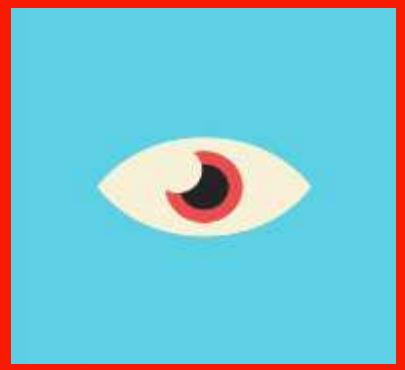
بسم الله الرحمن الرحيم

العين المتأرجحة

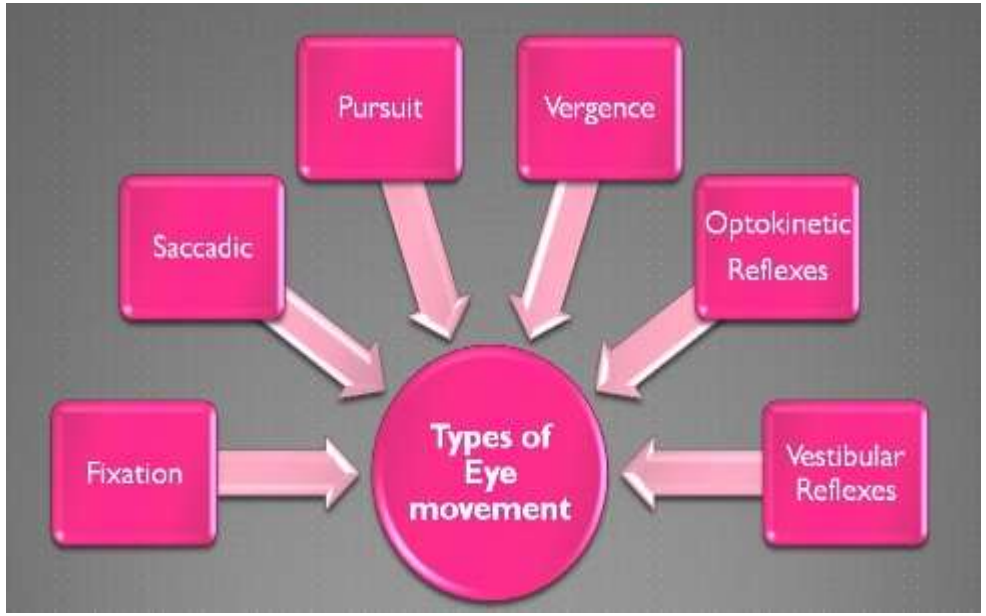
Nystagmus and Nystagmoid Eye Movement



Prof. Mohamad Shehadeh Agha

MD MRCP (UK)

Types of eye movement



Types of eye movement

Information Gathering	Stabilizing
Voluntary (attention)	*Reflexive*
Saccades new location, high velocity, ballistic	vestibular ocular reflex (vor) body movements
Smooth pursuit object moves, velocity, slow	optokinetic nystagmus (okn) whole field image motion
Vergence change point of fixation in depth slow, disjunctive (eyes rotate in opposite directions) (all others are conjunctive)	

Fixation: period when eye is relatively stationary between saccades.

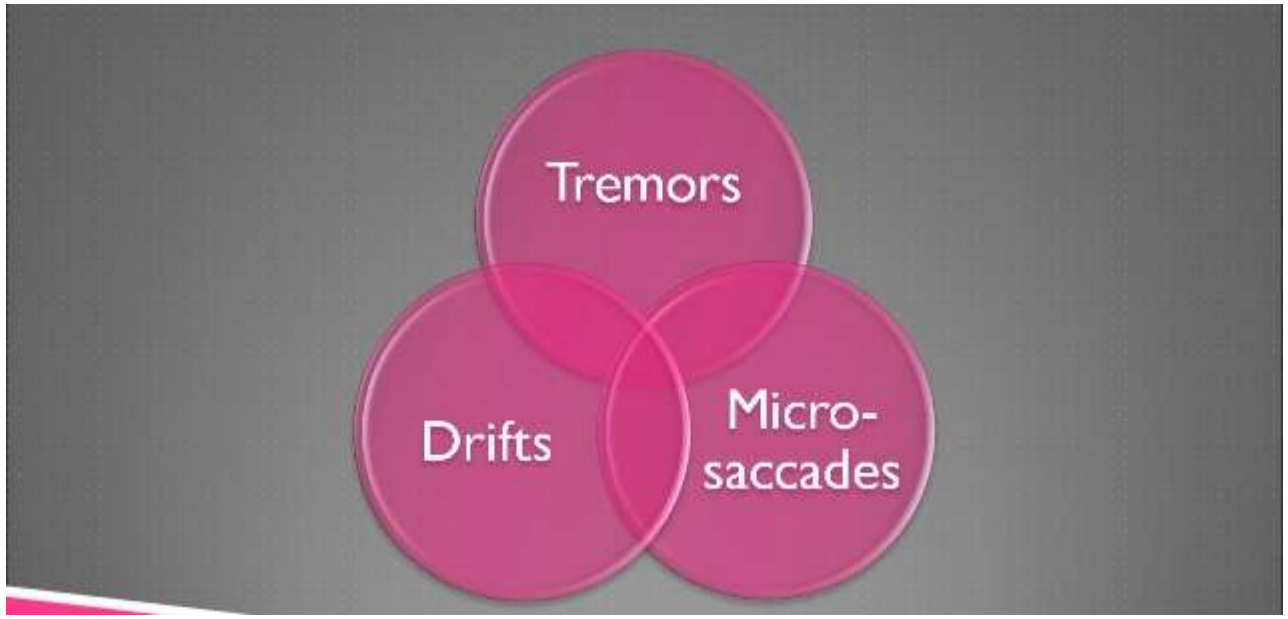
Eye Fixation

Question:

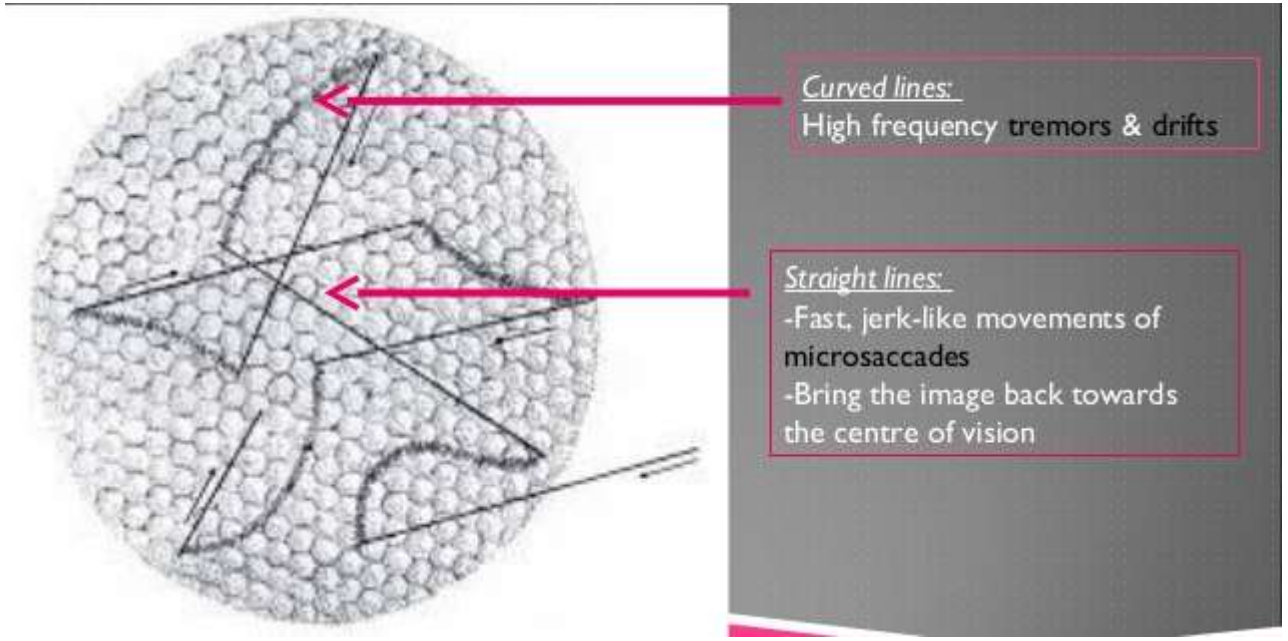
Do our eyes move or still during fixating on a stationary object?

