ACCOMMODATIVE ANOMALIES
L - 1 & 2

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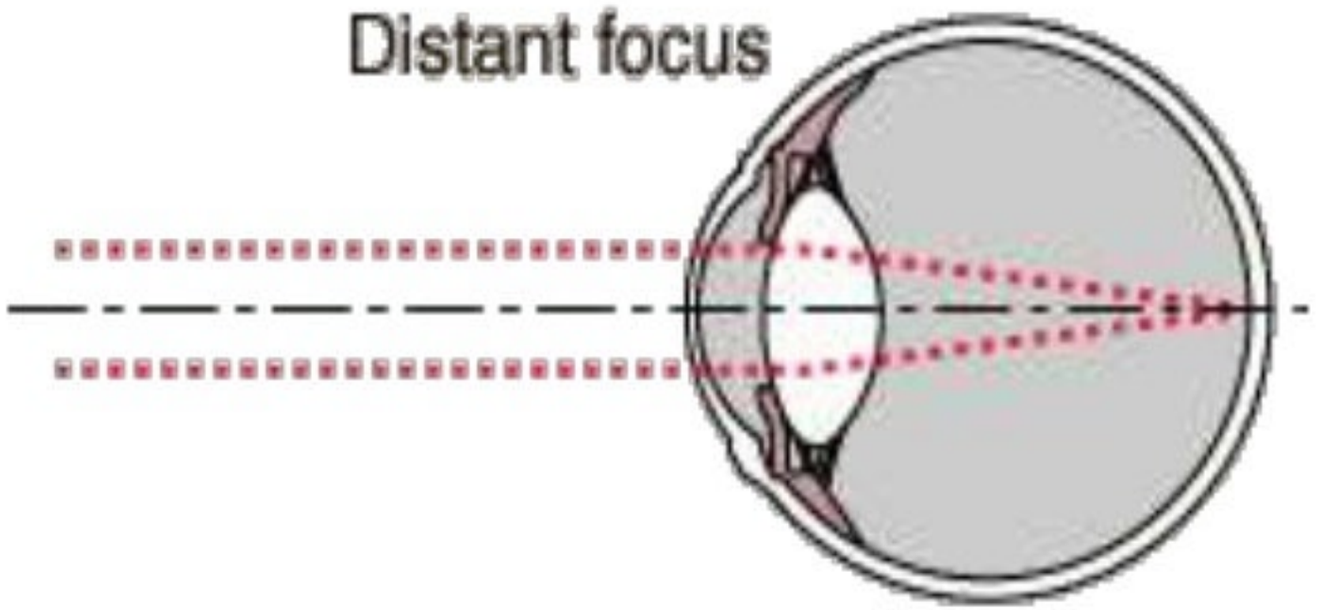
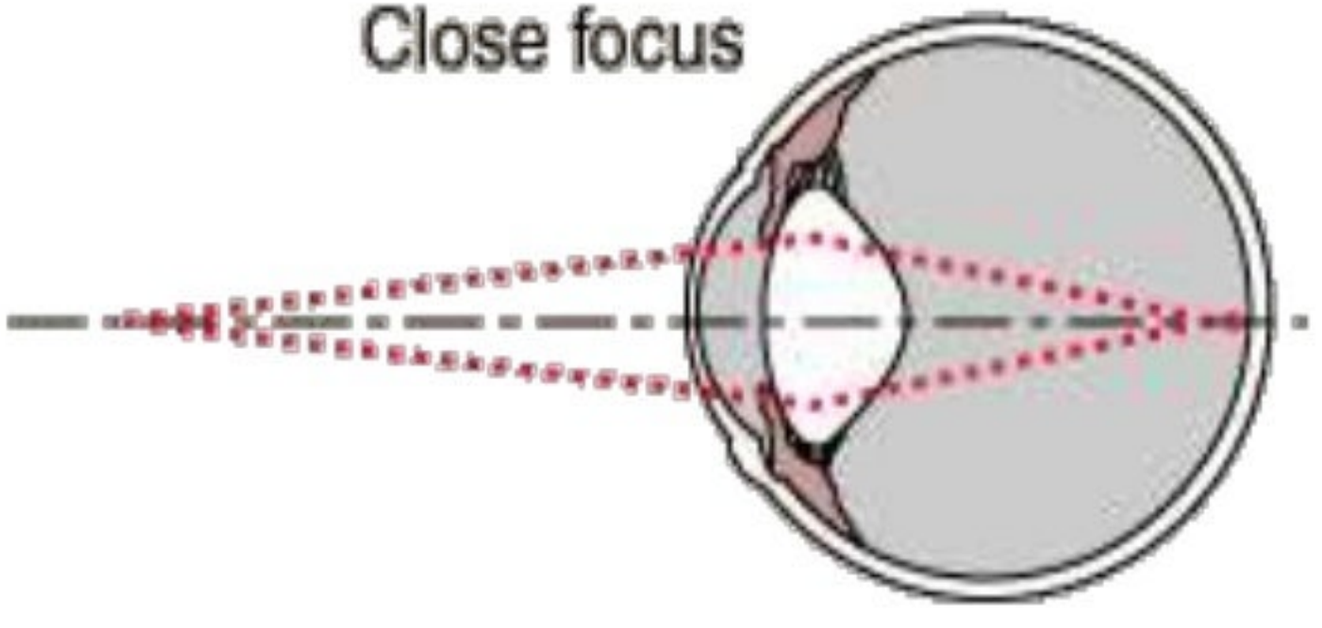
ACCOMMODATION

