
  - Glasses
  - Tinted
  - UV absorptive