Eye Fixation

EYE FIXATION-COMPONENTS

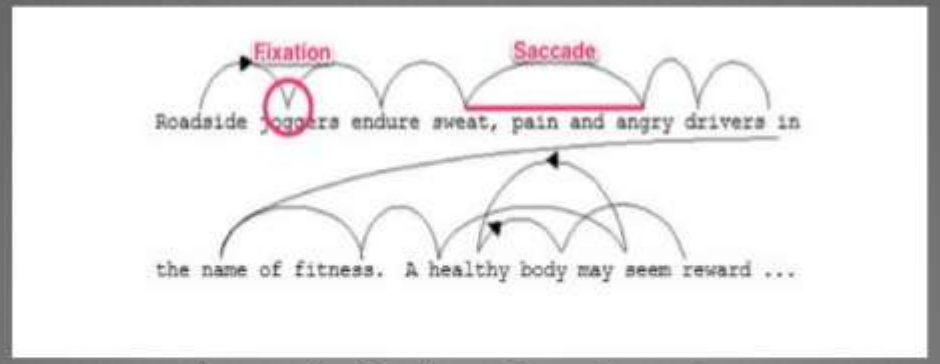


TREMOR, DRIFT & MICROSACCADES ACROSS PHOTORECEPTORS



EYE FIXATION-CONCEPT

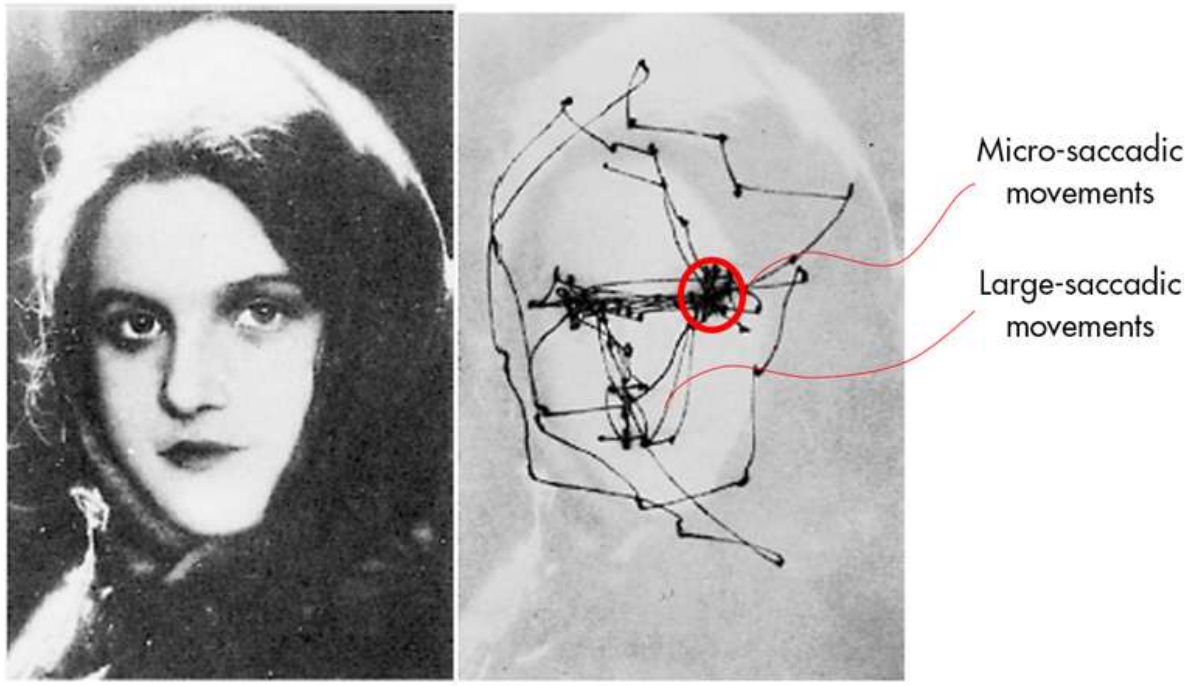
ALTERNATE EYE SACCADE AND FIXATION



An example of fixations and saccades over text

- This is the typical pattern of eye movement during reading.
- The eyes never move smoothly over still text.
- Fixation lengths ~ 100 to 600 milliseconds → length shows information processing.
- During this stop the brain starts to process the visual information received from the eyes

Microsaccades



The lines on this image display the saccadic and microsaccadic movements of a person's eye while they looked at this face. The involuntary, micro-saccadic movement is not steady when the person's eyes are concentrated at the eyes of the woman, while the voluntary, saccadic movement goes around the periphery of the face once at any give point.

Five types of eye movements

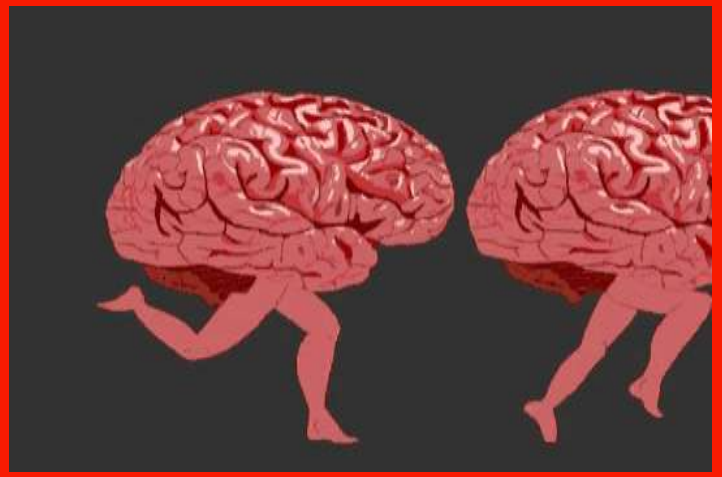
Five types:

Gaze shifting
1) Saccades
2) Vergence
3) Smooth pursuit

Gaze holding
4) Vestibular ocular reflex
5) Optokinetic reflex (OKR)

Saccade

Normal Pursuit



Saccades involve fixating on a point then jumping to the next object of interest.

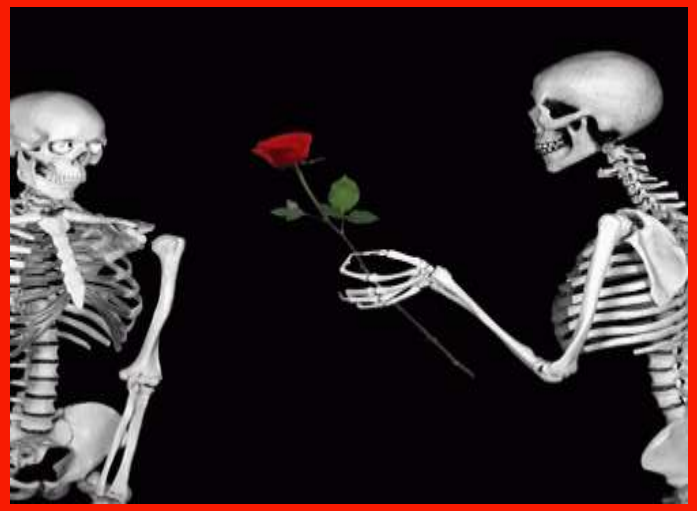
Smooth pursuit involved keeping a visible moving target on the fovea.

Although voluntary, smooth pursuit requires a stimulus to track; they cannot be executed in the absence of some environmental stimulus.

The trigger for a smooth pursuit movement is a velocity difference between the eyes and the target.

Convergence

Divergence



They are just disconjugate movements, i.e., eyes move in opposite directions, producing a convergence or divergence of each eye's visual field to focus an object that is near or far.

Vestibulo-Ocular Reflex

Vestibulo-Ocular Reflex Suppression

Vestibular ocular reflex (VOR) stabilizes the eyes relative to the external world, compensating for head movements, by rotating the eyes in opposite direction.

