UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
„NICOLAE TESTEMIȚANU” DIN REPUBLICA MOLDOVA

Catedra Oftalmologie

BINOCULAR VISION and STRABISMUS

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Aim

- This unit will introduce you to the study of binocular vision process, disorders and strabismus features

Harold Haydon
Binocular Vision

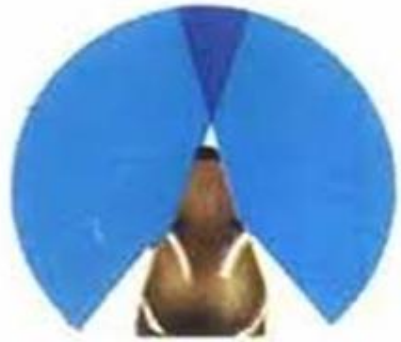
- **Binocular vision -** is vision in which both eyes are used together.

  Cortical integration of the images received simultaneously by the 2 eyes.

- **Binocular vision** (BV) is not present at the birth and it develops with the AV.

Importance of Stereopsis and Binocular single vision

- Increase field of vision
- Eliminate the blind spot since the blind spot of an eye fall on the opposite eye's visual field.
- Binocular acuity is greater than monocular
- Depth perception
- Estimation of Distance



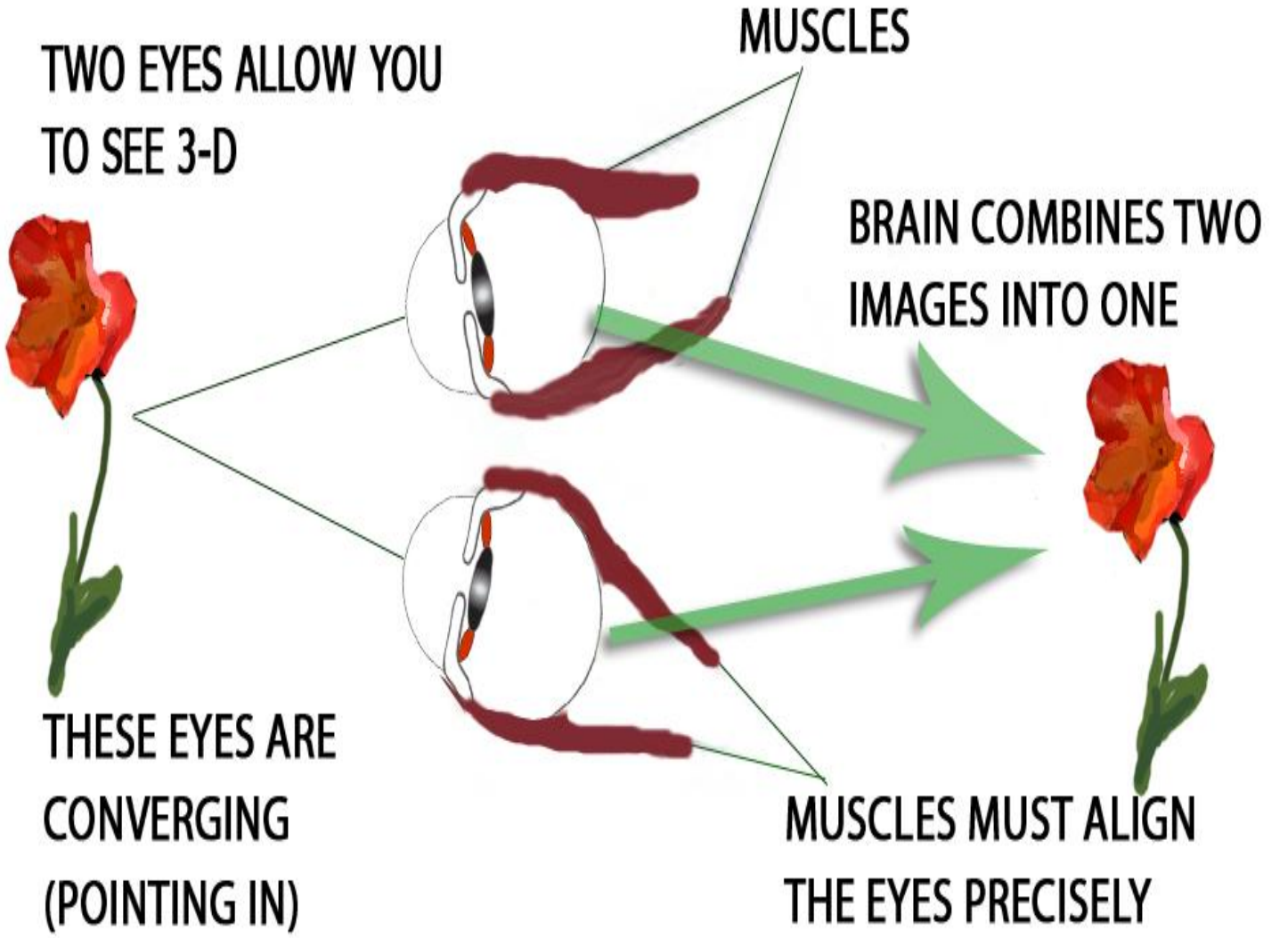
DEVELOPMENT OF BINOCULAR VISION

- At birth - eyes not associated with each other - act as two independent sense organs