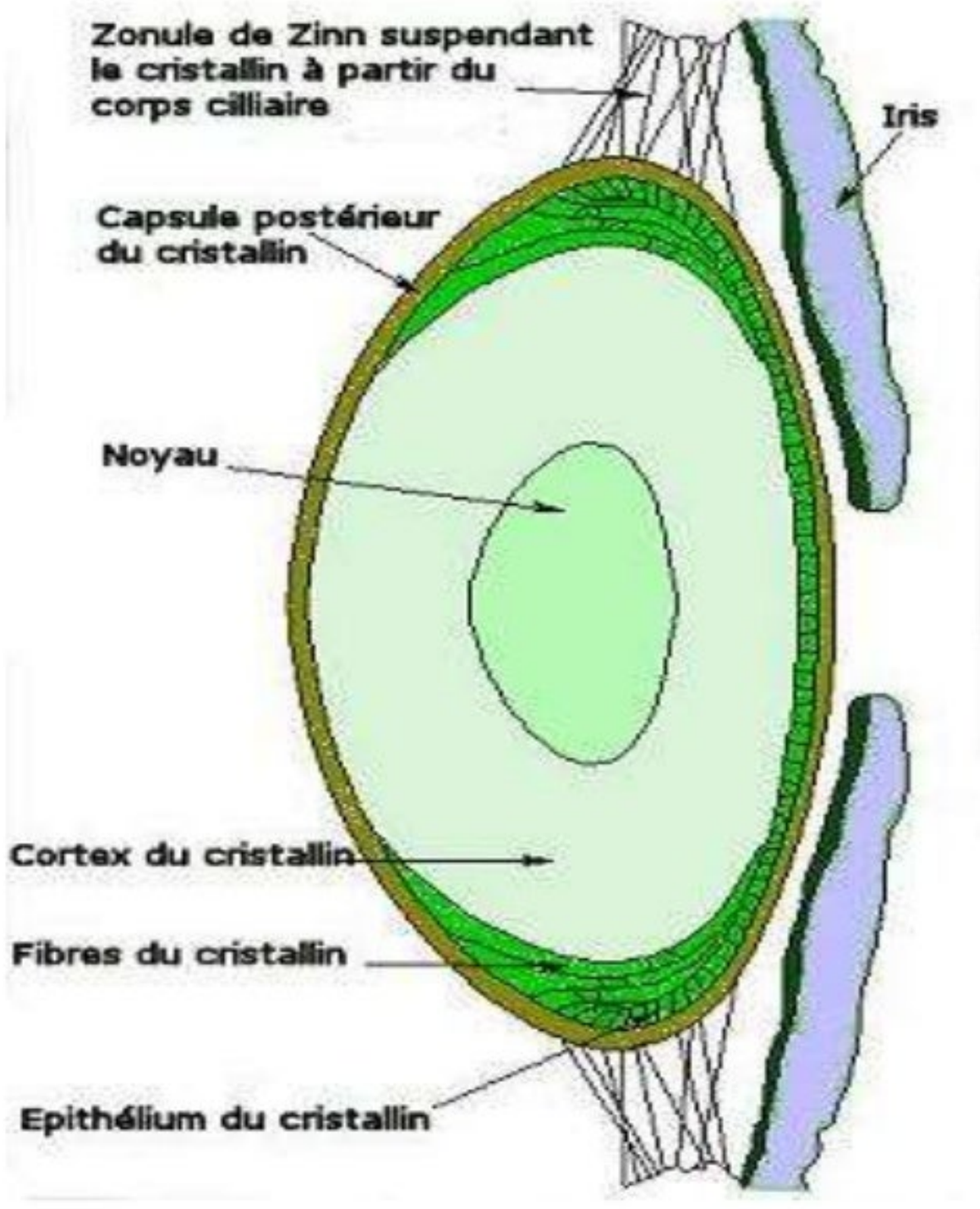
- **The process by which the dioptric power of eye changes so that an infocus retinal image of an object of regard is obtained and maintained at high resolution at fovea.**





