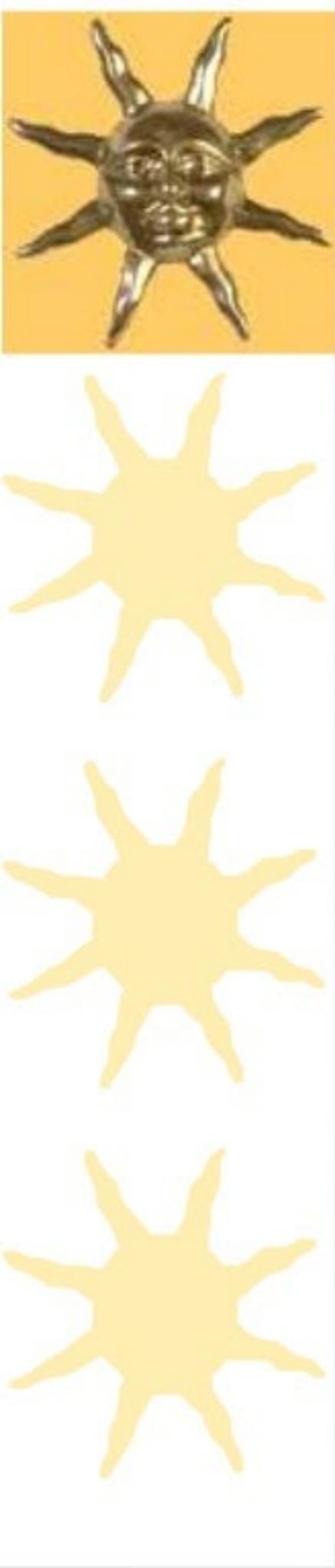


BINOCULAR ANOMALIES:

What we should know?

Prepared by:
Anis Suzanna Binti Mohamad
Optometrist



Introduction

* Definition binocular vision:

- Vision in which both eyes are used together.

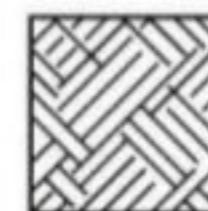
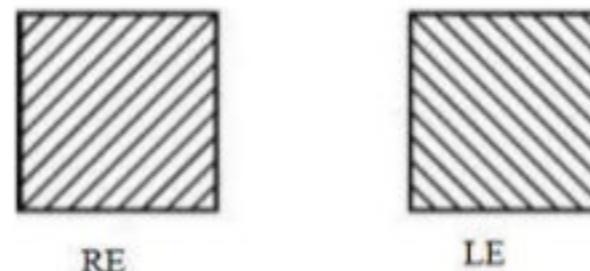
Simultaneous



Fusion



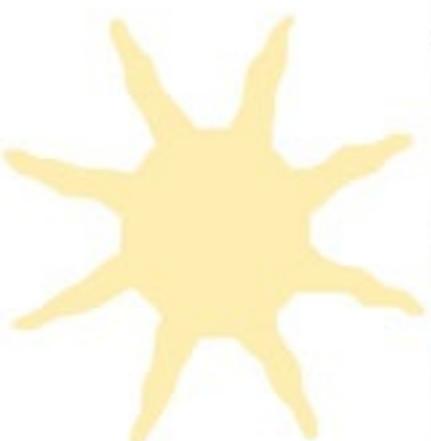
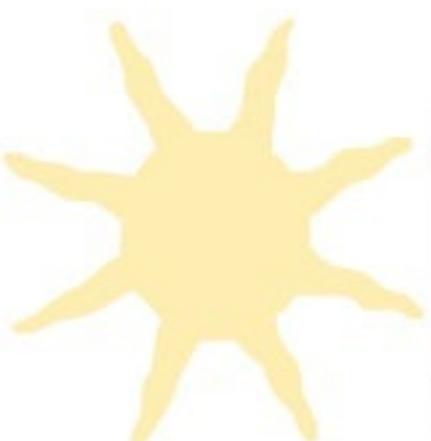
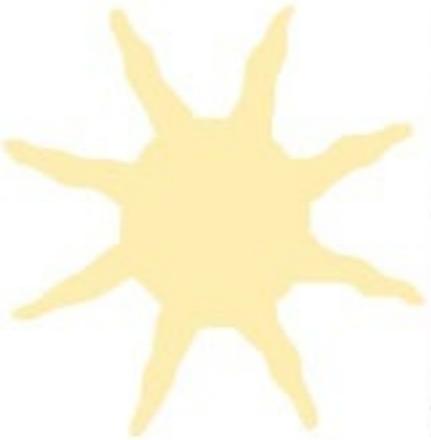
Stereopsis



BE : Retinal rivalry



What are binocular anomalies?



Strabismus

- Concomitant
 - Esotropia, exotropia, vertical deviations
- Incomitant
 - Paralytic, Mechanical, myogenic, neurogenic

Non-strabismus

- Accommodation anomalies
 - Accom. Weakness, infacility, excess, spasm, paralysis
- Vergence anomalies
 - Convergence / Divergence insufficiency, Convergence / Divergence Excess

Sensory adaptation to squint

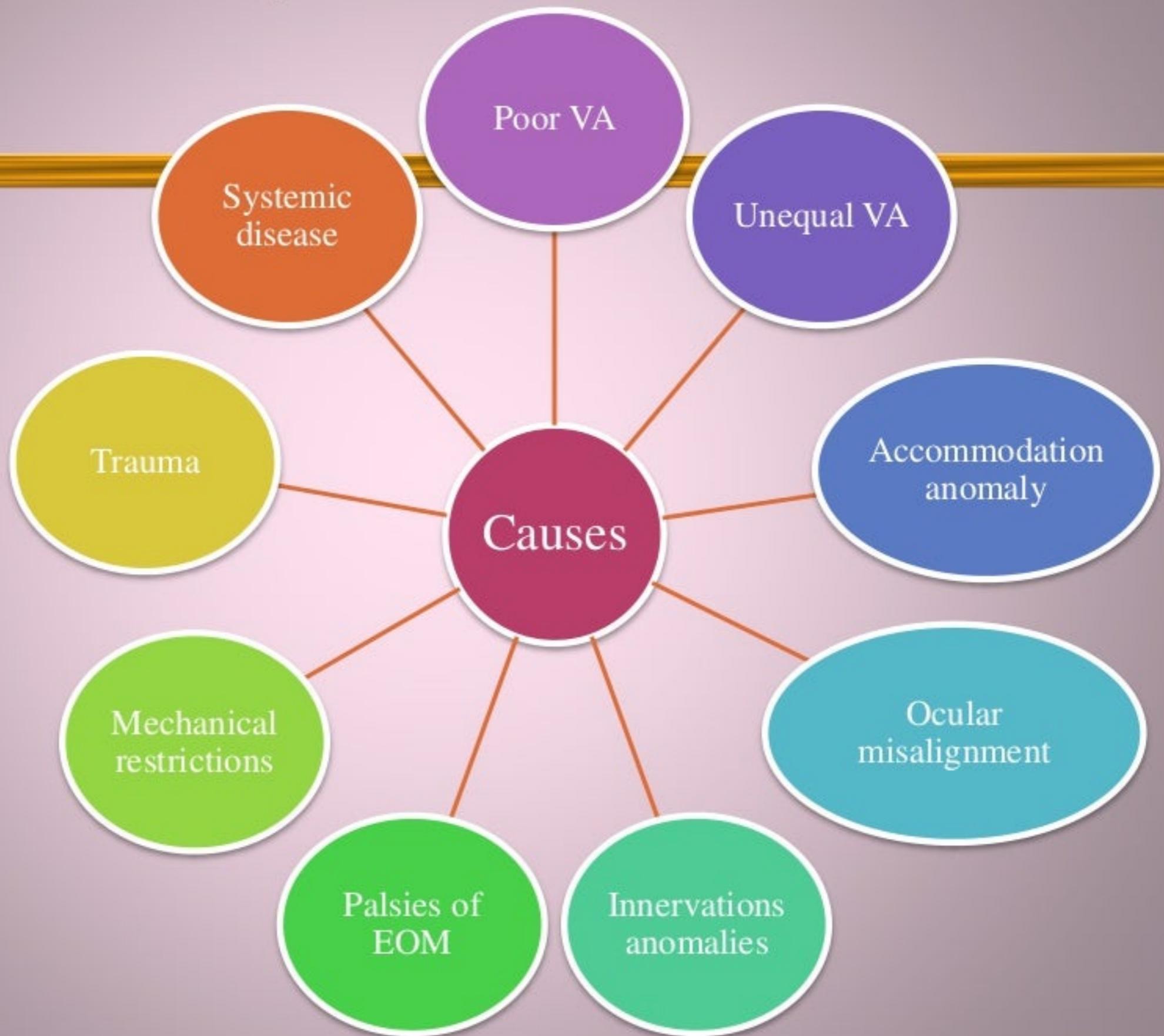
- Diplopia, Anomalous Retinal Correspondence (ARC), Eccentric fixation, Suppression, Amblyopia

Eye movement disorders

- Nystagmus, etc.



Causes of binocular anomalies

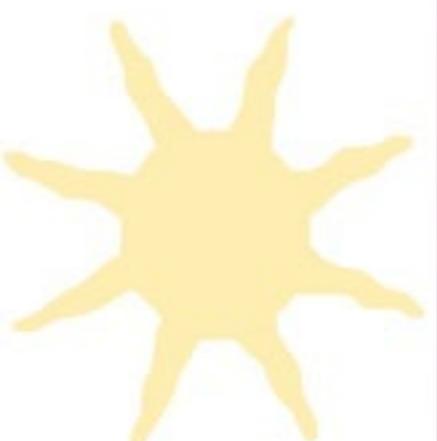
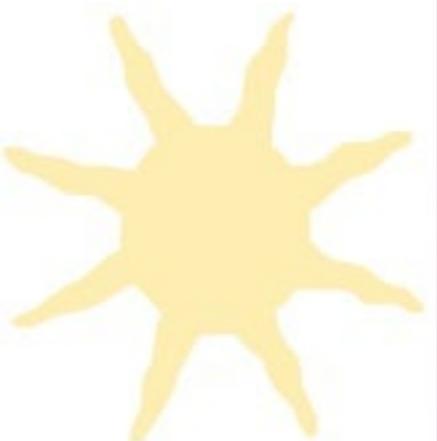
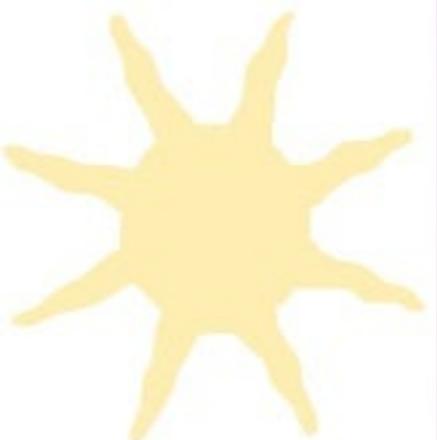




Chief complain of binocular anomalies

- ★ Diplopia
- ★ Confusion
- ★ Headache
- ★ Asthenopia
- ★ Eye pain
- ★ Blurred vision





Point to ponder

- ★ Simple cases of binocular anomalies may be managed and treated on first visit.
- ★ Complicated cases may require consecutive visits for detail assessment of other visual functions employing special techniques etc.



Why?

* Successful BV assessment, diagnosis and management depends on:

- Age
 - Visual maturity @ 7 years old
 - VA established and amblyopia not occur if therapy is discontinued
- Plan
 - Only do necessary
 - Work out strategy in your approach to pt
- Speed
 - Accurate measurement in fresh pt
- Limit the ‘exam pollution’
 - Do not disturb fusion in early assessment.

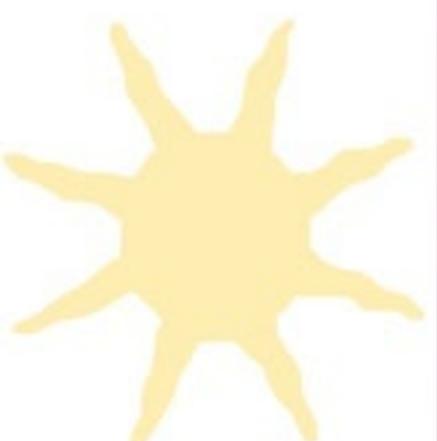
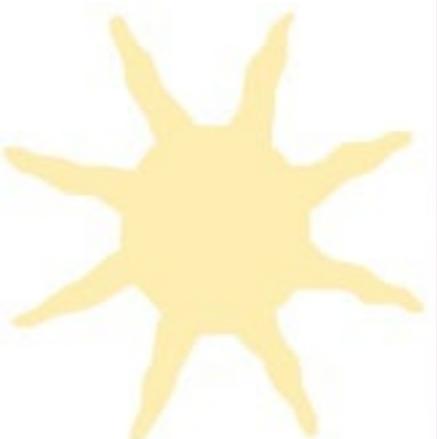
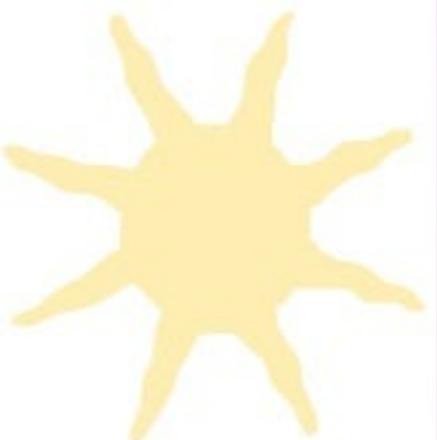
Primary care clinic Vs BV assessment clinic

Primary care clinic

- ★ Entrance test
- ★ Vision testing
- ★ Refractive examination
- ★ Accommodation assessment
- ★ Ocular alignment
- ★ Binocularity function

BV assessment clinic

- ★ History and observation
- ★ Binocularity function
- ★ Ocular alignment
- ★ Vision testing
- ★ Refraction if necessary
- ★ Accommodation and vergence assessment