- Binocular vision - an acquired faculty
- Starts developing by 6 weeks of age - beginning of **fixation reflex**
- **Refixation reflex** - develops by 4 - 6 months of age
- By age of 6 years, fovea develops fully and child has almost 6/6 vision in each eye with BSV and stereopsis if eyes are straight

During the first few years of life certain normal conditions are required for the development of binocular vision:

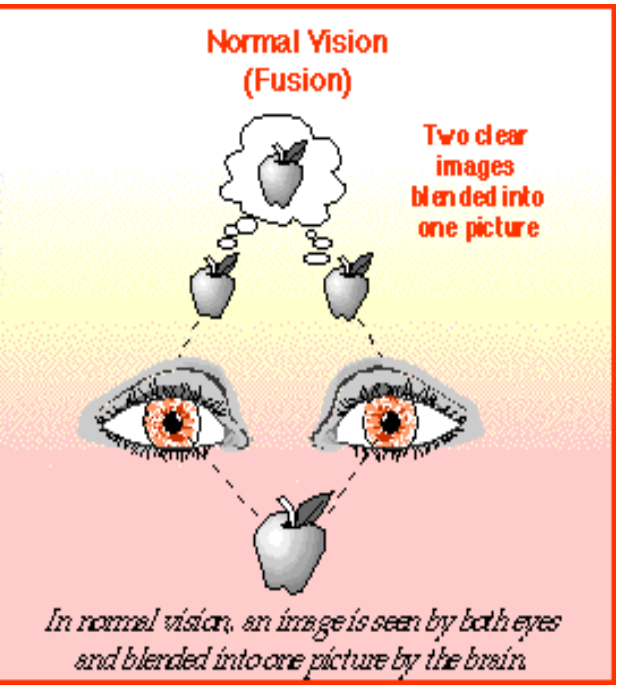
1. the bilateral retinal images must be similar in size, shape and clarity for that the anatomical and diopt. structure of the eyes must be normal, without anomalies.
2. these images projected into bilateral retinal areas must have identical relationships to the fovea (in each eye-both corresponding areas are located equidistantly to the right or left of and above or below the fovea).
3. the above two requistes must be present by at least 2 years of age.

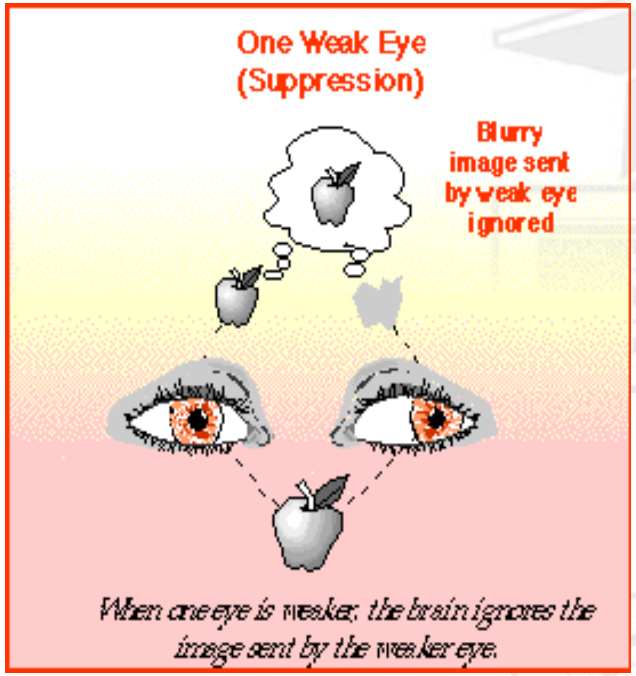
After the first nine years of life, the visual system is usually fully developed and usually cannot be changed.