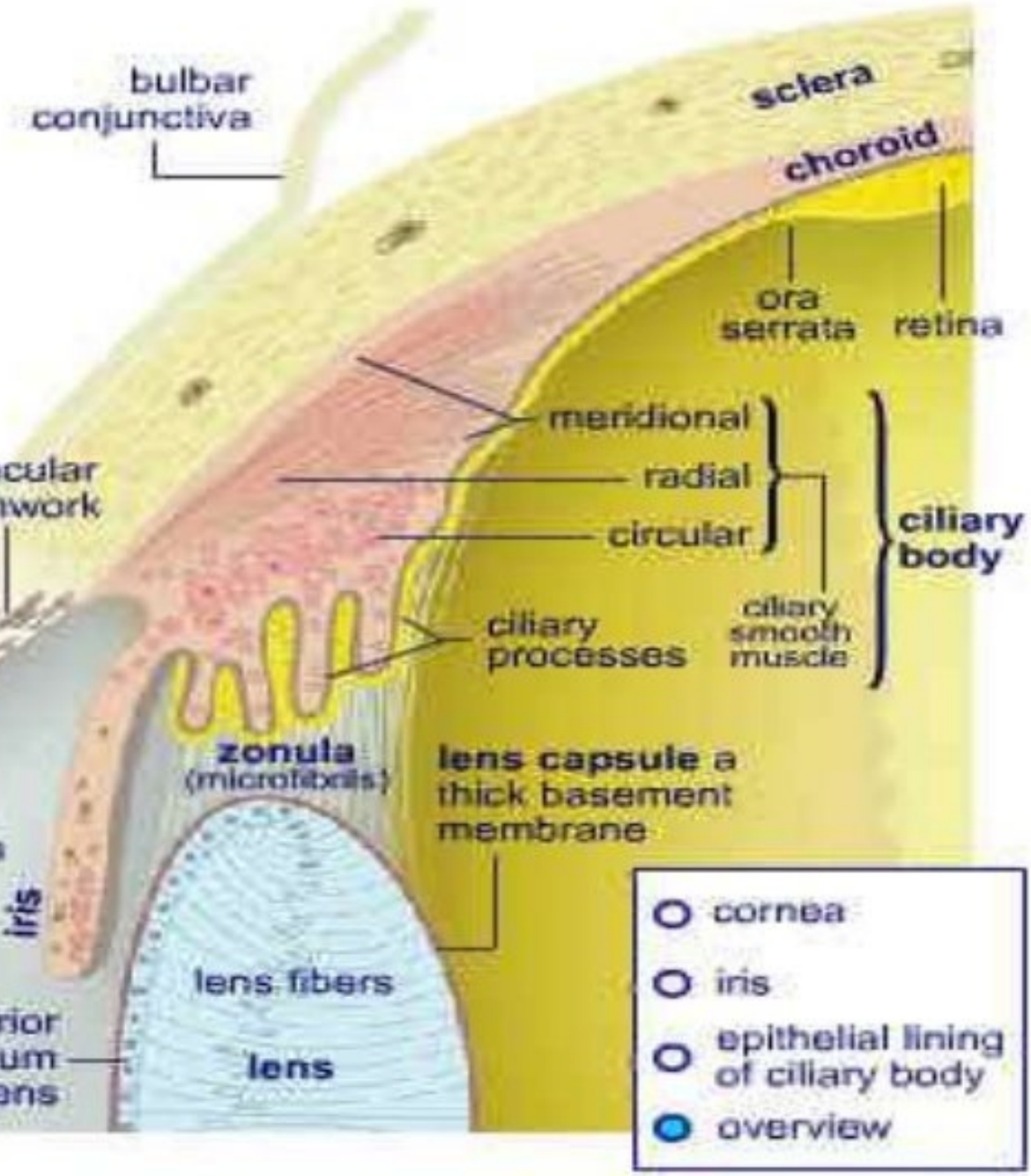
Accommodation ????