BV assessment clinic



* *History*

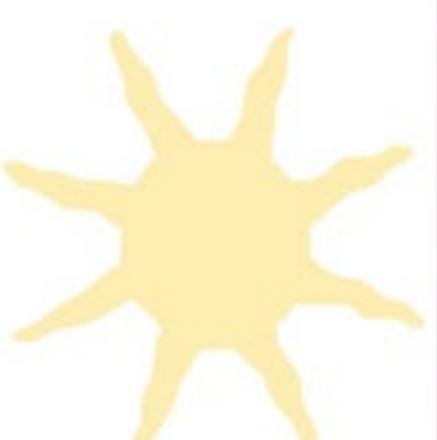
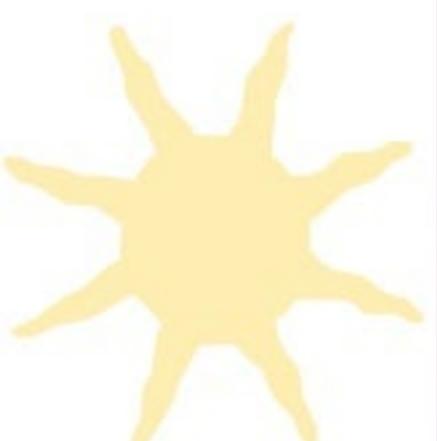
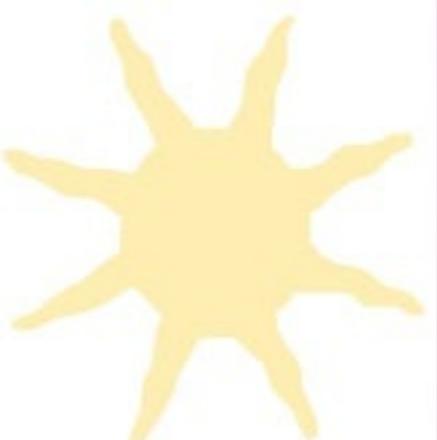
- Presenting complain
- Ophthalmic/ medical history
- Obstetric/ antenatal/ development history
- Family history
- Social history

* *Observation*

- Actively observe the pt
 - Obvious squint
 - Facial asymmetry
 - AHP, face turn, head tilt
 - Gait & posture



BINOCULARITY FUNCTION



- ★ Worth classification :
 1. Simultaneous perception
 2. Fusion
 3. Stereoscopic vision (3D)
- ★ Suppression :
 1. physiological suppression : in normal BSV to prevent physiological diplopia & retinal rivalry*

* State of fluctuation between competing components



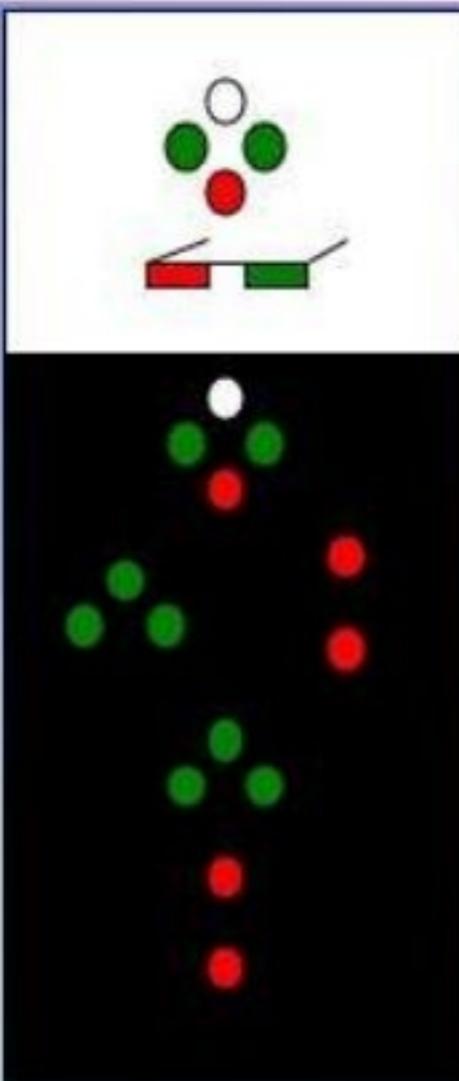
2.

pathological suppression : to overcome

- binocular diplopia

- confusion

- incompatible images



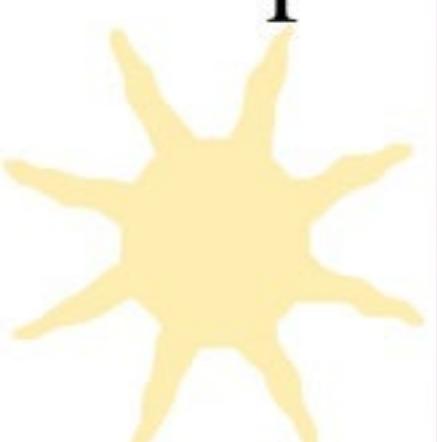
BSV

Diplopia

R Sup

L Supn

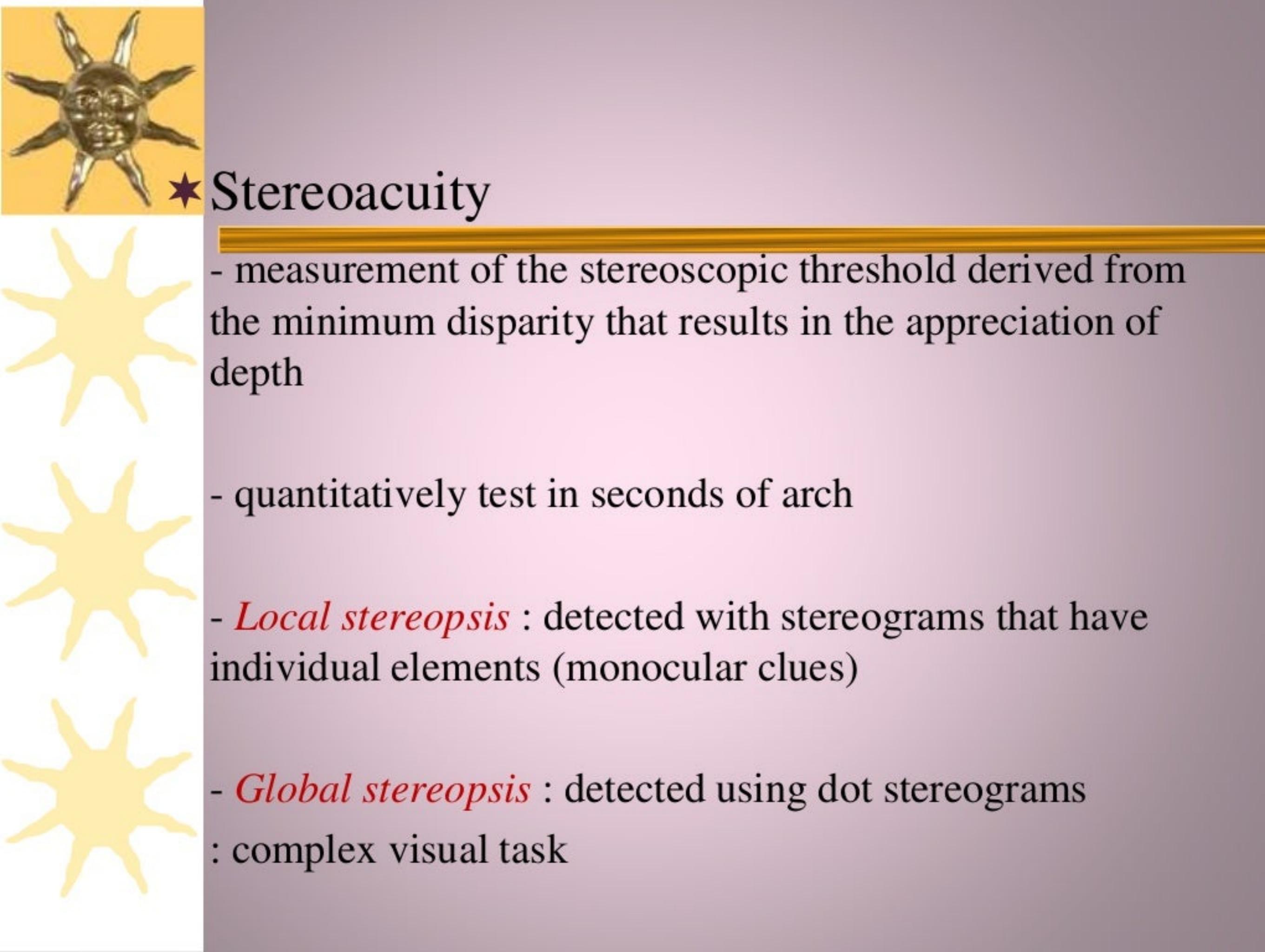
**WORTH'S FOUR DOT LIGHTS
TEST**



*Stereopsis

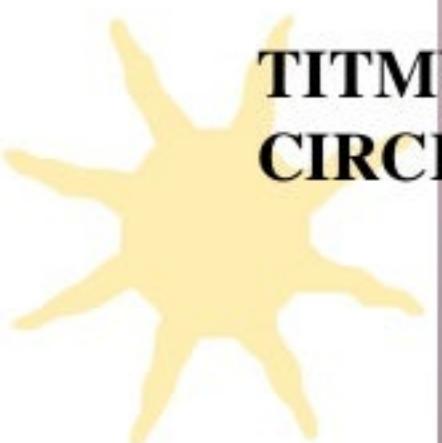
- binocular visual depth perception based on retinal rivalry
- qualitative test : Lang's two-pencil test



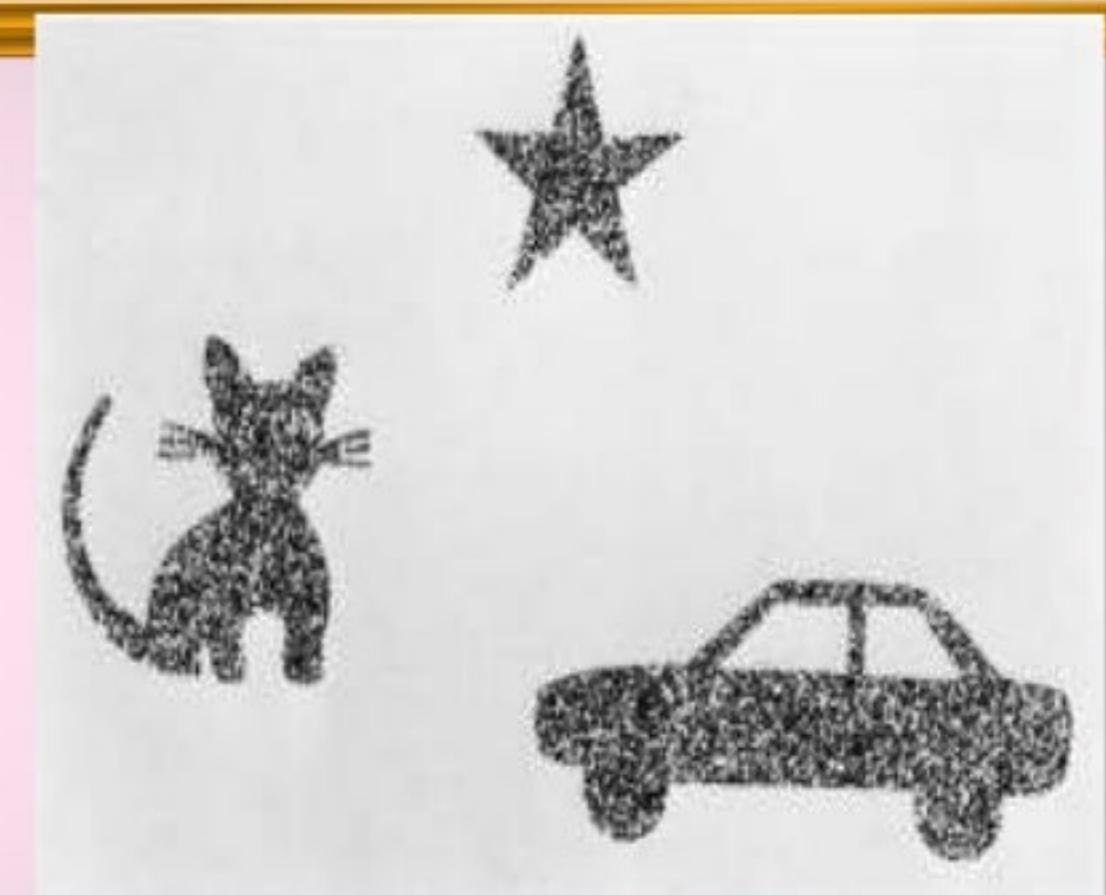


Stereoacuity

- measurement of the stereoscopic threshold derived from the minimum disparity that results in the appreciation of depth
- quantitatively test in seconds of arch
- *Local stereopsis* : detected with stereograms that have individual elements (monocular clues)
- *Global stereopsis* : detected using dot stereograms
: complex visual task