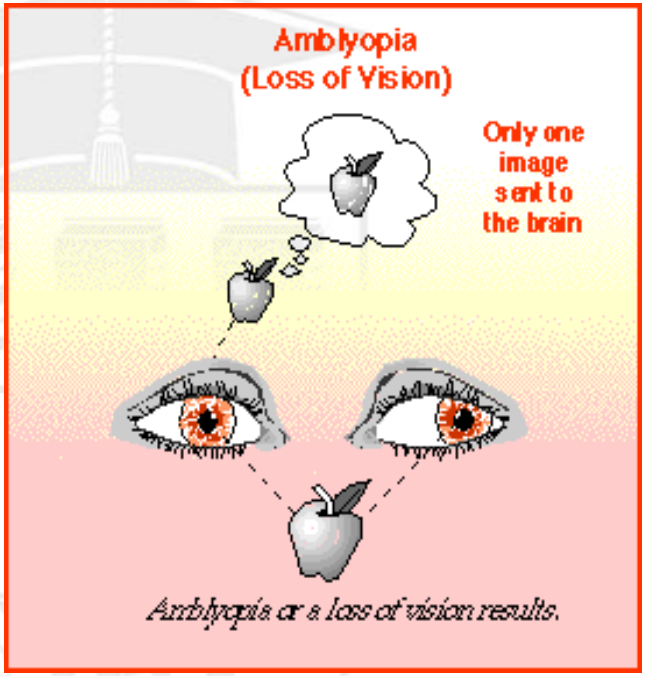

TWO EYES ALLOW YOU
TO SEE 3-D
MUSCLES
BRAIN COMBINES TWO
IMAGES INTO ONE
THESE EYES ARE
CONVERGING
(POINTING IN)
MUSCLES MUST ALIGN
THE EYES PRECISELY

A child’s visual pathways are not fully developed at birth. The vision system and the brain need to be stimulated by clear, focused, properly aligned, images from both eyes to develop properly. If the brain does not receive proper visual stimulation from an eye during the development period, it learns to ignore (suppress) the image from that eye, resulting in vision loss.

This development takes place mainly in the fisrt 3 years of life but is not complete until about 8-9 years of age.







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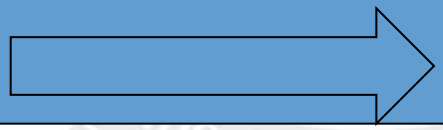


Suppression

the brain ignores the image received from an eye

If this is prolonged and constant during the sensitive period of visual development it causes – an amblyopia (lazy eye).

Amblyopia

Amblyopia is a developmental problem in the brain not one organic problem in the eye.

Usually, only one eye is affected by amblyopia.

Amblyopia **is reduction visual acuity without a visible organic lesion in the eye**.

After the first nine years of life, the visual system is usually fully developed and usually cannot be changed

Amblyopia has three major causes

1. Monocular Strabismus
2. Vision-obstructing disorders
3. Anisometropia (the most difficult type of amblyopia to detect since the child appears to have normal vision when both eyes are open)

What are the symptoms of amblyopia?

NO SYMPTOMS!!!!