- Brief anatomy of lens
- Transparent,biconvex
- Anterior surface is is less convex(abt10mm)
- Posterior surface more curved(6mm)
- Refractive index=1.39

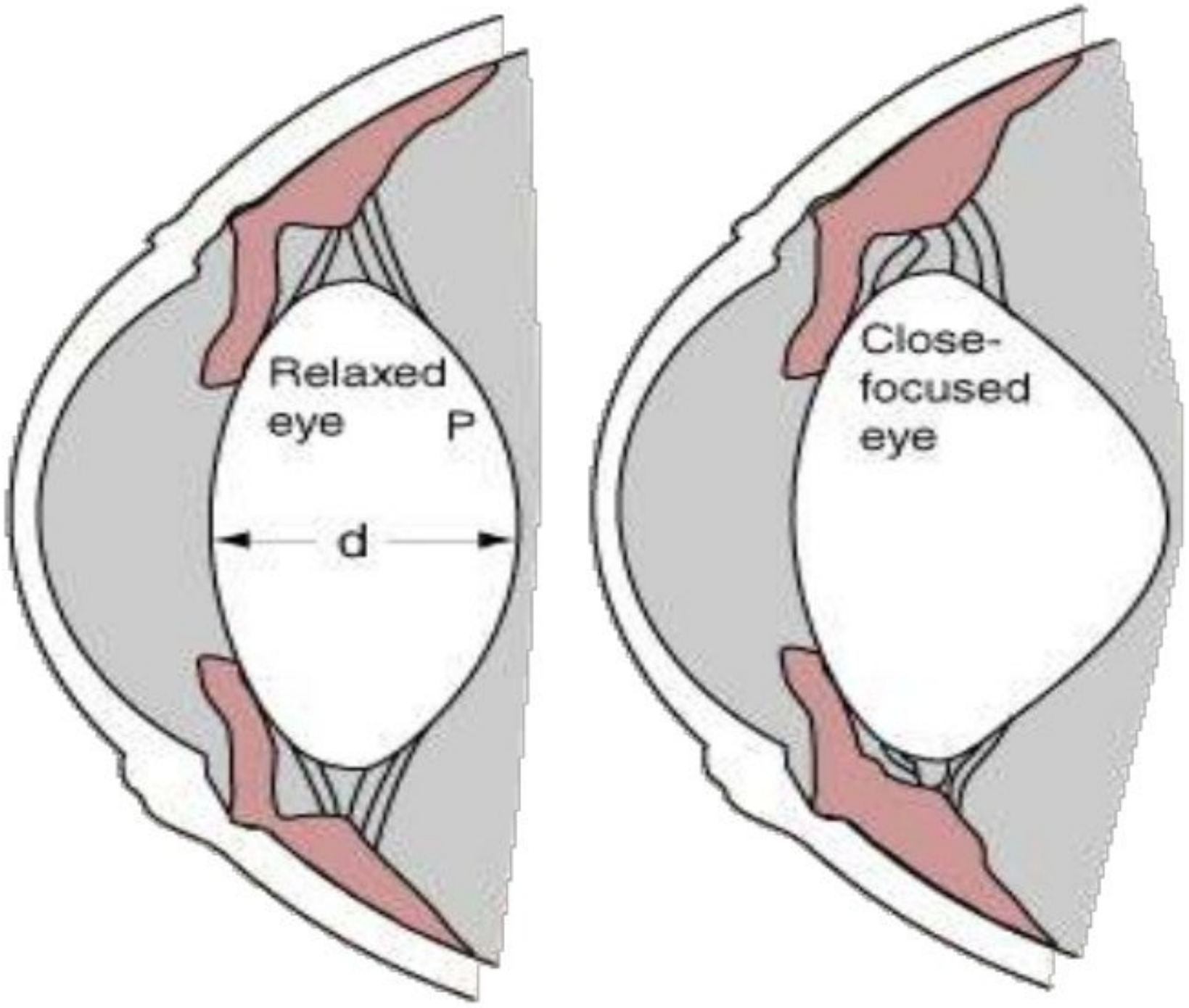


CILIARY MUSCLE AND ZONULES

Eye: Cornea, Iris, Cilliary Body and Lens

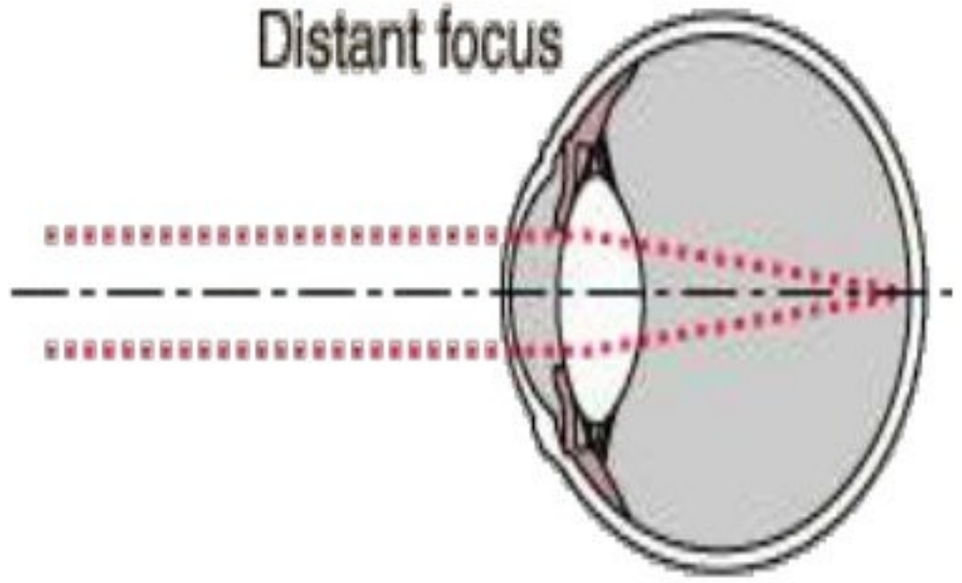


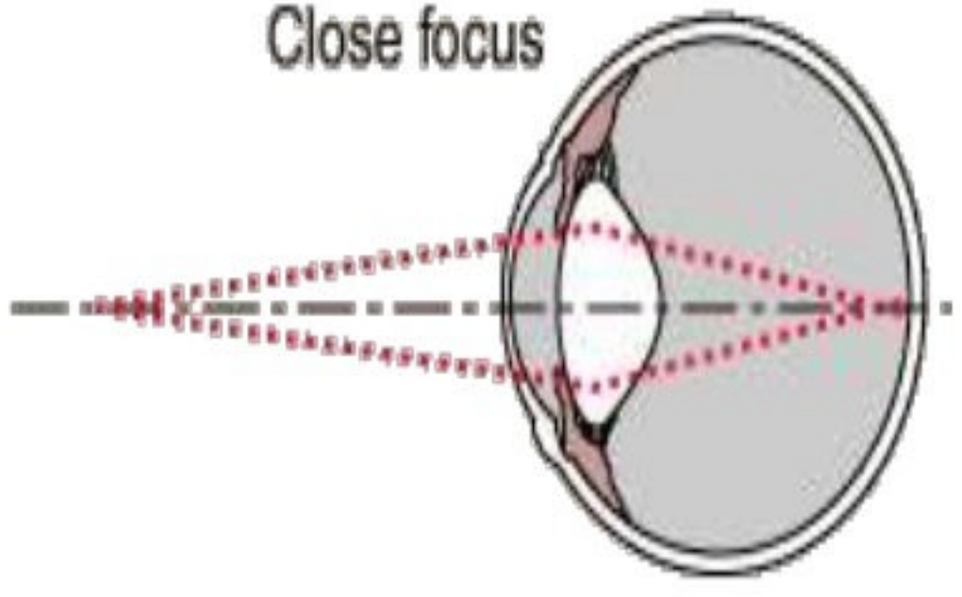
Changes in accommodation



Ranges and amplitude of accommodation

- **Punctum proximum-**
- **Punctum remotum-**
- **Ranges of accommodation-**
- **Amplitude of accommodation-**
- **Variation with refractive error???**





Variation of amplitude of accommodation with age

DONDER'S TABLE

AGE (yrs)	AMP (Ds)	AGE (yrs)	AMP (Ds)
10	14	40	5.50
20	10	50	3.5
30	7	60	1

Hoffsteter's formula for amplitude of accommodation

- Minimum = 15-0.25 * age
- Average = 18.5-0.3 * age
- Maximum = 25-0.4 * age
- E.g. for 40 yrs minimum = 5Ds, intermediate=6.5Ds and maximum = 9Ds.
- ????????

Anomalies of accommodation

- **Insufficiency of accommodation**
- **Excess or spasm of accommodation**

Insuffeciency of accommodation

- Physiological anomaly

- Pharmacological anomaly

- Pathological anomaly

Physiological anomaly

- Presbyopia –not a disease
- Age of onset depends on sex, race and occupation.