**TITMUS FLY & WIRT
CIRCLES**



LANG TEST



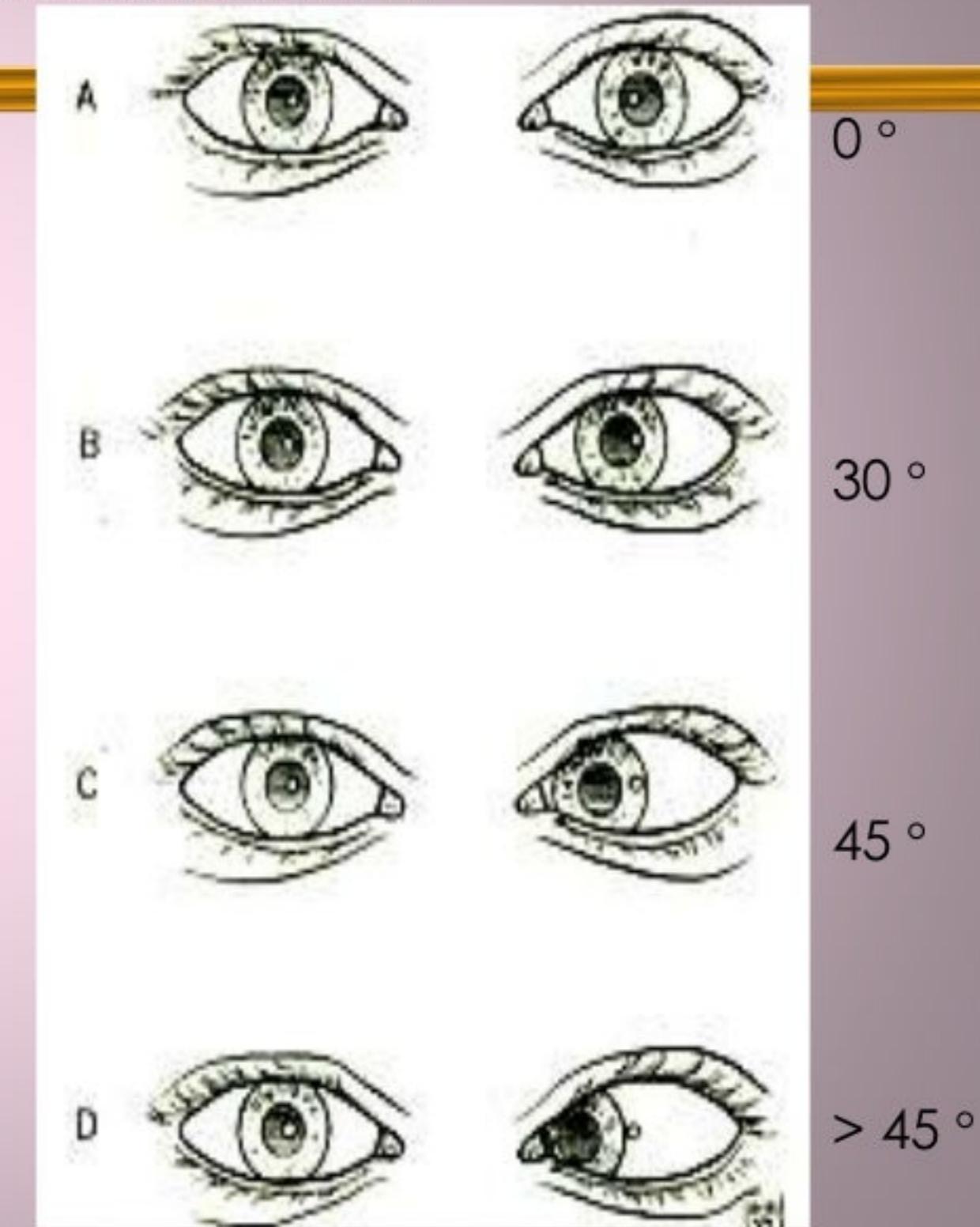
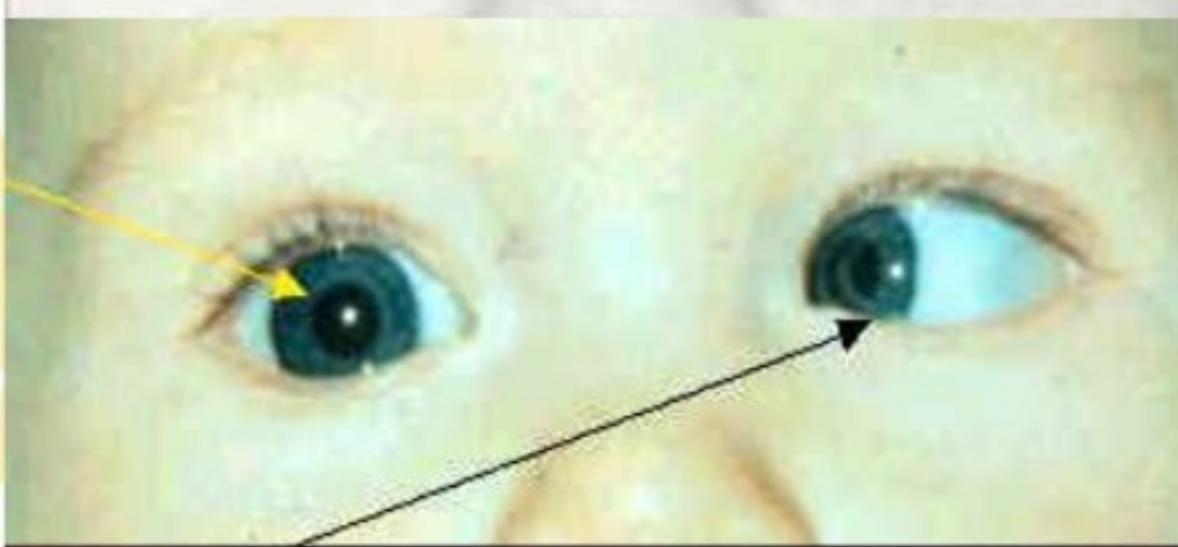
Ocular alignment

- ★ Hirschberg test/ Bruckner test
- ★ Oculomotility test
- ★ Quantitative measurement- Prism cover test, simultaneous PCT, prism reflection test, Krimsky test
- ★ Cover test
 - Cover/uncover cover test
 - Alternating cover test



Size of deviation

1. – Hirchsberg's reflection test

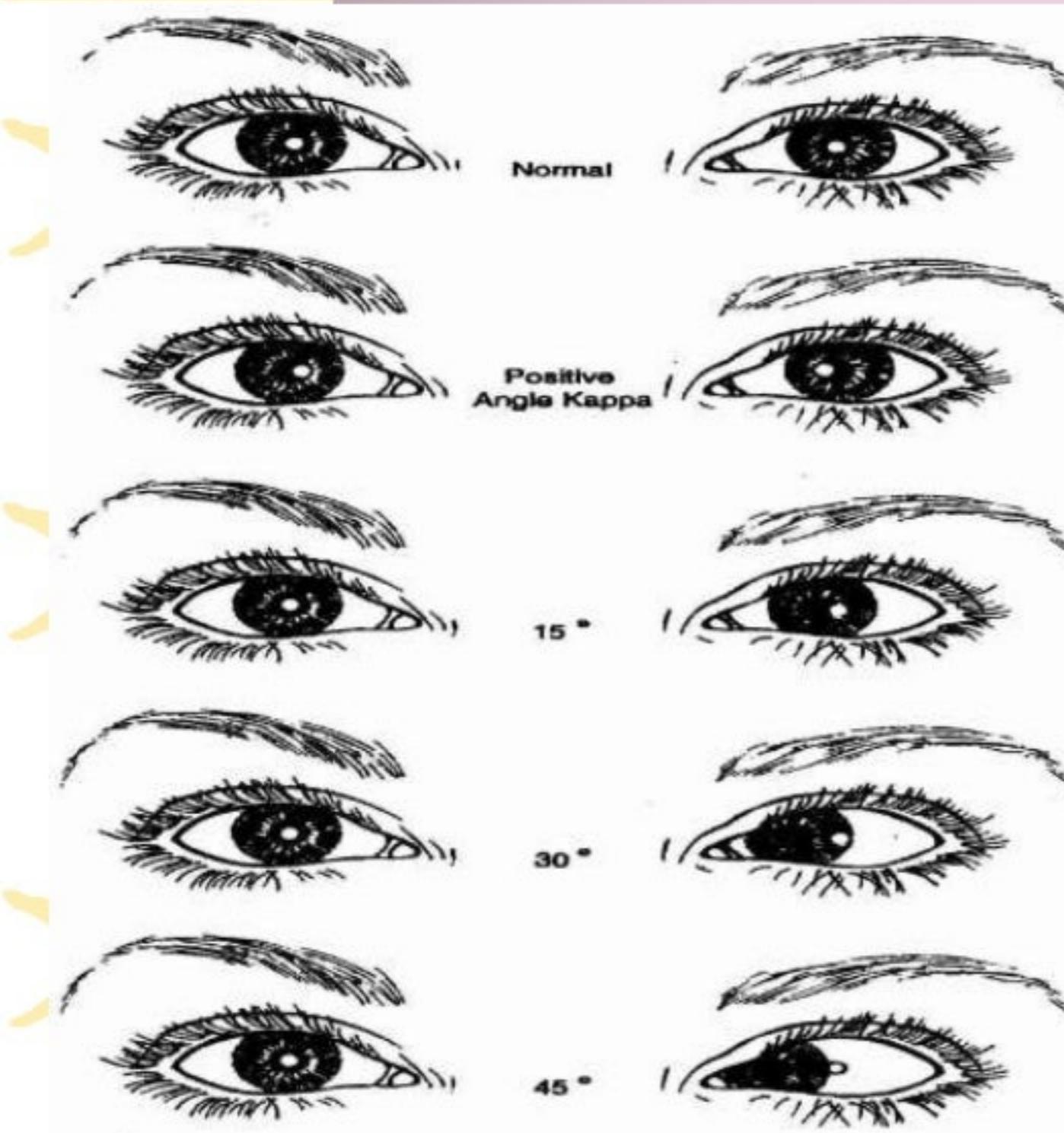


Brodie (1987)



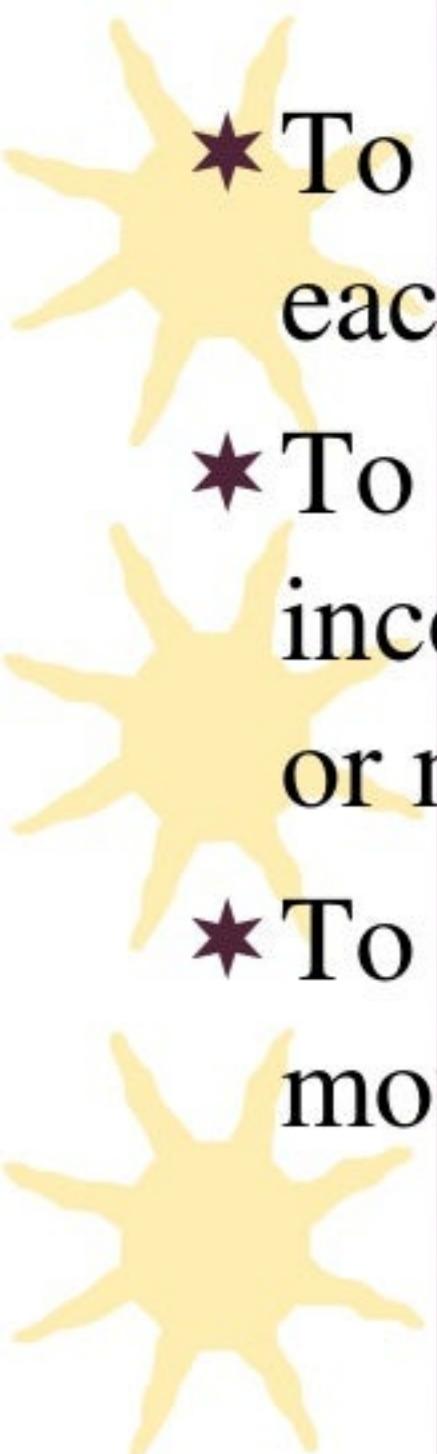
2. Bruckner test

- Uses ophthalmoscope
- Observe the color and - brightness of fundus reflexes and compared



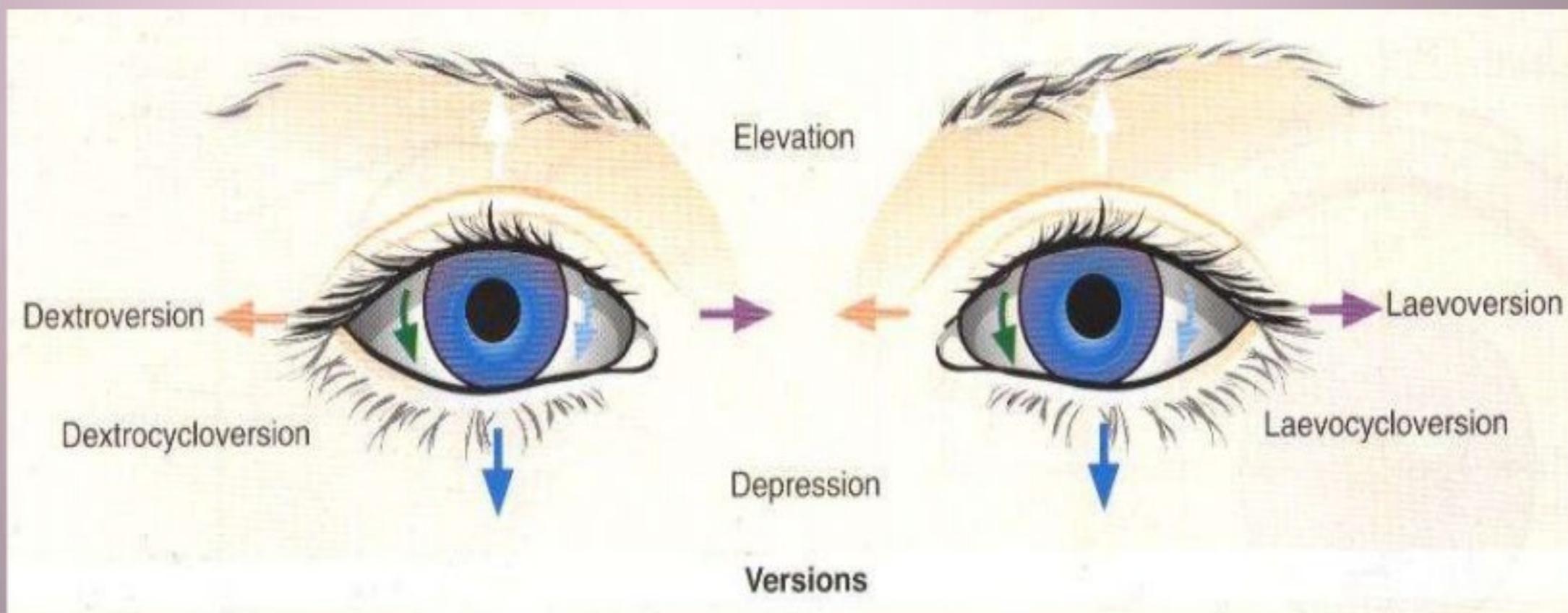


OCULOMOTILITY TESTING

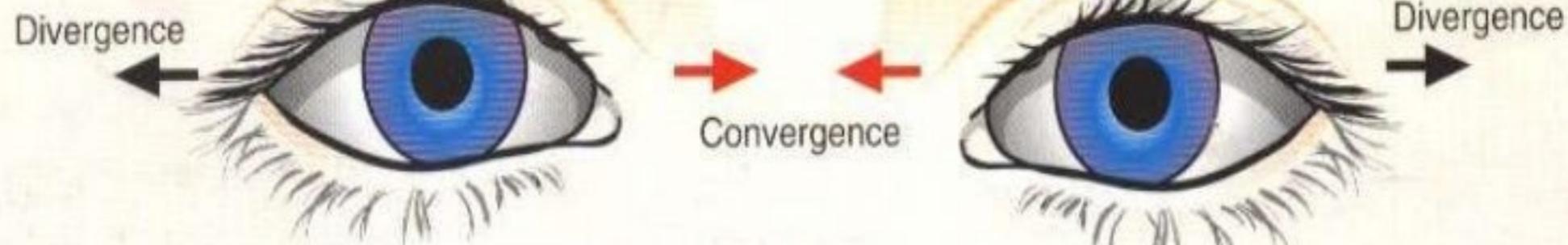
- ★ To elicit the extent & quality of movement of each eye
 - ★ To determine the presence of comitancy or incomitancy (decompensation of heterophoria or muscle defect)
 - ★ To establish the integrity of the ocular movement systems & the neural pathways
- 