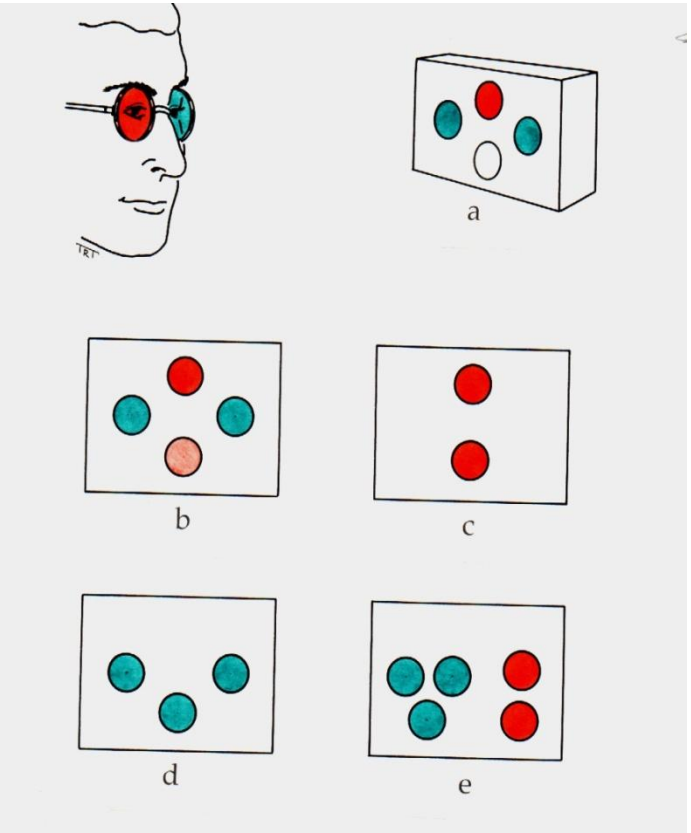
Amblyopia often goes undetected, unless the child has a misaligned eye or other obvious abnormality.

The child accepts having one good eye and one poor eye and considers amblyopia to be the normal situation.

In most cases, amblyopia must be detected by checking vision.

Examination of binocular vision

Test Worth



Socolov test

Strabismus is derived from the Greek word *strabismos* (to squint, to look obliquely).

Strabismus occurs in 2-5% of all children.

Strabismus is a condition in which the eyes do not point in the same direction.

(Wikipedia medical encyclopedia)

Strabismus means ocular misalignment, whether due to abnormalities in binocular vision or anomalies of neuromuscular control of ocular motility.

CLASSIFICATION

1. According to fusion status

- *Phoria:* a latent deviation in which fusion control is always present.
- *Tropia:* a manifest deviation in which fusion control is not present.

2. According to age of onset

- *Congenital:* occurring prior to the age of 6 months;
- *Acquired*: with onset after the age of 6 months.

3. According to the comitancy

- *Comitant strabismus:* no metter where they look, the degree of deviation does not change.
- *Incomitant strabismus:* the amount of misalignement depends upon which deviation the eyes are pointed.

CLASSIFICATION

4. According to fixation

- *Alternating:* there is spontaneous alternation of fixation from one eye to the other.
- *Monocular:* there is definite preference for fixation with one eye.

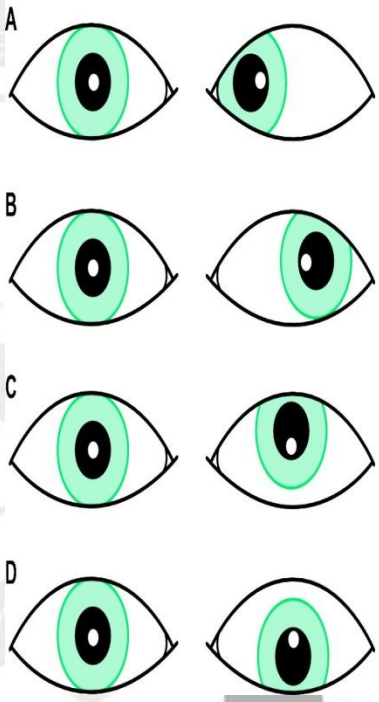
5. According to the type of deviation

- *Horizontal:* esodeviation or exodeviaton
- *Vertical:* hyperdeviation or hypodeviation
- *Combined:* horizontal, vertical and/or torsional

6. According to the constancy

Constant

Intermittent



Millodot: Dictionary of Optometry and Visual Science, 7th edition. © 2009 Butterworth-Heinemann

Aetiology of non-paralytic squint (multi factor):

General:

1. Hereditary – 45% risk when both parents are strabic.
2. Prematurity – 35% risk.

Ocular disease:

a) High refractive errors - this is the most common factor. High degree of uncorrected refractive error in children may cause deviation of the most affected eye (where retinal image will be blurred).