- Why ?????
- Helmhotz –Hess Gullstrand theory
- Donder Duane fincham theory

Types of presbyopia

- Incipient presbyopia
- Functional presbyopia
- Absolute presbyopia
- Premature presbyopia
- Nocturnal presbyopia

- **<u>Symptoms</u> –**
- **Small print become indistinct in dim illumination.**
- **Hand short for reading**

Optical correction

- Glass..near glass, bifocal glass, progressive addition lens, monovision glasses
- Contact lens option
- Distance single vision CL and near glasses
- Monovision CL
- Bifocal /multifocal CL
- Non refractive bifocal
- Weakest glass which are compatible with good vision????

Methods determining addition

- A general rule an individual require 1D at 40 and in every 5 yrs ,increases by 1D until 55 then stabilizes.
- Considering amplitude of accommodation
  - RAF ruler
  - Donder's table
  - hoffsteter’s formula
  - Dynamic retinoscopy
- Binocular cross cylinder test-

- **Negative relative accommodation (NRA)and positive relative accommodation (PRA)-**
- **Addition-NRA+1/2 relative amplitude of accommodation**

- **E.g. if PRA is – 0.50 Ds and NRA is +2.00**
- **Amplitude of accommodation= +2.50**
- **Addition==2.00-1/2 * 2.50= +0.75Ds**

Treatment ???