Optokinetic Reflex

VOR doesn't work well for slow, prolonged movements, so vision through the optokinetic reflex (OKR) assists the VOR.

OKR is activated when the image of the world slips on a large portion of the retina and produces a sense of self motion.

Mechanisms of Gaze Stability

The visual fixation mechanism:

- Detection of retinal image drift
- Programming of corrective eye movements
- Suppression of unwanted saccades

The vestibulo-ocular reflex:

- Compensates for head movements

Gaze-holding mechanism:

- Sustains eye at an eccentric position in the orbit against the elastic pull of the globe's suspensory ligaments and muscles

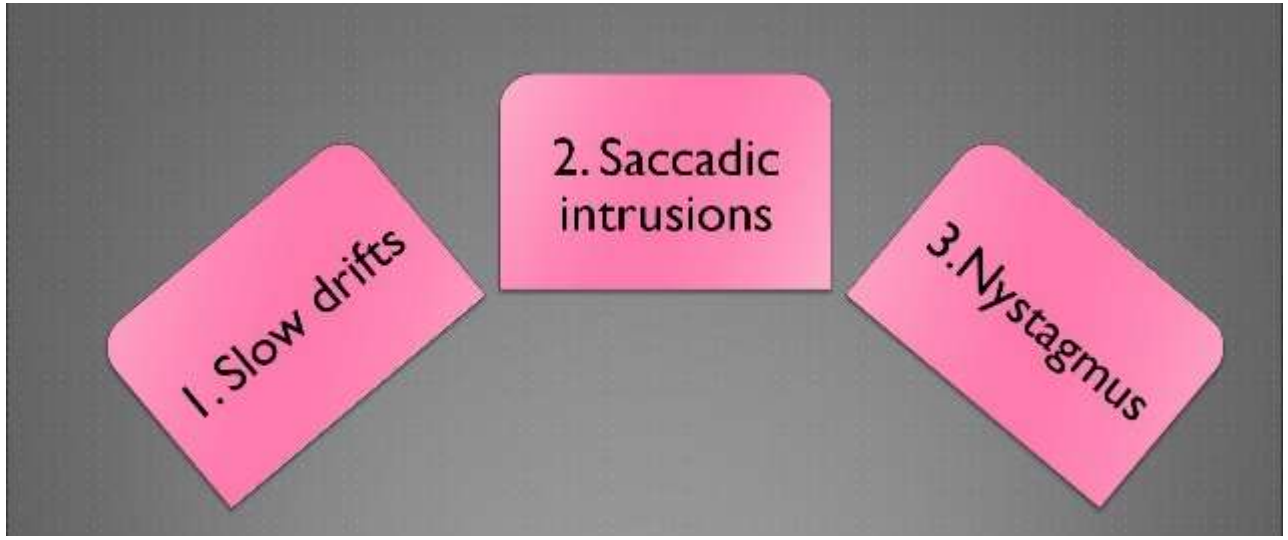
Mechanisms of Gaze Stability

- Failure of any of these control systems will cause disruption of steady fixation
- There are 2 types of abnormal fixation:

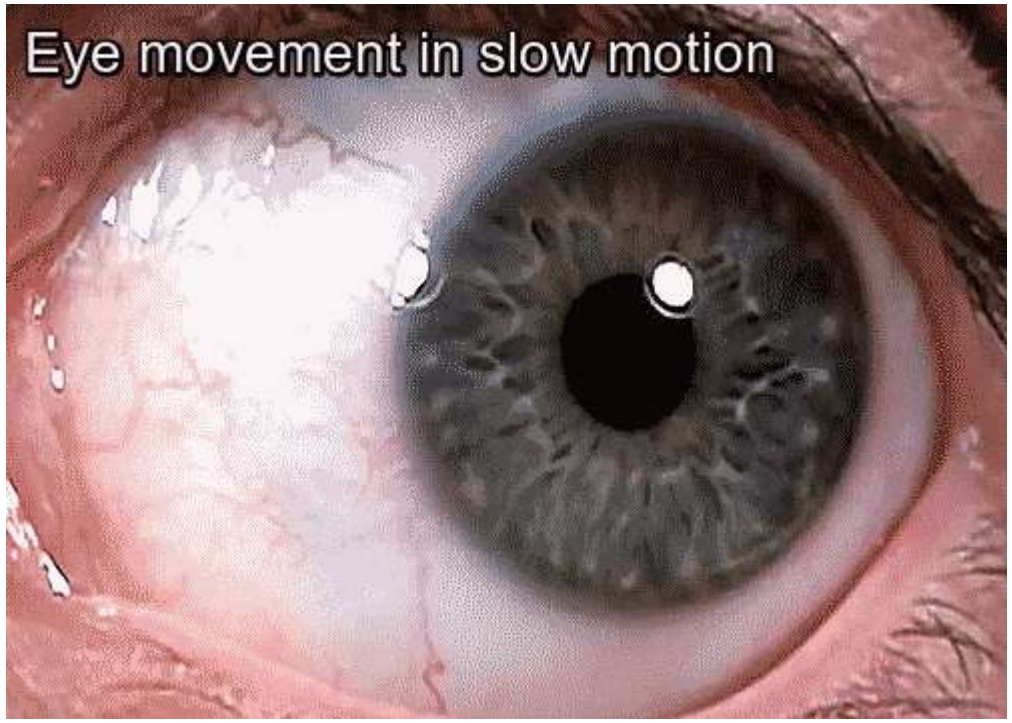
1. Nystagmus
2. Saccadic intrusions & oscillations