b) Monocular organic diseases – ex:congenital cataract, congenital ptosis, optic atrophy).

c) Orbital and intraorbital causes - (pathological development of orbital bonnes, muscles)

Aethiology of paralytic squint

- 1.Trauma
- 2. Tumors (orbital or cranial)
- 3.Vascular disease (diabetes, hypertension,etc)
- 4. Inflammation (sarcoidosis, vasculitic disease, etc)

Difference between paralitic and non-paralytic squint

In a **non-paralytic squint**:

1. The movements of both eyes are full in all directions (there is no paresis)
2. The angle of deviation is constant and unrelated to the direction of gaze (concomitant squint).

Difference between paralitic and non-paralytic squint

In a **paralytic squint**:

1. Is underaction of one or more of the eye muscles due to a nerve palsy or extraocular muscle disease.
2. The size of the squint is dependent on the direction of gaze and for a nerve palsy, is greatest in the *field of action* of the affected muscle (*inconcomitant squint)*.
3. Presence of diplopia (double vision - an object is seen to be in two different places).

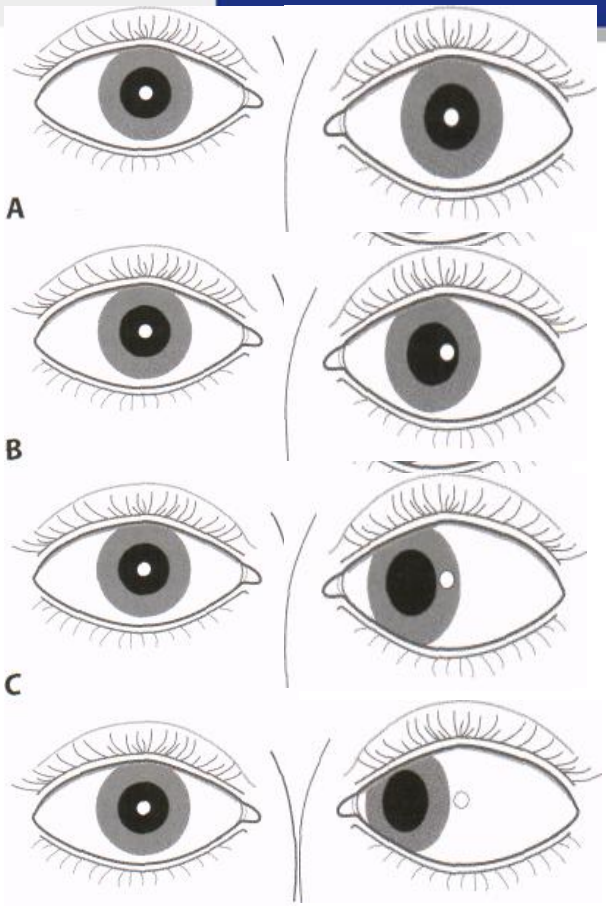
Exams and Tests

A physical examination will include a detailed examination of the eyes.

Eye tests include:

- Corneal light reflex (Hirschberg test)
- Cover/uncover test
- Retinal exam

- **Standard ophthalmic exam**
- **Visual acuity**
  - A brain and nervous system (neurological) examination will also be performed.
  - Surgery does not change the vision; it attempts to align the eyes by shortening, lengthening, or changing the position of one or more of the extraocular eye muscles and is frequently the only way to achieve cosmetic improvement.



A– ortophoria
B – esotropia 15°;
C – esotropia 30°;
D – esotropia 45°.

Hirschberg's method is based on the premise that 1 mm of decentration of the corneal light reflection corresponds to about 7° or 15 PD of ocular deviation of the visual axis.