- Surgical procedure
- Made artificially anisometropic
- New advancement in surgical process

Pharmacological anomaly

- Ciliary body is supplied by both sympathetic and parasympathetic supply.
- Sympathetic receptor include alpha and beta
- Parasympathetic include muscarinic receptor M1, M2, M3

Group of drugs affecting accommodation

- Parasympatho mimetic
- Parasympatholytics
- Sympathomimetics
- sympatholytics

Some other causing accommodation insuffeciency

- Alcohol
- Phenothiazine
- Antihistamine
- Marijuana
- Digitalis

Pathological anomaly

- **Insuffeciency of accommodation-**
- **Accommodative power is consistently poor than what may be considered as normal at that age.**

❑Etiology

- **General debility**
- **Malnutrition**
- **Anaemia**
- **Glaucoma (?)**

Treatment

- Cause is treated
- If not treatable,symptom relieving majors…
- Optical treatment-1st choice
- Accommodation therapy…

Lag of accommodation

- Accommodative response is smaller than accommodative demand.
- Causes asthenopic symptoms.
- Can be found by dynamic retinoscopy, jackson cross cyl method.
- Corrected by giving addition for near.

Research report

- Normal accommodative lag in Nepalese population-Dhungana Purushottam
- 151 patient were examined out of which 88(58%) were female,63(42%)male.
- He found normal accommodative lag increase with age and ranges from 1.004-1.33(16-35yrs)in monocular fixation and 0.915-1.116(16-35yrs)in binocular condition.

Conclusions of the study

- Accommodation lag in entire Nepalese population found to be increase with age
- Myope showed lag towards higher side, hyperope towards lower side.
- Normal lag 1.174(+/-0.17) monocular fixation, 0.998(+/-0.003)binocular condition.

Ill sustained accommodation/fatigue of accommodation

- Accommodation is normal initially but can not be maintained over length of time.
- Initial stage of true insufficiency
- Convalescent period from debilitating illness
- Tiredness
- refractive status
- relationship with convergence