- The difference between them lies in the initial movement that disrupts fixation
- In nystagmus, it is a slow drift, while in saccadic intrusions and oscillations, it is a fast movement that moves the eyes off target

Fixation Abnormalities



Slow Drifts



Saccadic Intrusions

Nystagmus

The afferent nystagmus are due to defective vision. Defective vision in early infancy is more likely to cause nystagmus. The common conditions associated with nystagmus are—**Congenital cataract, albinism, aniridia, hypoplasia of optic nerve, achromatopsia, and optic atrophy.**

The efferent nystagmus are due to ocular motor disturbance

The rule of 2-4-6

i. If the child has poor vision before 2 years of age he will always develop some type of nystagmus.
ii. Between 2 to 4 years, only some children with central loss of vision will develop nystagmus.
iii. If the loss of central vision develops after 6 years of age, chances of developing nystagmus are nil.

Classification of Nystagmus

- Age of onset: ➡ congenital, acquired
- Nature of movement: ➡ pendular, jerk
- Plane of movements: ➡ horizontal, vertical, torsional
- Effect of fixation block: ➡ latent, manifest, latent-manifest

Nystagmus :

"nystagmos" Greek word for drowsiness “nodding off to sleep"

Nystagmus :

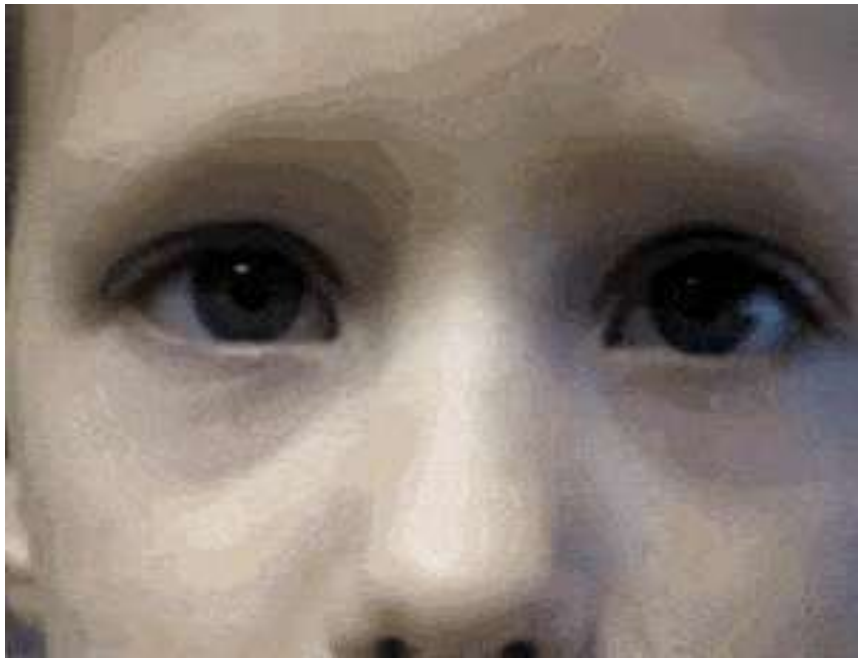
It can be described as periodic, involuntary movements of one or both eyes in either a fast or slow oscillatory motion

Nystagmus :

By definition, nystagmus starts by a slow movement of the eye away from the visual target. The second movement brings the eye back to the visual target.

Nystagmus :

If the second movement is slow, the nystagmus is said to be ***pendular***.

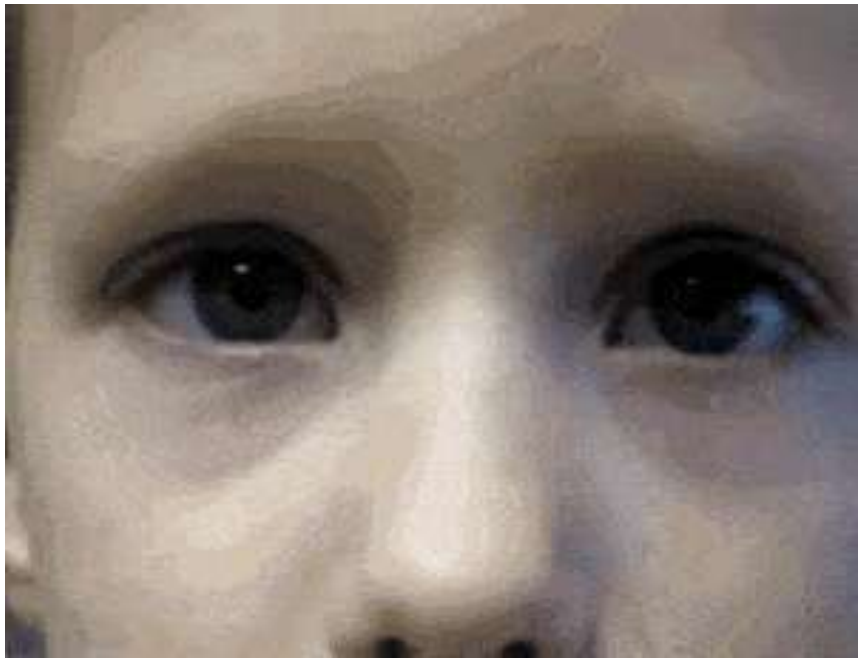


Nystagmus :

Usually congenital, or onset in early childhood,

due to low vision

Both phases have similar speed.