TREATMENT

A non-paralytic squint with no associated ocular disease is treated as follows:

1. **Nonsurgical treatment**

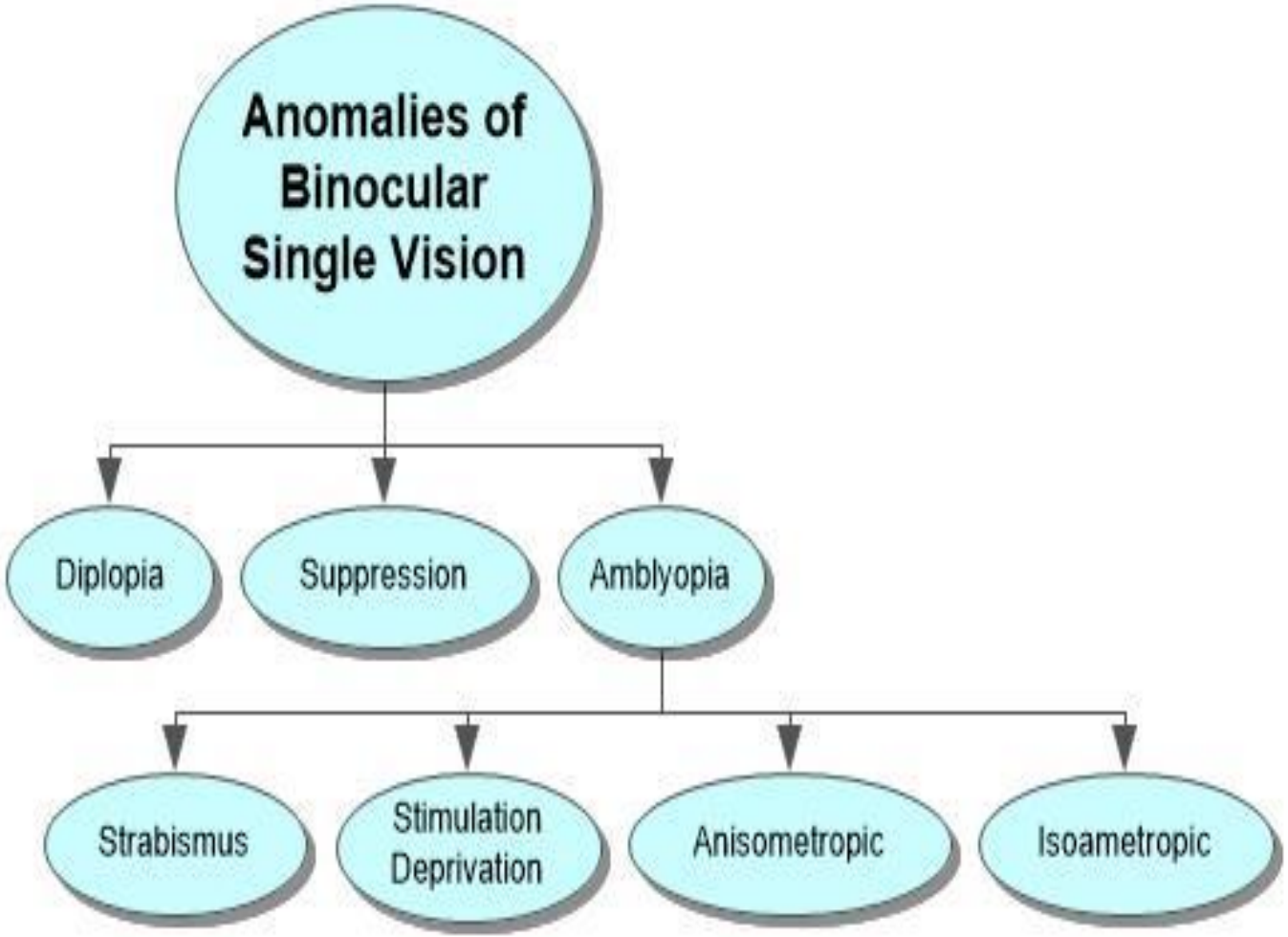
- Optical Correction
- Oclusion (paching) - is based on covering the sound eye to stimulate the amblopic eye
- Penalisation - a method for blurring the sound eye to force fixation to the ambliopic eye
- Botulinum toxin injection

TREATMENT

2. **Surgical treatment** does not change the vision; it attempts to align the eyes by shortening, lengthening, or changing the position of one or more of the extraocular eye muscles and is frequently the only way to achieve cosmetic improvement.

- The main principles:
  - Recession - moving the muscle insertion backwards on the globe (weakens the muscle).
  - Resection - removing a segment of the muscle (strengthens the muscle).

Conclusion


Anomalies of Binocular Single Vision
Diplopia
Suppression
Amblyopia
Strabismus
Stimulation Deprivation
Anisometropic
Isoametropic

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