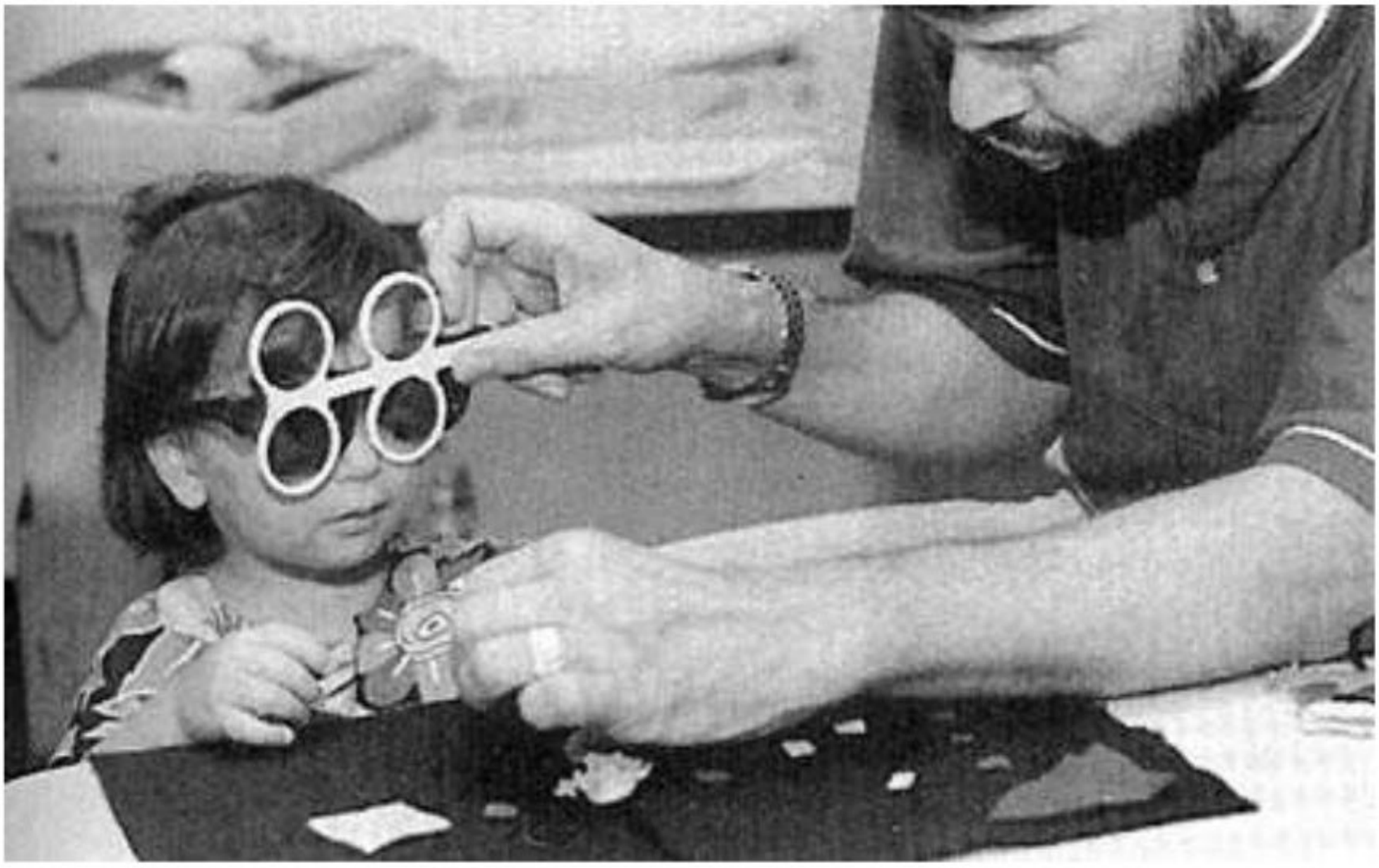
Treatment

- Correct significant ametropia
- High astigmatism ? - check near cyl axes
- Advise on lighting and length of time accommodation

Inertia of accommodation
accommodation facility

- Difficulty is experienced in altering the range of accommodation .
- Measurement of quality of the eye ability to smoothly and efficiently change the amount of accommodation
- Cycles per minute by flipper

Facility testing



Normal value

- **Monocular distribution of monocular accommodative measurement using +/-2 Ds for 100 eyes,12-14 cycles constitute about 50 percent eyes. (asymptomatic)**
- **Binocular accommodative facility measurement using +/-2Ds, 8-14 constitute about 50 percent total screened(asymptomatic)**

Paralysis of accommodation

- Disease affecting cranium and oculomotor nerve.
- Paralytical mydriasis.
- If accommodation paralysis is isolated cause, it is cortical in origin.
- Other cause include encephalitis, anterior poliomyelitis, TB, syphilis etc

- **May be partial or total, unilateral or bilateral**
- ***Signs and symptoms***
- **Blurred vision**
- **Micropsia**

Aetiology

- Congenital defects e.g., no ciliary muscle
- Cycloplegic drugs
- topical eye drops intentional or unintentional
- Systemic drugs

- **Degenerative conditions e.g. Parkinson's**
- **Exogenous poisons e.g., snake bites, bee stings**
- **III N lesion (tumour, aneurysm, haemorrhage)**
- **Ocular disease (anterior uveitis, glaucoma)**
- **Trauma to head or eye (temporary or permanent paralysis)**

Management

- If recent onset and not previously investigated then refer and, if of sudden onset, urgently
- Subsequent intervention will include spectacles and management of any diplopia

Excessive accommodation

- Tone of ciliary muscle is increased,inducing pseudomyopia.

❑ ***Symptoms***

- Blurred vision depending on patient's refractive status
- Macropsia
- Asthenopia during close work
- Pain (brows/headache)
- Poor concentration
- Miosis
- Convergence anomalies (excess or insufficiency)

Investigation

- Cycloplegic refraction used to determine true refraction

▪aetiologies

- Functional cause
- Organic cause

Functional cause

- **Functional spasm**
- **A response to over fatigue and "eye strain". Precipitated by 3 factors:**
- **Bad visual hygiene e.g., poor lighting, glare unaccustomed work**
- **Optical or ocular motor difficulties e.g., anisometropia, early presbyopia, convergence anomalies**
- **psychological factors**

Organic cause

- **Irritation of parasympathetic system**

❑ ***Aetiology***

- **Ciliary spasm**
- **- drug induced e.g., physostigmine, pilocarpine, morphine, digitalis**
- **- lesions of brain stem**
- **Inflammation e.g., anterior uveitis**
- **Trigeminal neuralgia**

Treatment

- Reversible or irreversible….
- Reversible then + lens
- Irreversible than – lenses

Unequal accommodation

- Can be due to ciliary muscle weakness or decrease in elasticity of lens capsule..
- Other causes include amblyopia,unilateral sclerosis..

Accommodative esotropia

- Accommodative esotropia……
- Refractive accommodative esotropia..(AC/A normal)
- Non refractive accommodative esotropia (high AC/A ratio)
- Mixed
- AC/A= ipd + N. phoria - D.phoria/D

Accommodative therapy

- To improve accommodative amplitude, facility
- Principle is to alter the stimulus for accommodation by glasses or changing distance
- Initially therapy is performed monocularly so that vergence system does not influence.