Nystagmus :

If this second movement is quick, the nystagmus is called ***jerk nystagmus***

Nystagmus :

By convention, the direction of jerk nystagmus (eg., right-beating nystagmus) is named after the fast phase of nystagmus. In a right-beating nystagmus, the fast phase is to the patient's right

Nystagmus :

can be congenital or acquired.

Vision is reduced by varying degree (unpredictable), but is the result rather than the cause of the nystagmus

Wave form: slow movement (pursuit) in one direction (the defect)

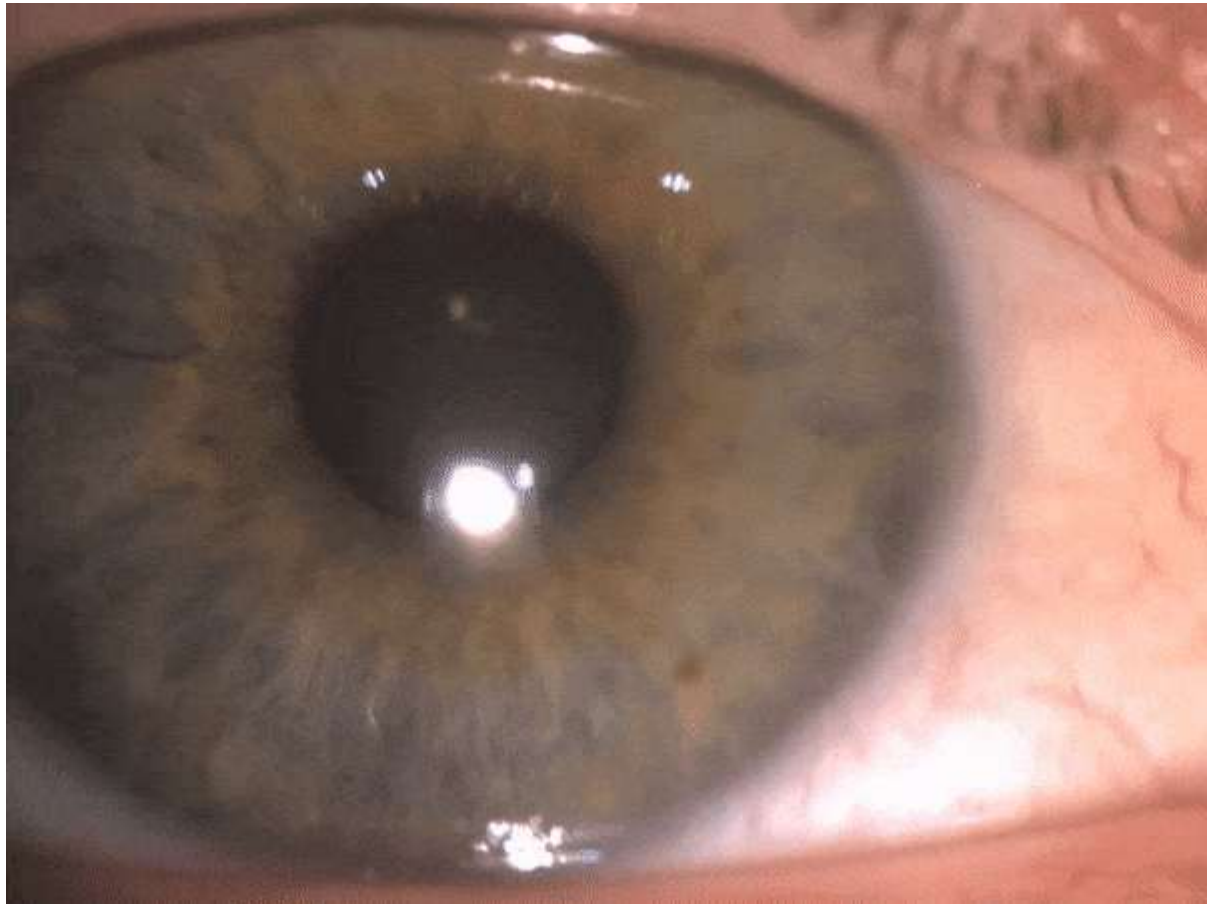
fast movement (saccade) in other direction (the correction).

Nystagmus

- Defect in slow phase.
- Nystagmoid movement : no slow phase.
- Important to distinguish jerk from pendular nystagmus.