◎ Action of EOM

1. Duction : movement of one eye
2. Version : simultaneous & equal movement of BE in the **SAME** directions



3. Vergence : simultaneous & equal movement
of BE in the **OPPOSITE** direction





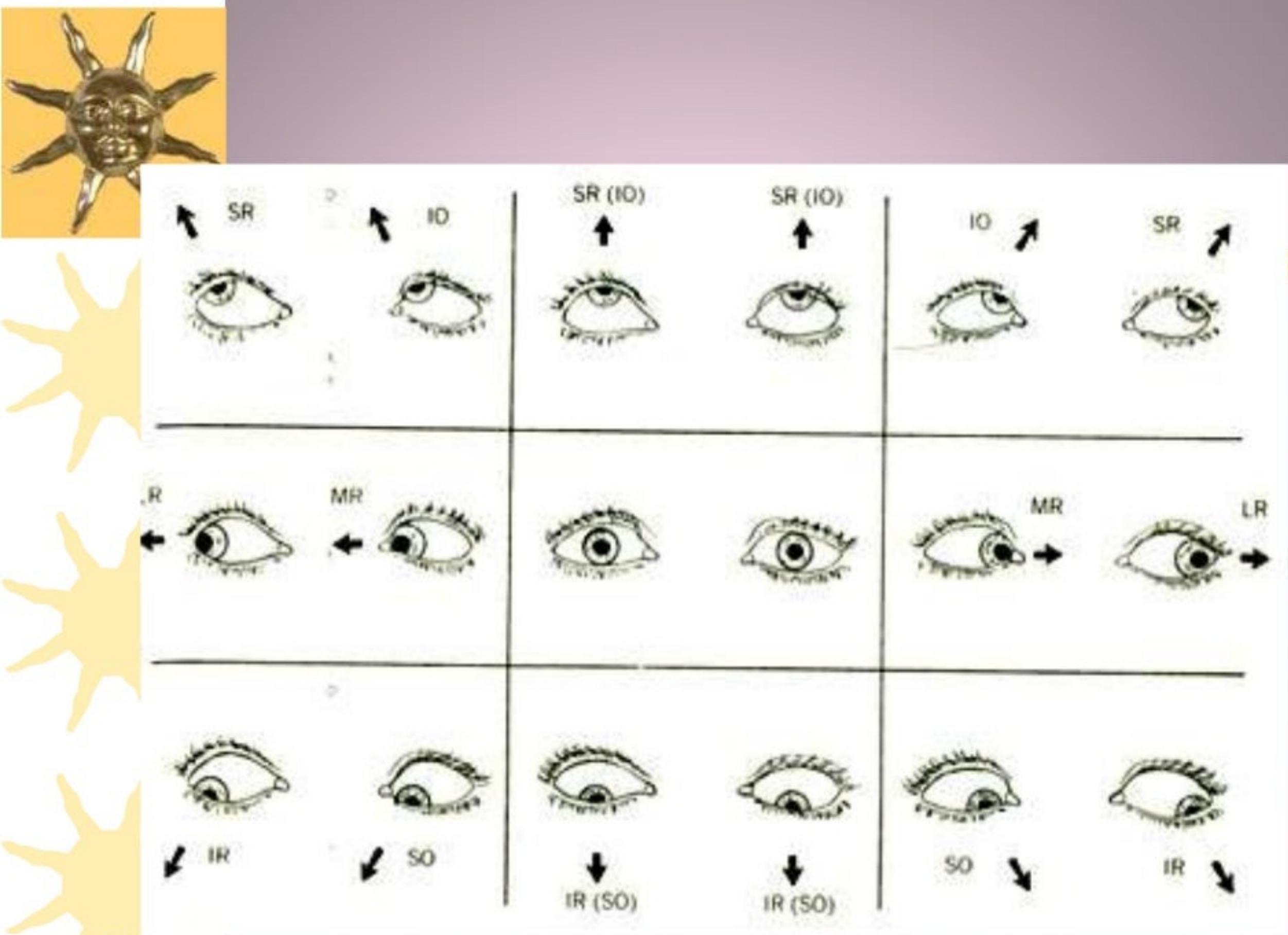
◎ MUSCLE SEQUELAE

1. Herring's Law of equal innervation
 - when a nervous impulse is sent to an ocular muscle to contract, an equal impulse is sent to its contralateral synergist to contract also
2. Sherrington's Law of reciprocal innervation
 - when a muscle receives a nervous impulse to contract, an equal impulse is received by its antagonist to relax



EOM & their actions

EOM	PRIMARY	SECONDARY	TERTIARY
MR	ADDUCTION		
LR	ABDUCTION		
SR	ELEVATION, max in abd	INTORSION, max in add	ADDUCTION, max in add
IR	DEPRESSION, max in abd	EXTORSION, max in add	ADDUCTION, max in add
SO	INTORSION, max in abd	DEPRESSION, max in add	ABDUCTION, max in abd
IO	EXTORSION, max in abd	ELEVATION, max in add	ABDUCTION, max in abd



★ Abnormalities of EOM are graded using a numerical grad :

UNDERACTION (-)

0 – NORMAL

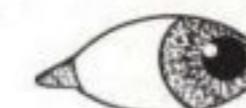
1 – MILD

2 – MODERATE

3 – MARKED

4 – NO ACTION

Normal



-1



-2



-3



-4

OVERACTION (+)

0 – NORMAL

1 – MILD

2 – MODERATE

3 – MARKED

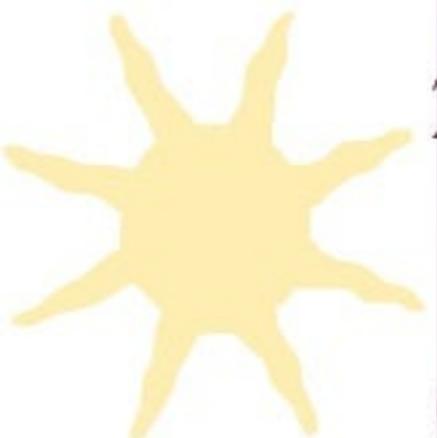
4 – VERY MARKED



- Associated patterns :

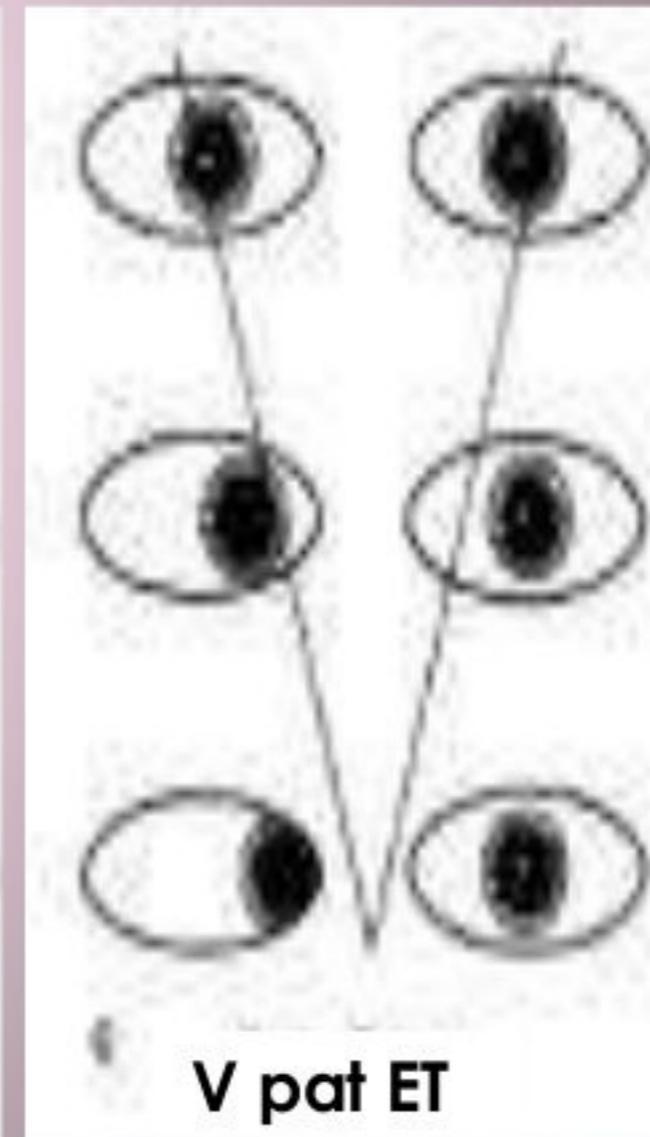
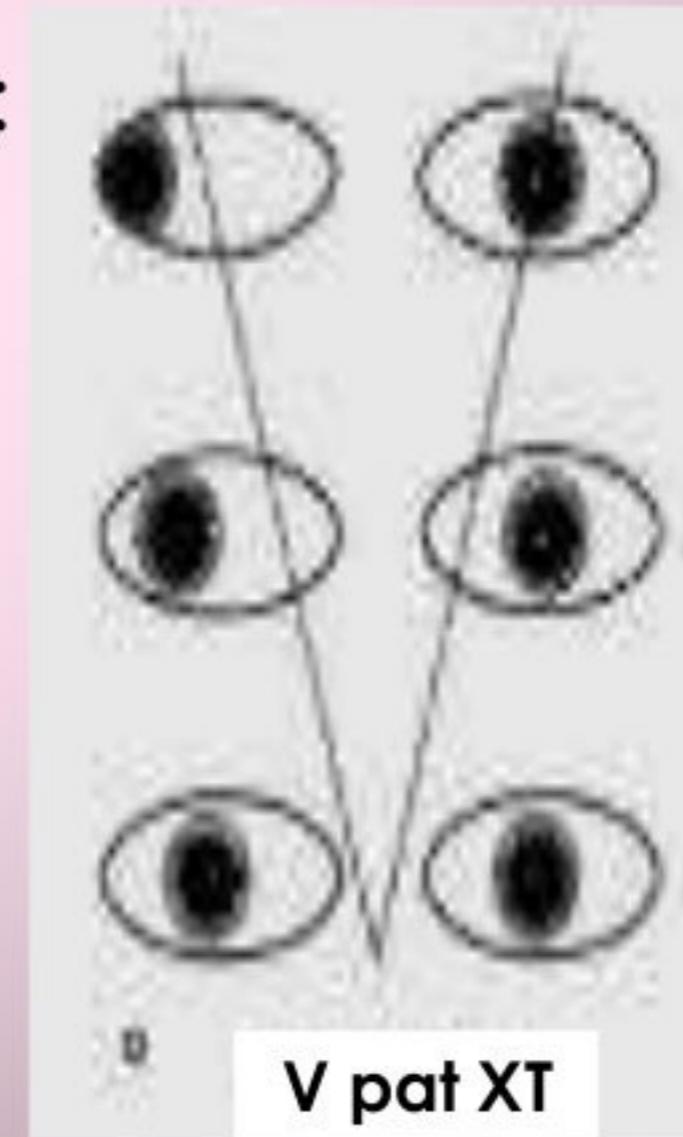
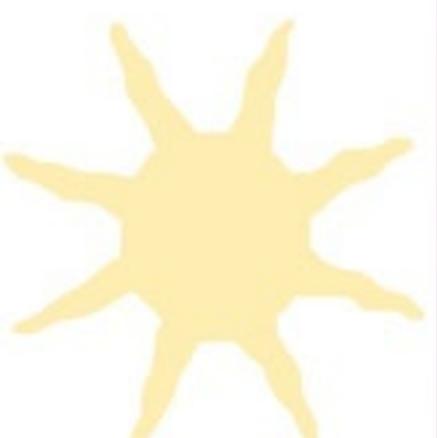
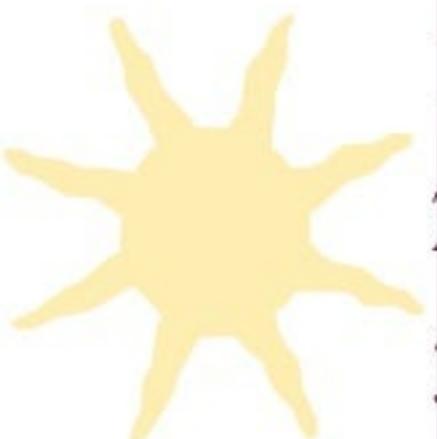
1. A pattern – min diff 10 PD
2. V pattern – min diff 15 PD