- **Hart chat push up(push up paddle)**
- **Hart chat distance near facility**
- **Lens flippers**
- **Loose minus lens rock**
- **Split pupil rock**

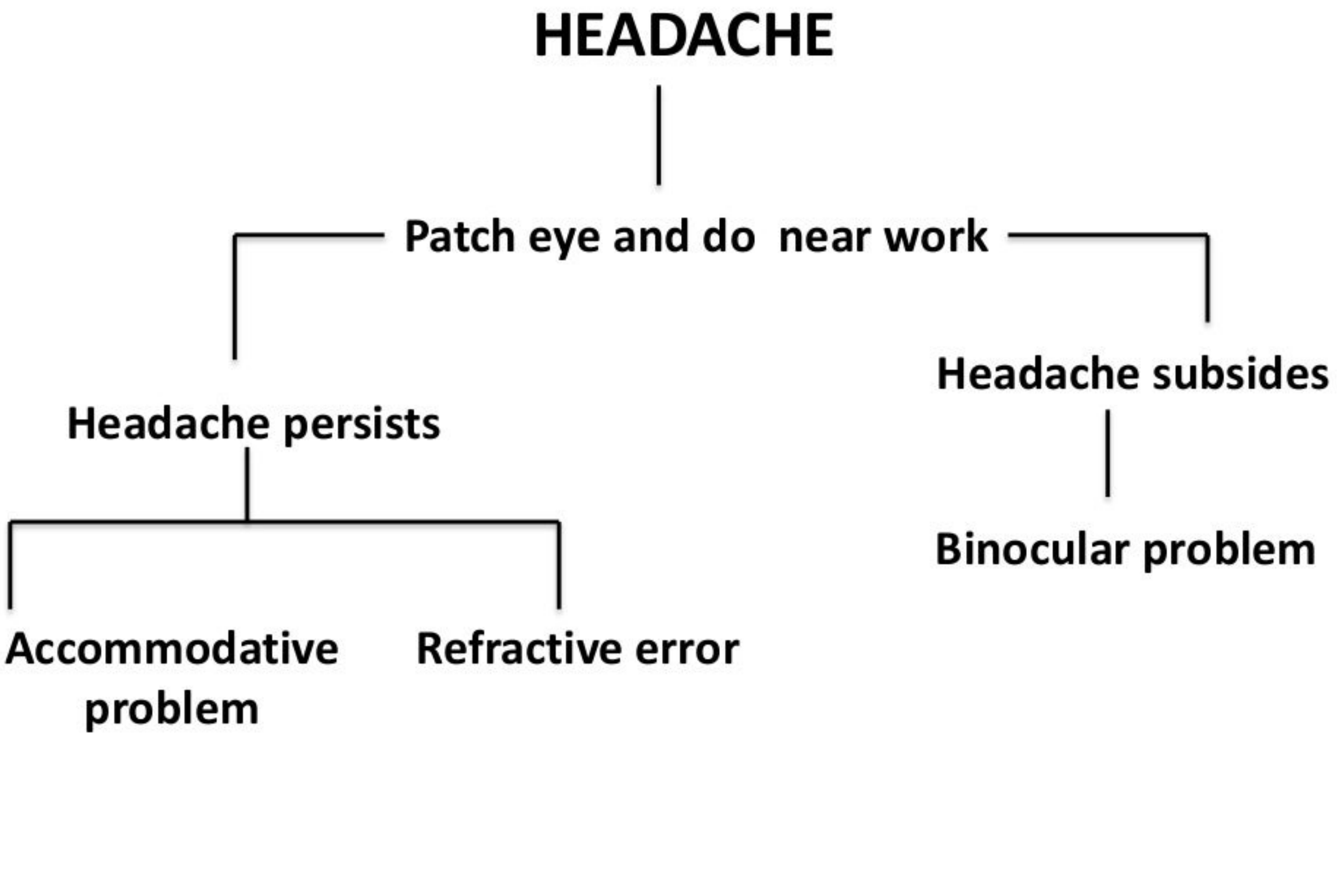
Anomalies

- Fatigue
- Failure
  - Physical
    - Presbyopia
    - Pre-senile cataract
  - Physiological
    - Partial failure
      - Insufficiency
      - Ill sustained
      - Inertia
    - Paralysis
- Spasm

conclusion

- **Accommodative anomaly is one of the most common cause of asthenopic symptom presenting to optometrist.**
- **So all patient should undergo tests for refractive error, muscle imbalance and convergence and accommodation anomaly should not be forgotten.**

Flow chart to approach Asthenopia



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