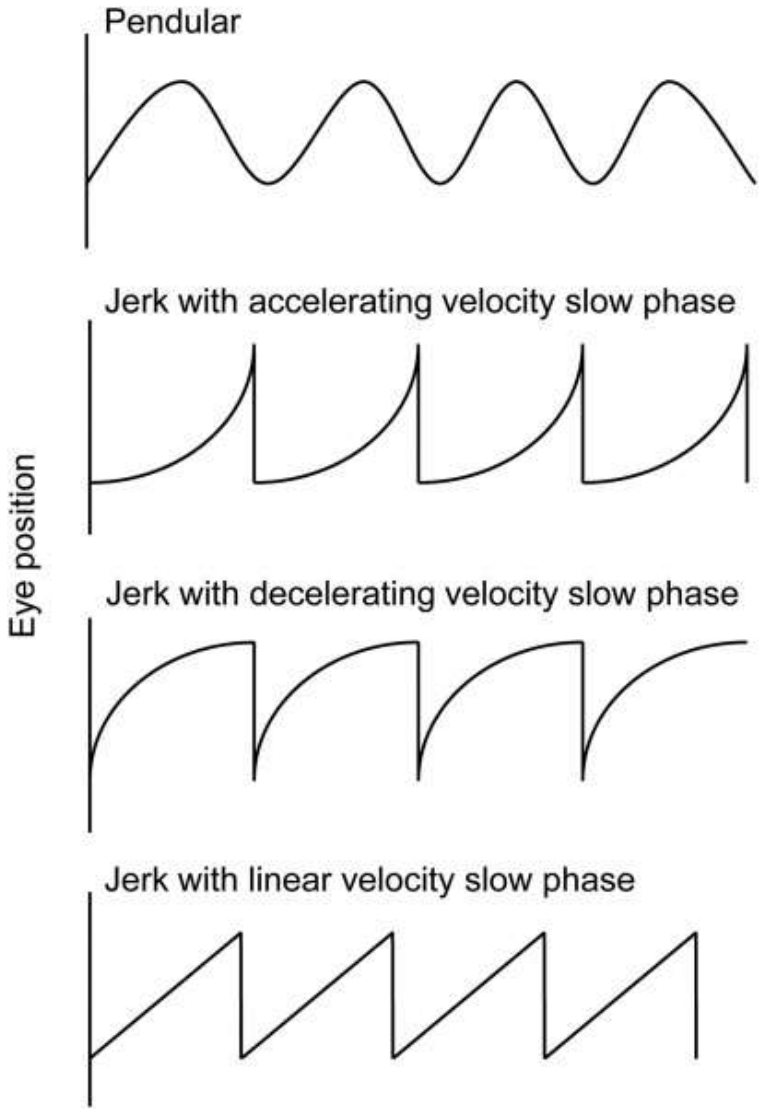
Superior Oblique Myokymia

- High frequency monocular oscillations produced by spontaneous firing of one SO muscle
- Idiopathic, but could be due to midbrain lesion
- Treatment by carbamazepine, bacolfen, propranolol
- Muscle surgery (SO tenotomy +/- IO resection or Harado-Ito procedure)