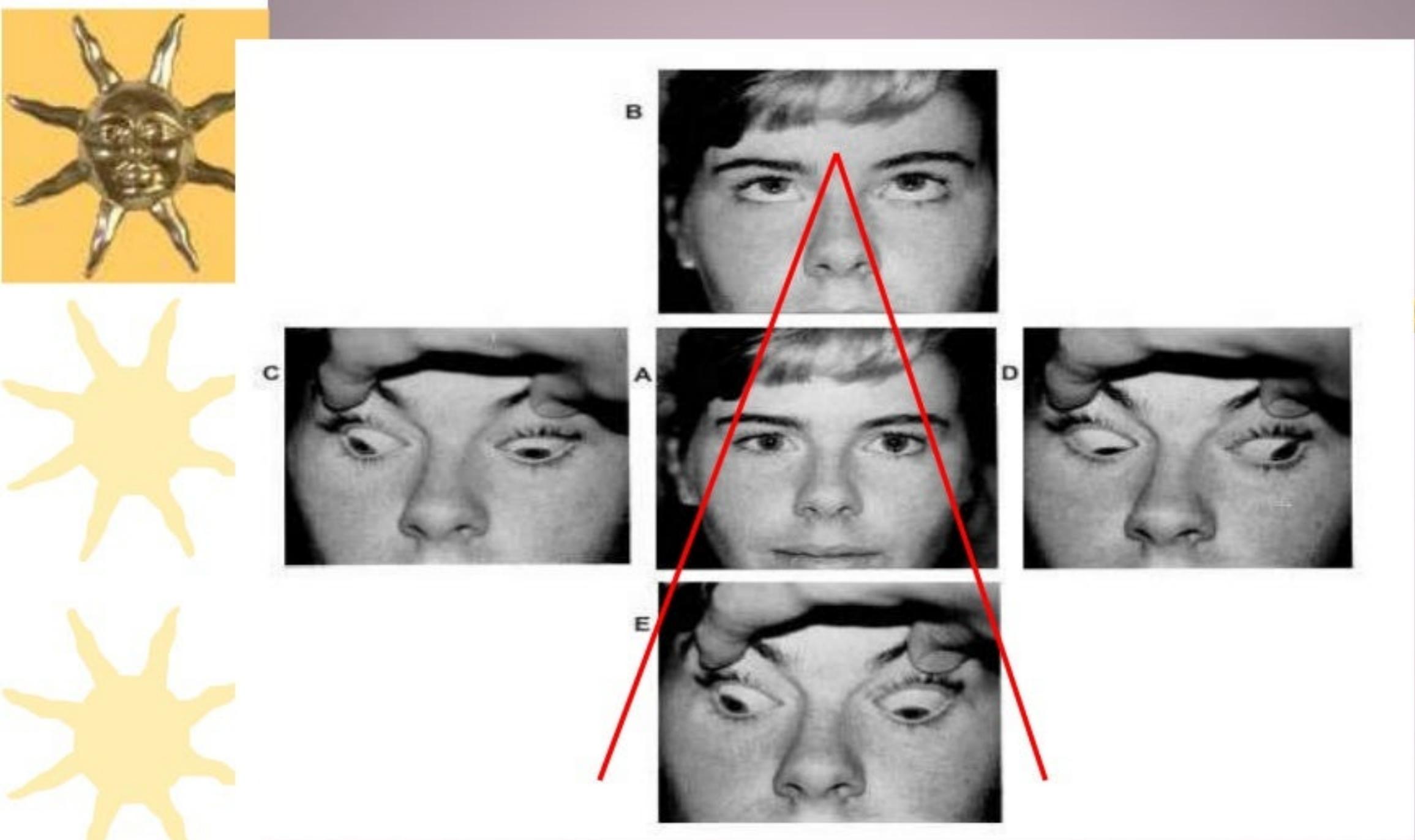
UP TO DOWN
GAZE



- Other variations :

1. Y pattern
2. X pattern
3. λ pattern





Primary position (pic A): eyes aligned with slight chin depression

Upgaze (pic B): small ET

Pic C: L SO u/a

Pic D: R SO u/a

Downturn (pic E): 50 PD XT



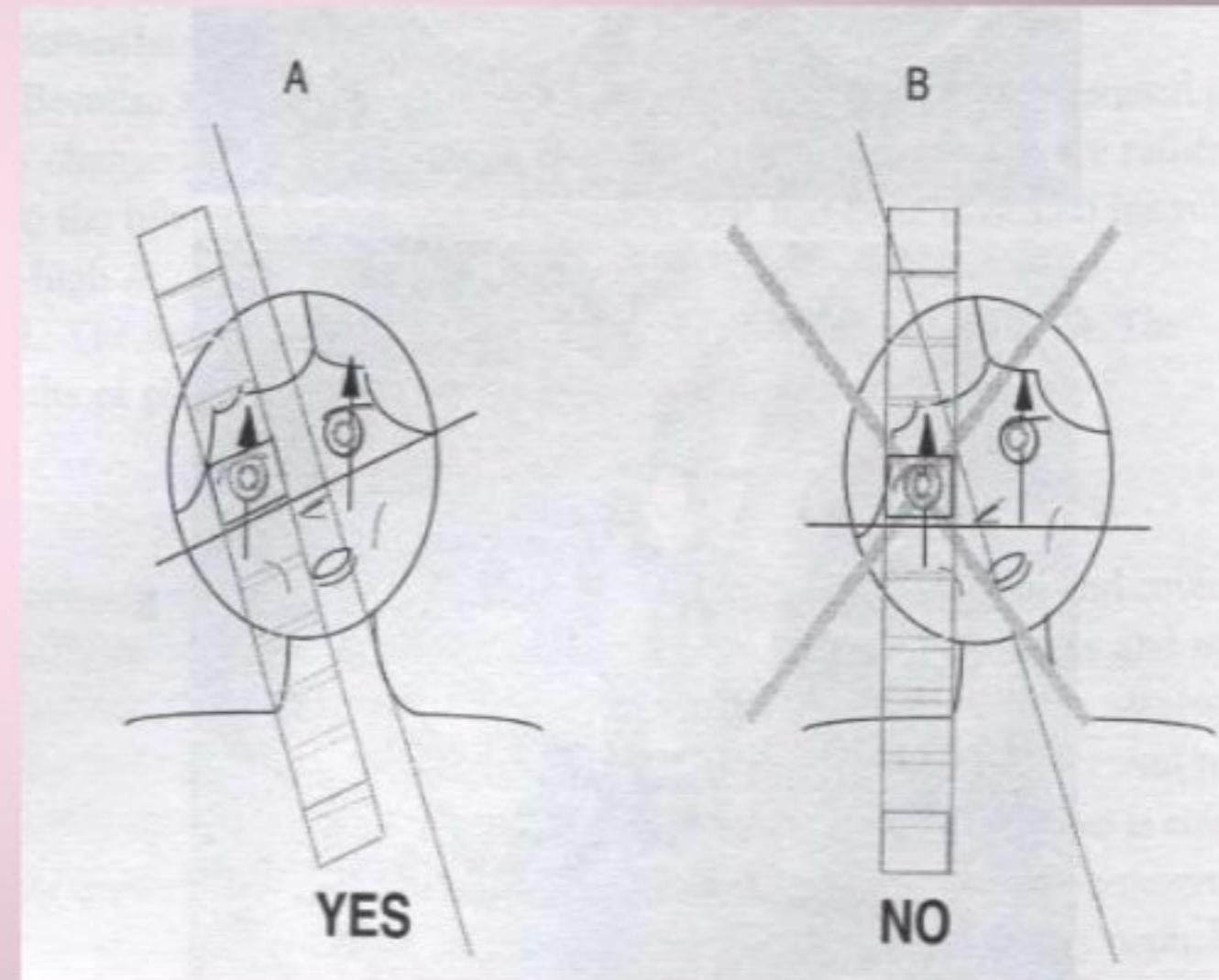
Quantitative Measurement For Strabismus

*PRISM COVER TEST

- measure the magnitude of angle deviation
- at 6 m & 33 cm, c & s gls
- prism in front of the deviating eye in TROPIA
- prism in front of either eye in PHORIA
- precautions:
 1. prevent fusion & elicit the total deviation
 2. maintain & control accommodation



3. correct position of prisms during measurement of deviation





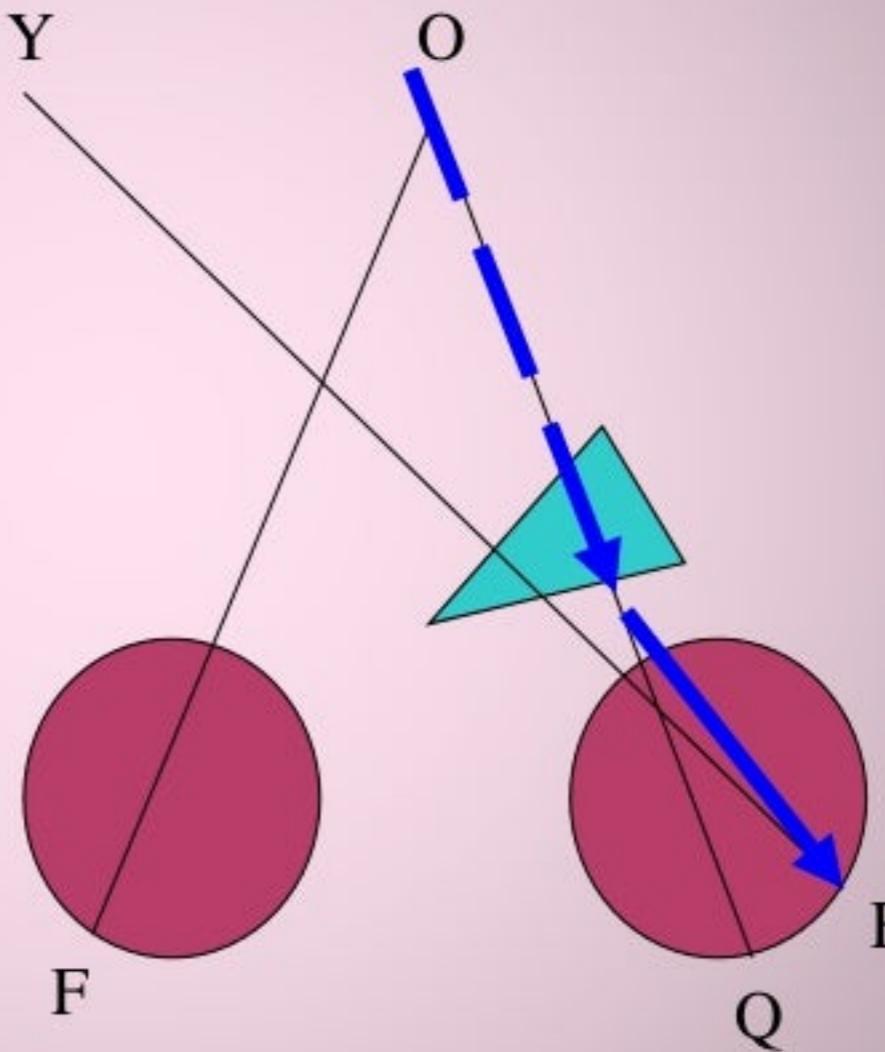
*Prisms :

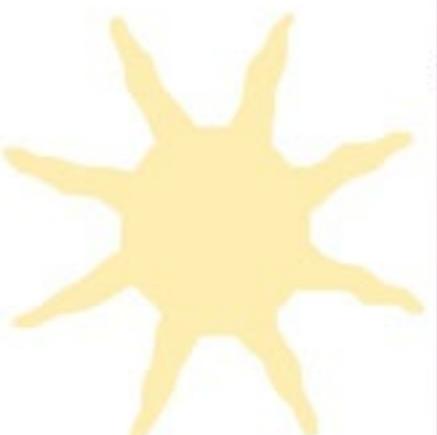
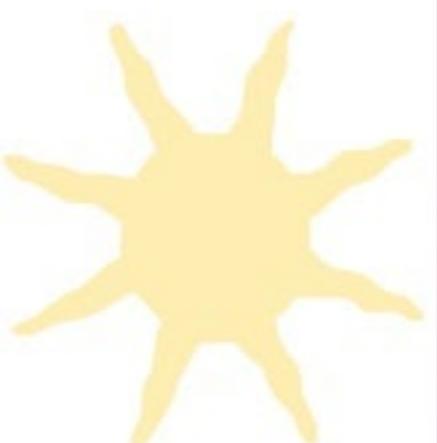
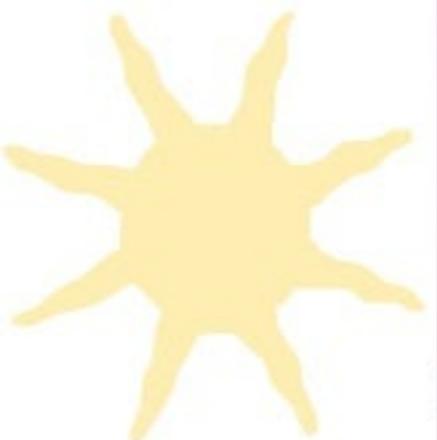
BO – ESO

BI – EXO

BU – HYPO

BD – HYPER





* SIMULTANEOUS PRISM COVER TEST

- neutralise the deviation without complete dissociation
- microtropia assoc. with heterophoria

* PRISM REFLECTION TEST

- small children or adults with poor vision (no foveal fixation)
- prism in front of deviating eye

* KRIMSKY TEST

- prism placed before fixing eye (Krimsky 1943)



COVER TEST

⦿ Cover/uncover cover test

⦿ To elicit the presence / absence of a heterotropia

⦿ To determine:

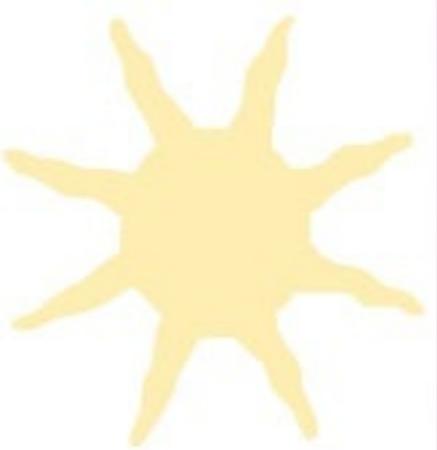
1. Type of deviation

- direction (Hx, Vt, Torsional or combination)
- Unilateral or alternating
- Constant or intermittent
- Effect of refractive error
- Effect of accommodation
- Effect of CHP



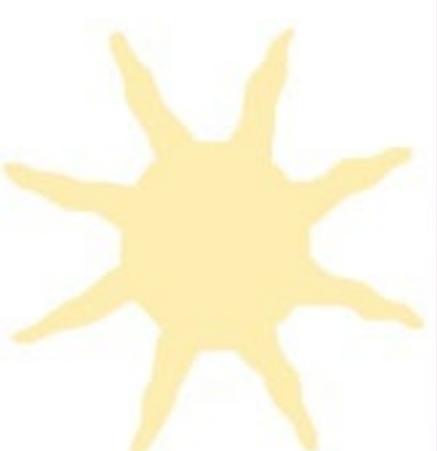
2. Size of deviation

- Hirschberg's reflection test
-



3. Fixation

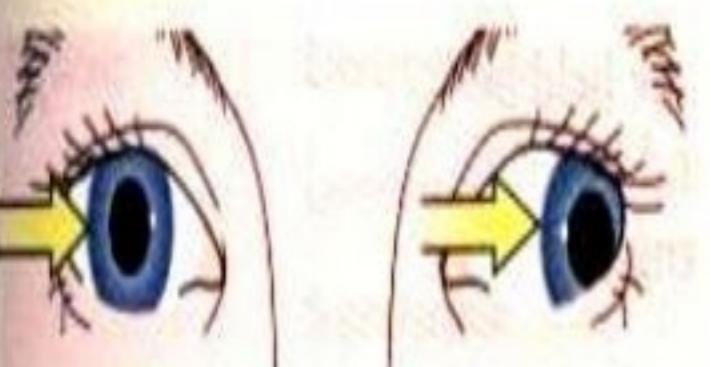
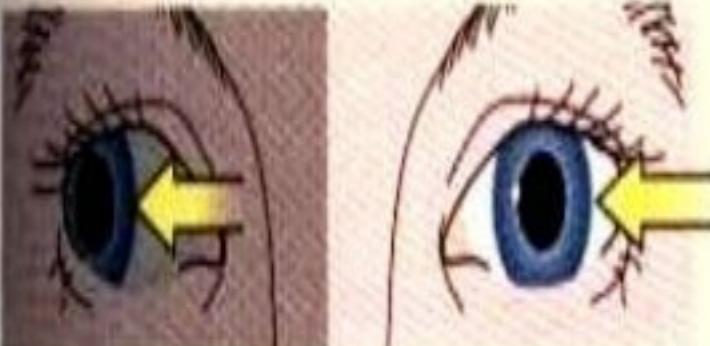
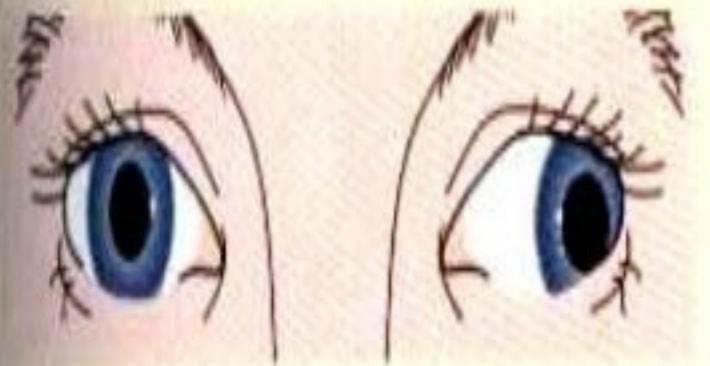
- central (foveal) or near central (parafoveal)
- eccentric
- wandering



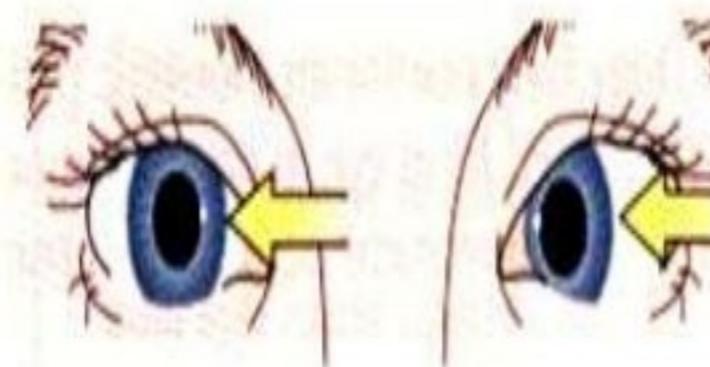
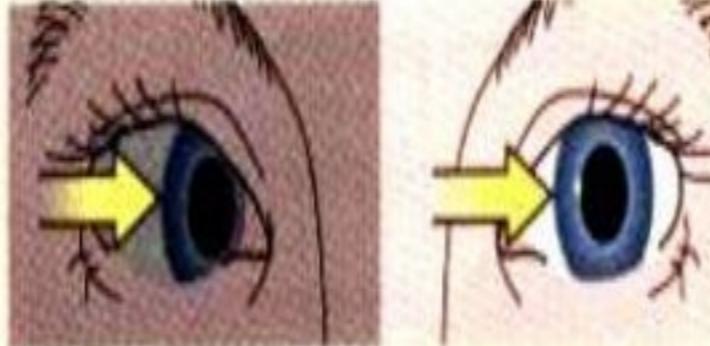
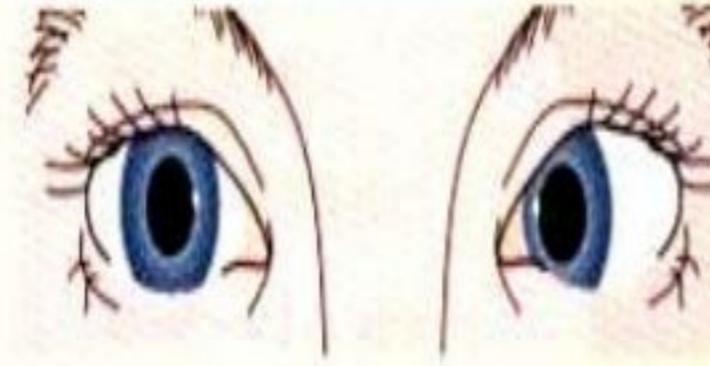
4. Visual acuity

- speed of uncovered eye to take up fixation : level of VA
- alternating deviations : equal VA
- objection to occlusion : poor VA

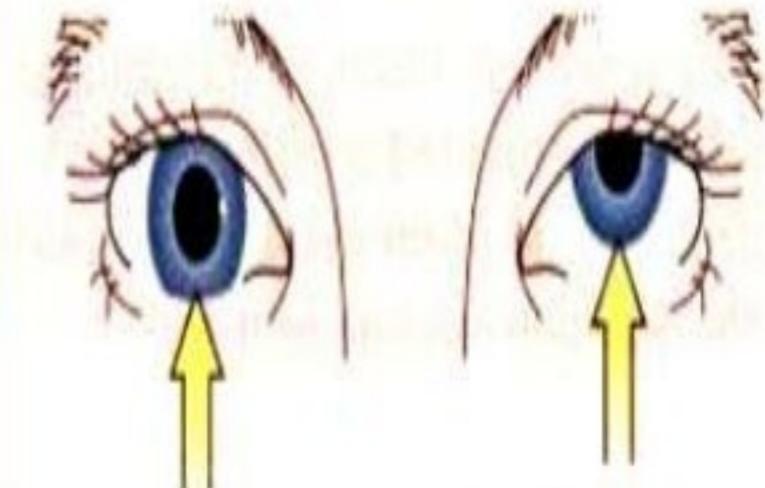
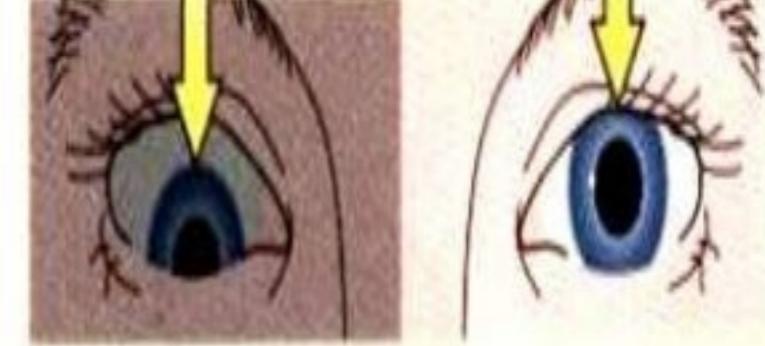
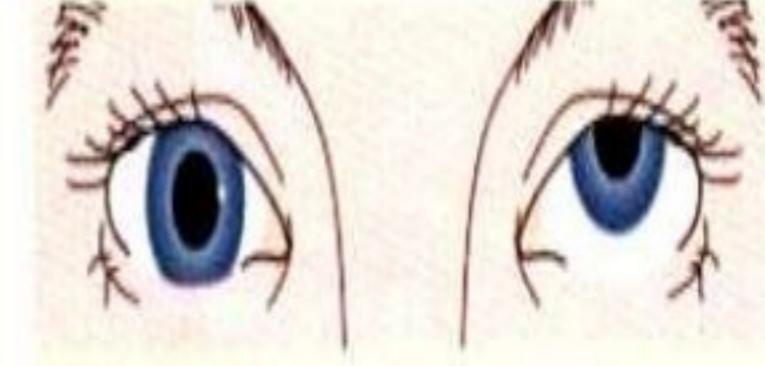
EXOTROPIA

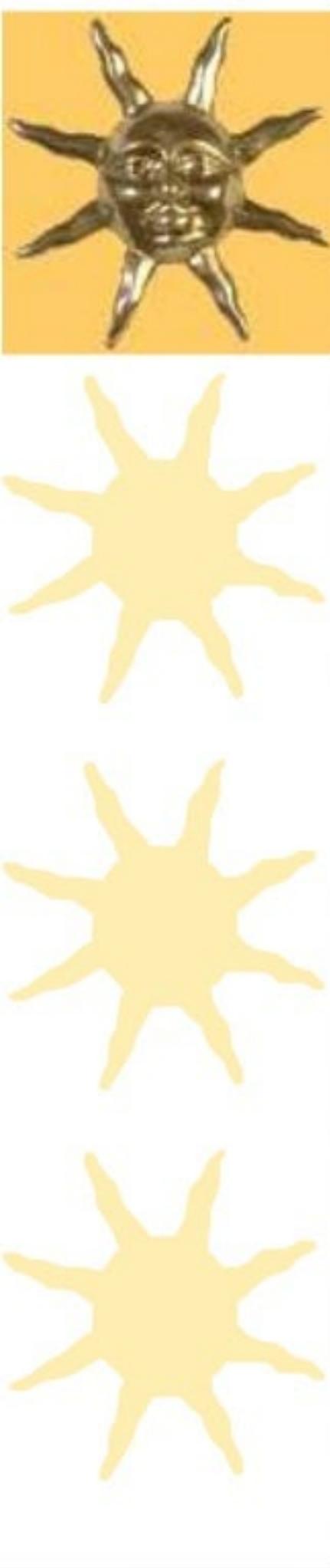


ESOTROPIA



HYPERTROPIA



- 
- **Alternate cover test**
 - To elicit the presence / absence of heterophoria
 - Complete dissociation achieved
 - Pt is never binocular during test
 - To determine:
 1. **Type of deviation**
 - effect of refractive correction
 - effect of accommodation
 - effect of CHP



2. Size of deviation

- excursion to take up fixation
- comitant & incomitant
- incomitancy : anisometropia / paralytic strabismus

3. Recovery movement

- rate of recovery : quality of fusion & control of deviation
- recovery : full to bifoveal fixation
: partial to small angle tropia



VISUAL ACUITY TESTING

*Less than 3 years:

- Cardiff acuity cards
- Keeler acuity cards
- Catford Drums

*3 – 5 years:

- Kay pictures
- Projector- Pediatric chart
- Tumbling E

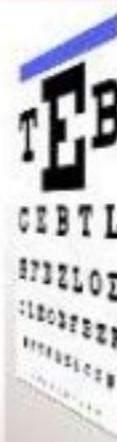


*Age 6 & older:

- Snellen letters/ numbers/ pictures

-Tumbling E

- Projector chart





REFRACTION

- Retinoscopy
- Cycloplegic refraction
- Near fixation retinoscopy (MOHINDRA technique)
- Brückner test

- observe relative colour & brightness of fundus reflex
- relative pupil size
- corneal reflex
- anisometropia, strabismus, anisocoria, media opacities or posterior pole abnormalities



ACCOMMODATIVE FUNCTION

*Amplitude of accommodation (AA)

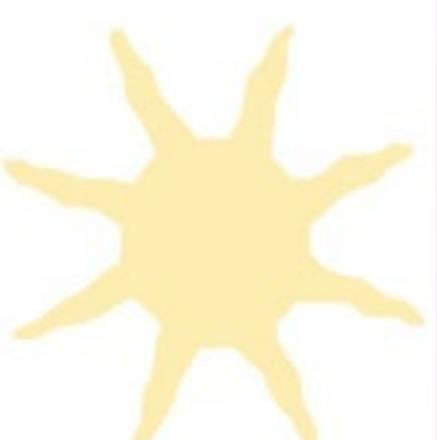
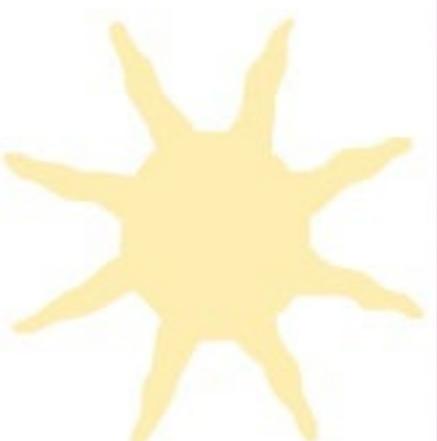
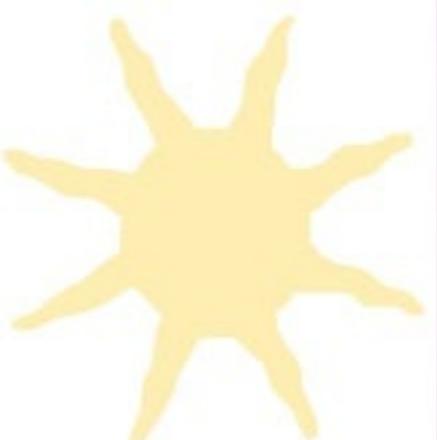
- max amount of accommodation that an individual can exert
- measured using Royal Air Force (RAF) rule
- monocularly & binocularly, repeated 3x
- record : blur/recovery
- amplitude = (blur + recovery)/2



Duane – Hoffstetter formula :

- Max AA = $25.0 - 0.40 \times \text{age}$
- Ave AA = **18.5 – 0.30 x age**
- Min AA = $15.0 - 0.25 \times \text{age}$

- AA reduced $0.2 - 0.42D / \text{year}$
(Hoffstetter 1965)
~ 0 D at the age 50 -55 years