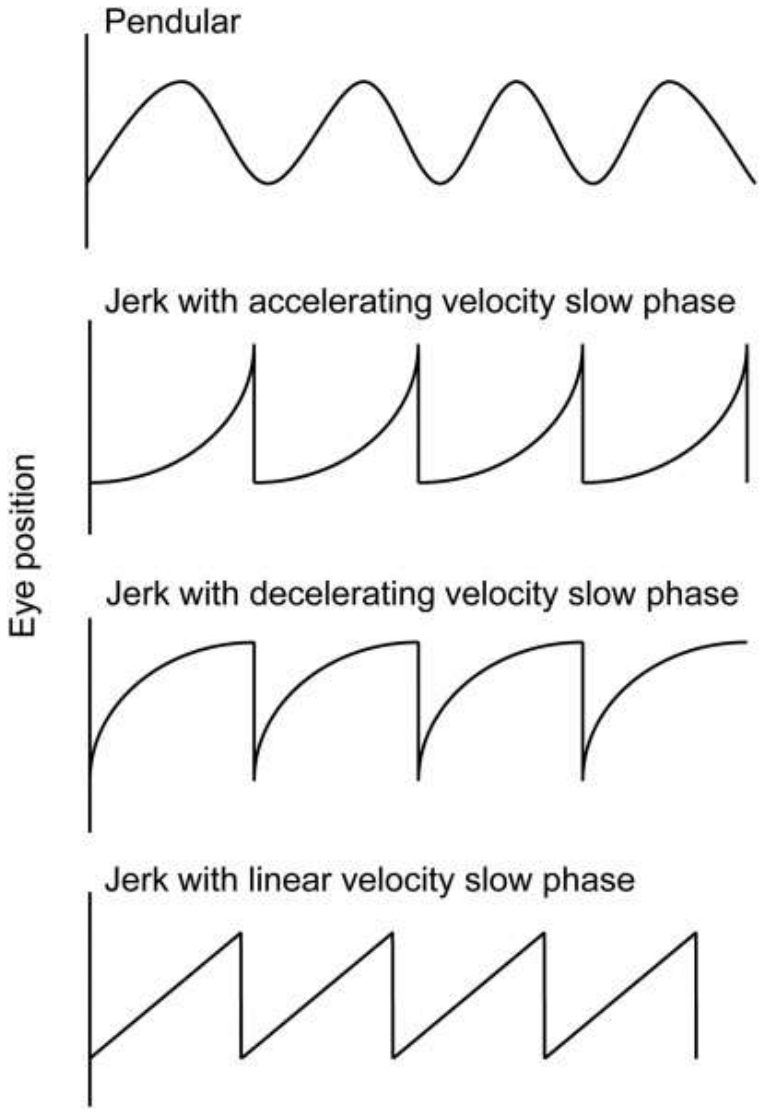
Nystagmus : Waveforms

Nystagmus waveforms are named for their *slow phase* velocity profile



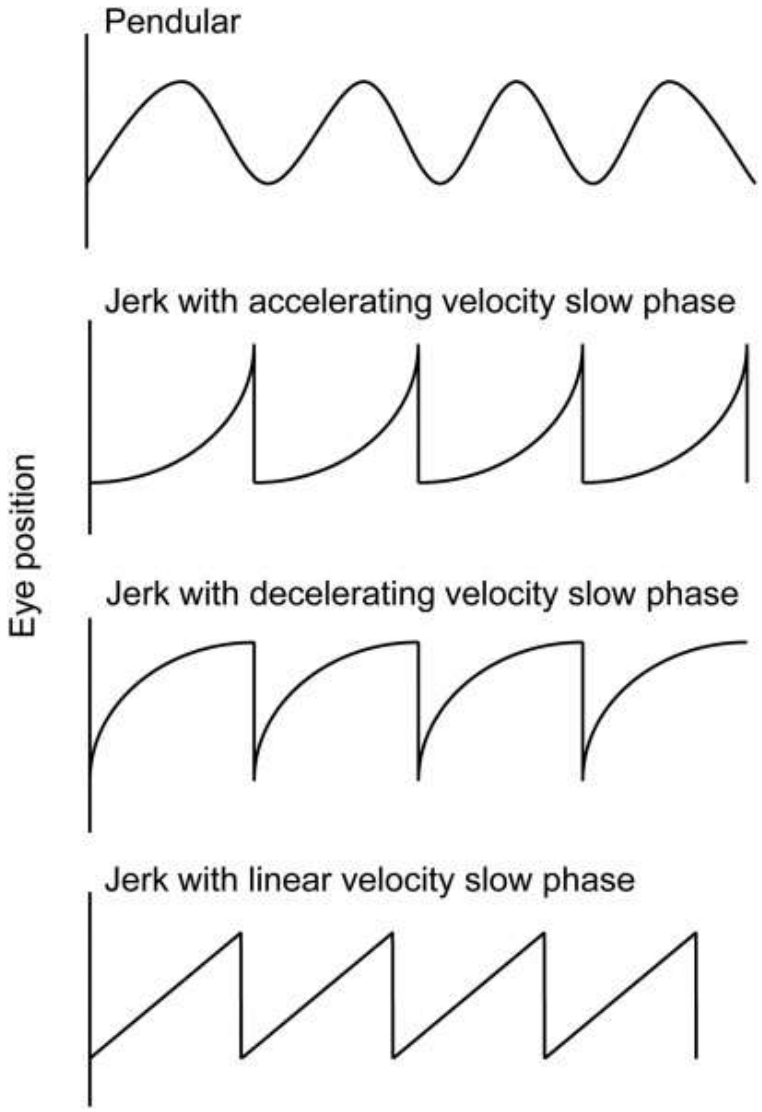
Nystagmus : Waveforms

The pendular form has no fast phase and is best depicted by the first wave



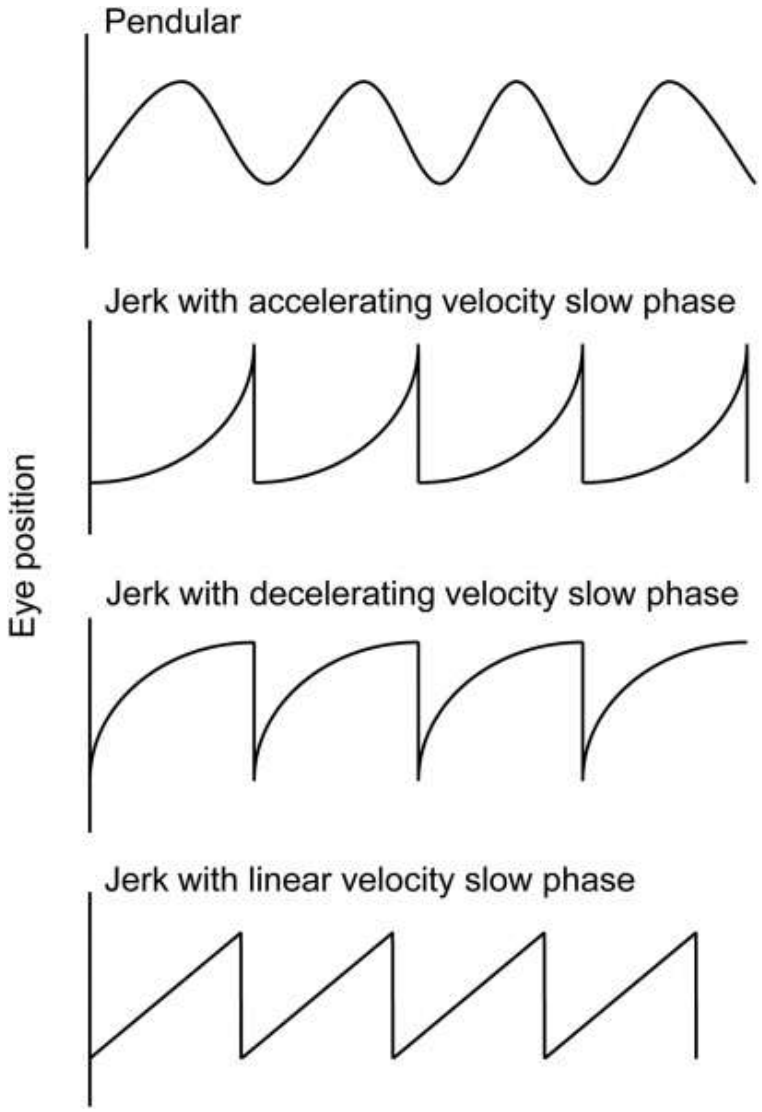
Nystagmus : Waveforms

The exponential increasing velocity type is associated with congenital nystagmus



Nystagmus : Waveforms

The exponential decreasing velocity waveform is commonly seen in gaze-evoked nystagmus, which can be a physiologic finding



Nystagmus : Waveforms

The linear waveform is typical of vestibular nystagmus