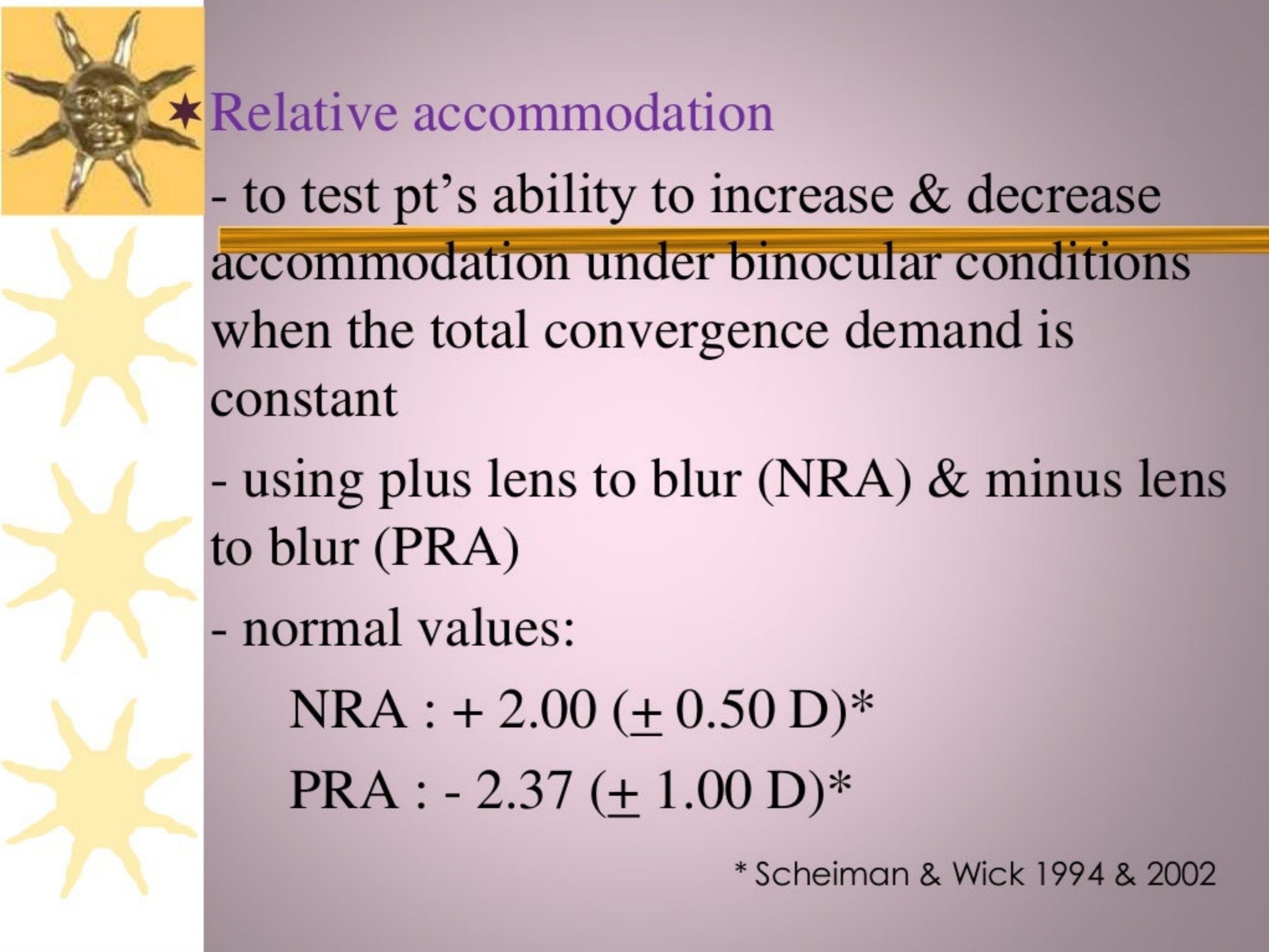


- **Accommodative facility**

- measure speed of accommodative change
- using Flipper lens (+/- 2.00 DS) at 40 cm
- monocular : 11.0 cpm \pm 5.0 cpm*
- binocular : 9.0 cpm \pm 5.0 cpm*

- **Lag of accommodation**

- the amount by which the dioptic accommodative response is less than the dioptic accommodative stimulus
- using MEM retinoscopy method
- normal value: +0.50 D (\pm 0.25 D)*



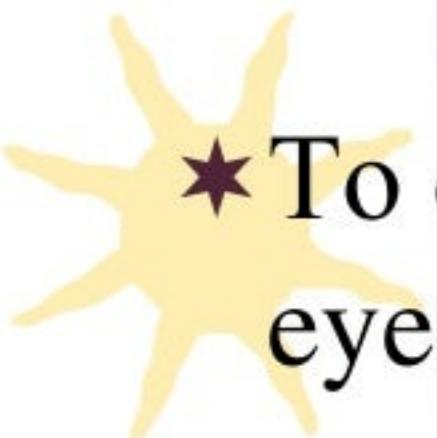
*Relative accommodation

- to test pt's ability to increase & decrease accommodation under binocular conditions when the total convergence demand is constant
- using plus lens to blur (NRA) & minus lens to blur (PRA)
- normal values:
 - NRA : + 2.00 (\pm 0.50 D)*
 - PRA : - 2.37 (\pm 1.00 D)*

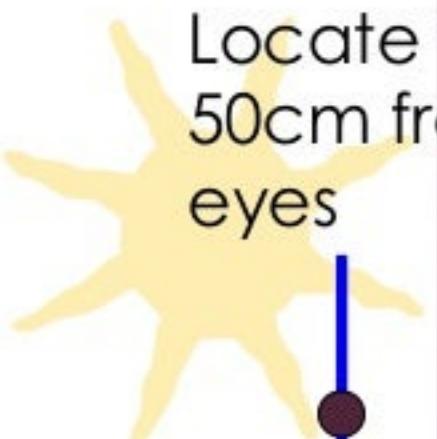
* Scheiman & Wick 1994 & 2002



NEAR POINT OF CONVERGENCE (NPC)



* To determine the pt's ability to converge the eyes while maintaining fusion



Locate target @
50cm from pt's
eyes



Pt fixate at
black dot

Pull target towards
nose while pt fixating
@ black dots



1. Line & dot doubled into two separate objects
2. One eye deviates out

Push target
backwards, away
from the nose



1. Line & dot become single
2. BE align



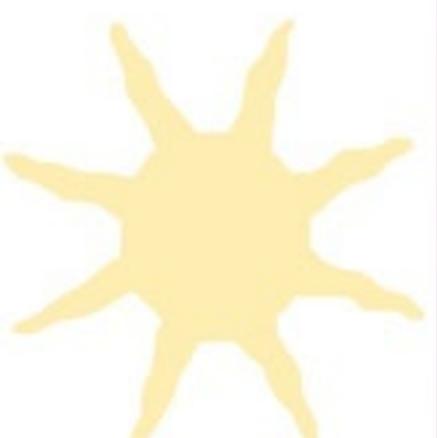
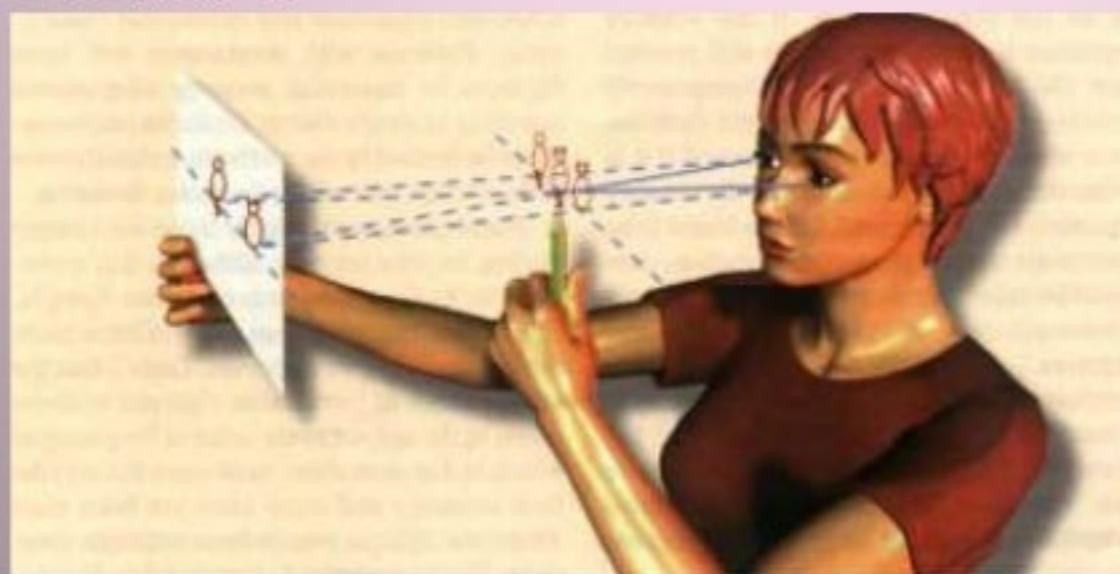
MANAGEMENT

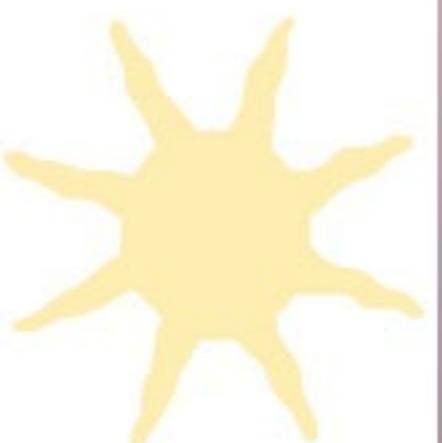
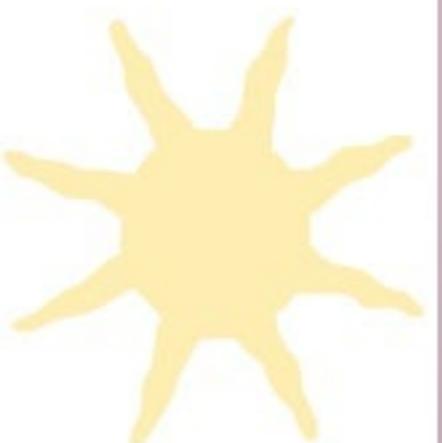
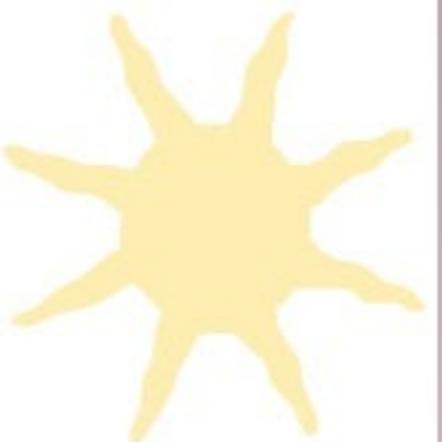


*OPTICAL AIDS (LENSES / PRISMS)



*SURGERY



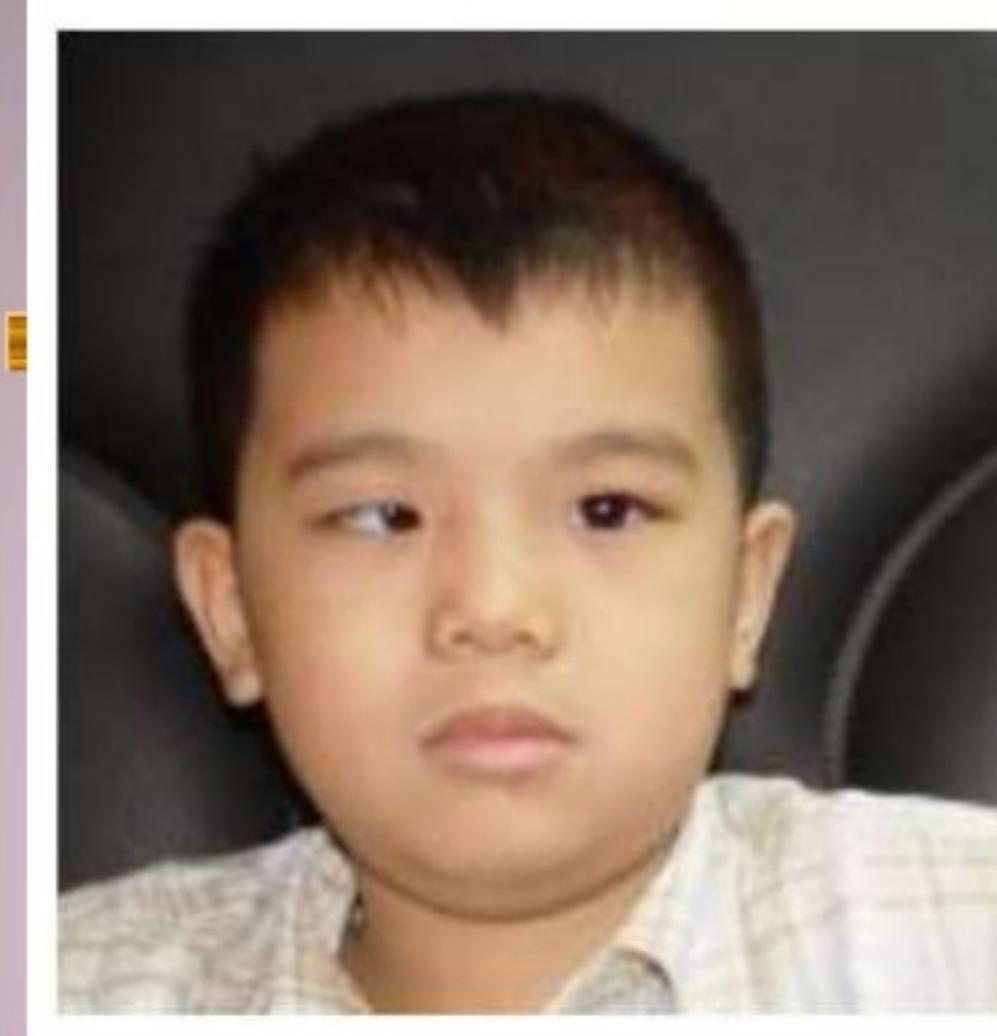
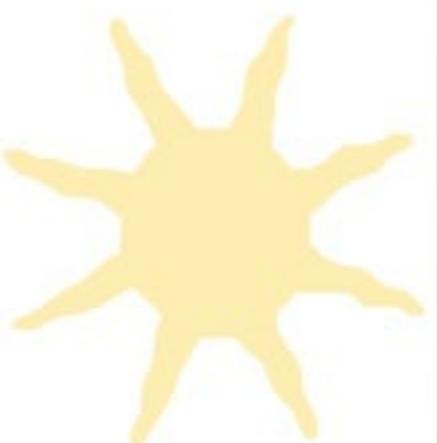
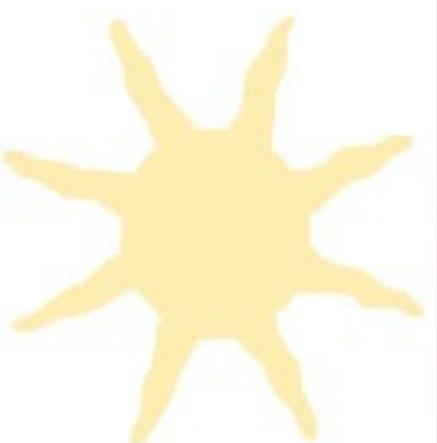
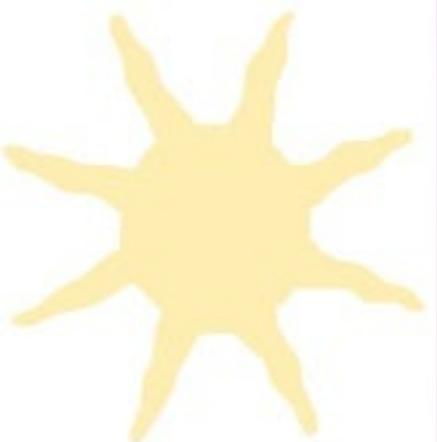


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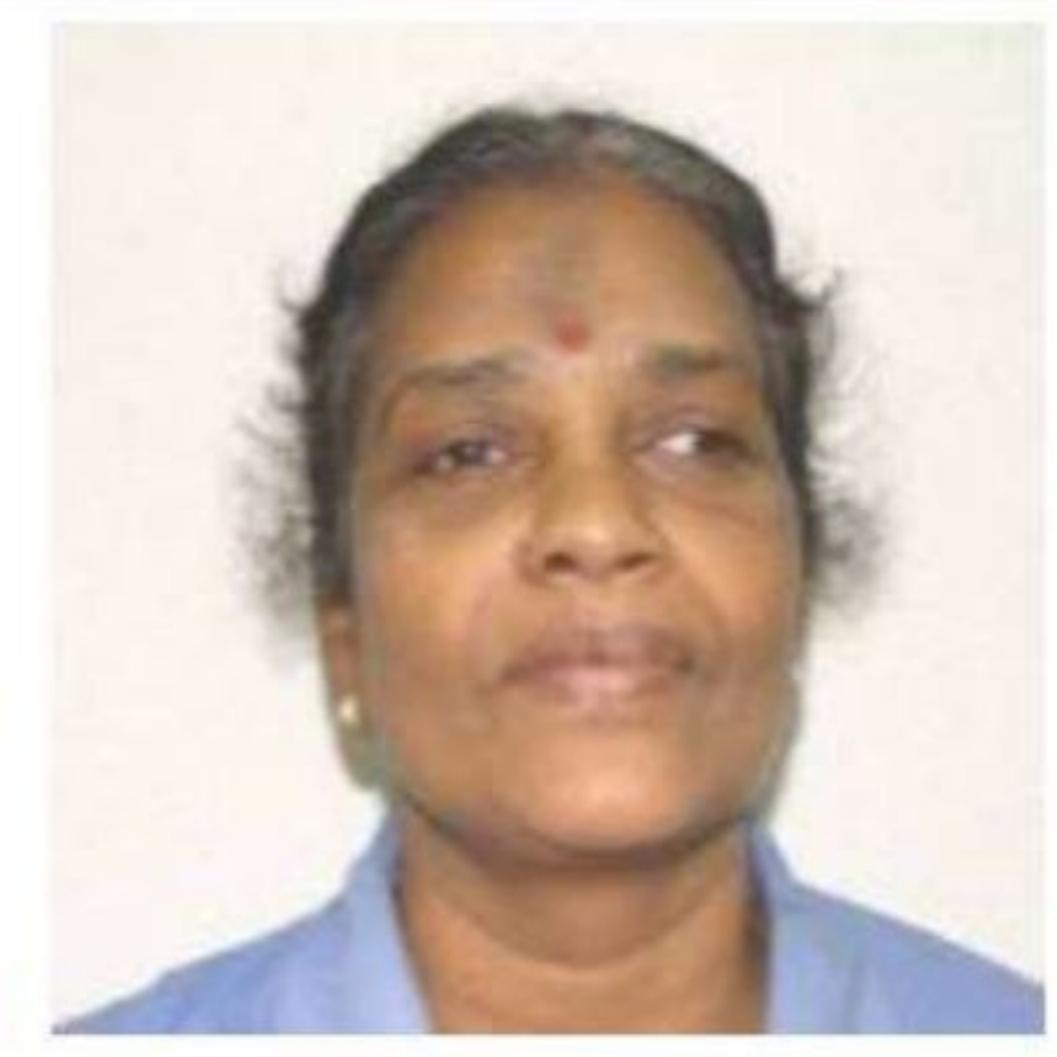
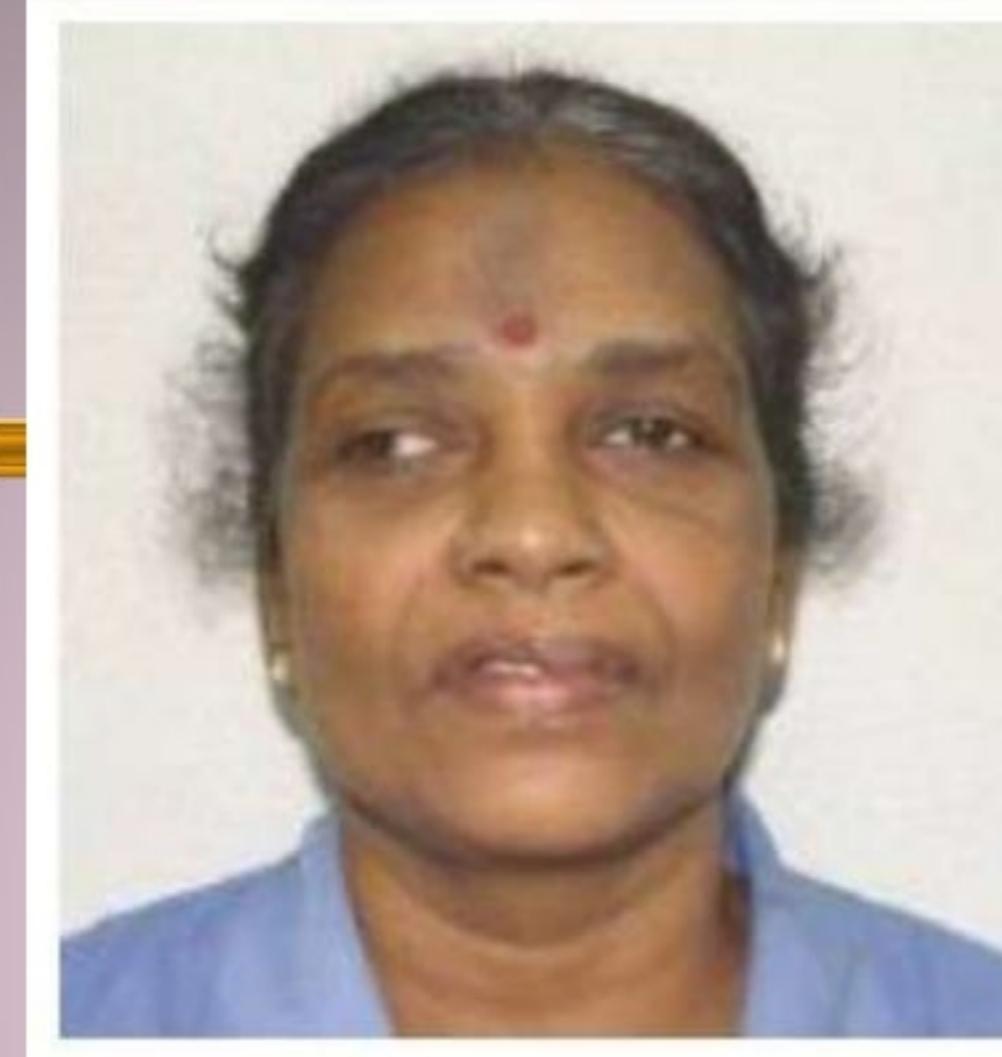
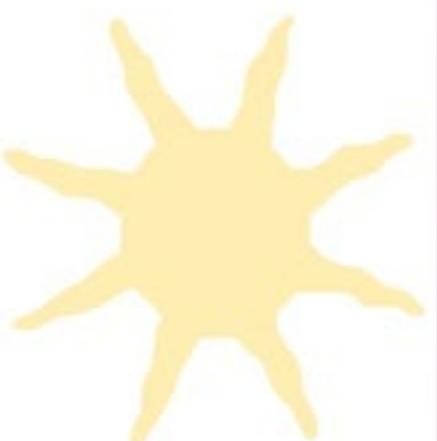
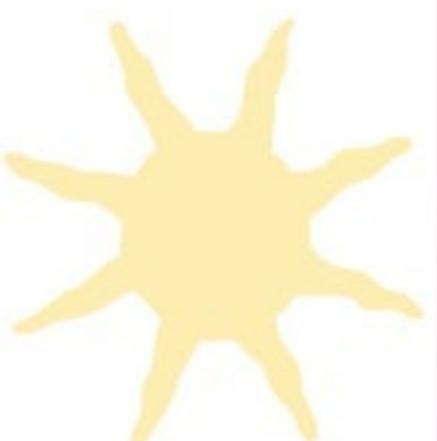
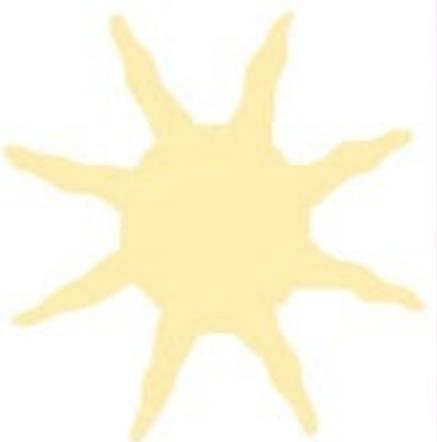
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**THANK YOU FOR YOUR
ATTENTION**

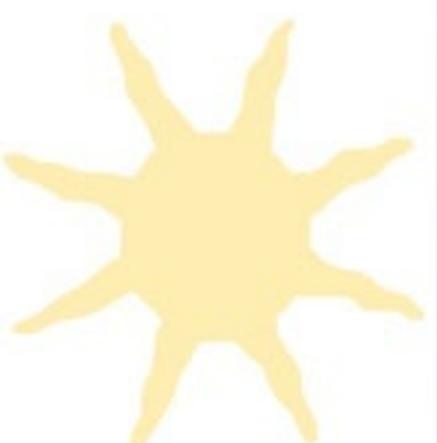
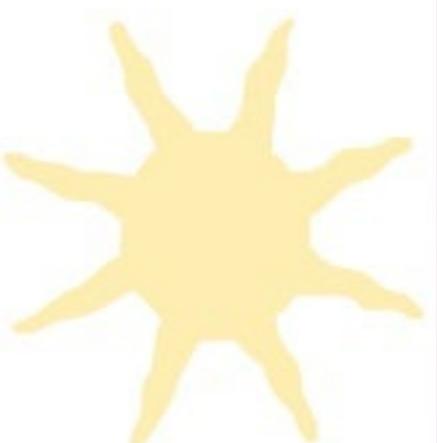
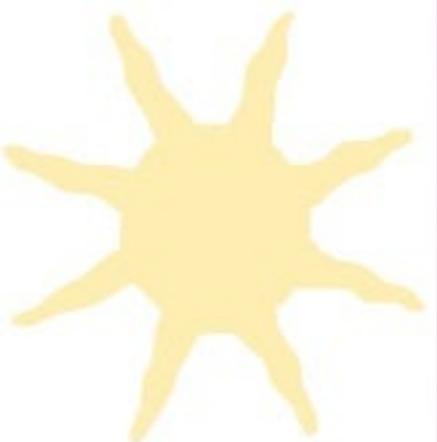




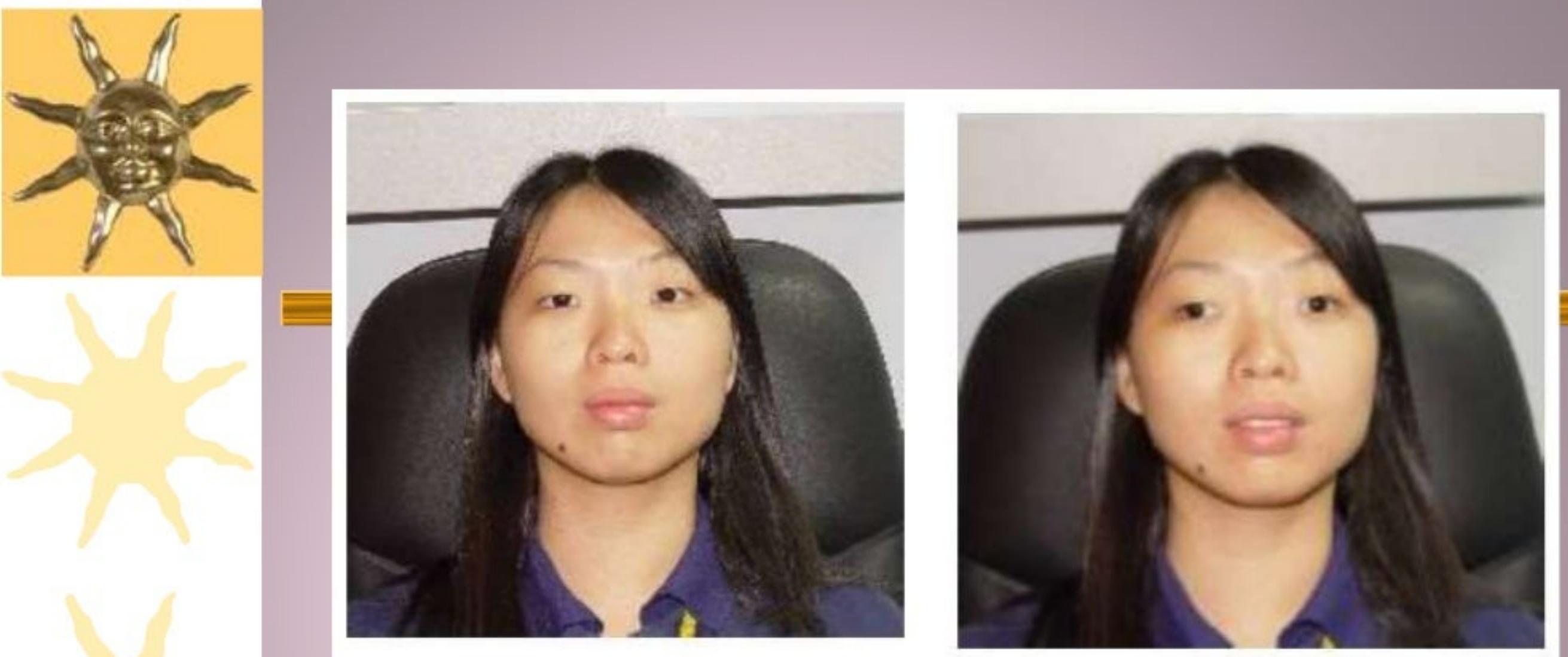
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