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Anatomy: Orbit and Extraocular Muscles

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Do.
Make.
Heal.
Innovate.
Reinvent the Future.

Session Objectives

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- Infer what structures can be affected by blowout fractures of the orbit.
- Differentiate actions and functions of extraocular muscles.
- Describe how extraocular muscles work in pairs to induce or avoid torsion.
- Describe how the extraocular muscles work in pairs to move the eye in primary position.
- Predict lesions in nerves of the orbit based on tests of extraocular muscles.

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Part 1: Orbit Boundaries and Contents

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Axial MRI of Head

- Orbit is full of adipose tissue!

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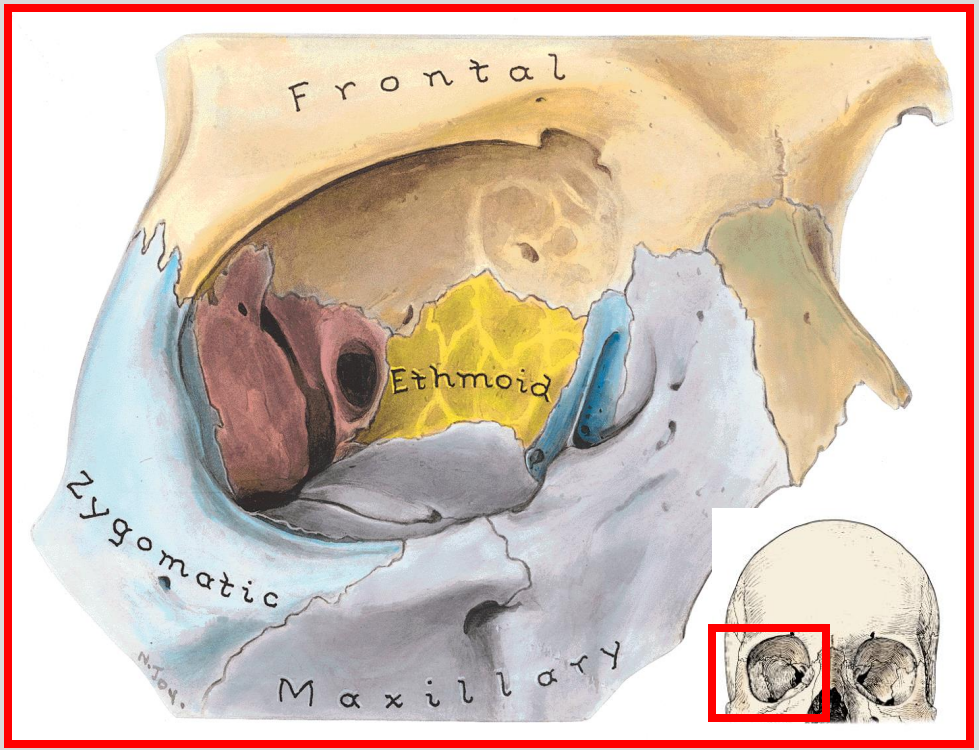

From COA, Moore and Dalley (2006)

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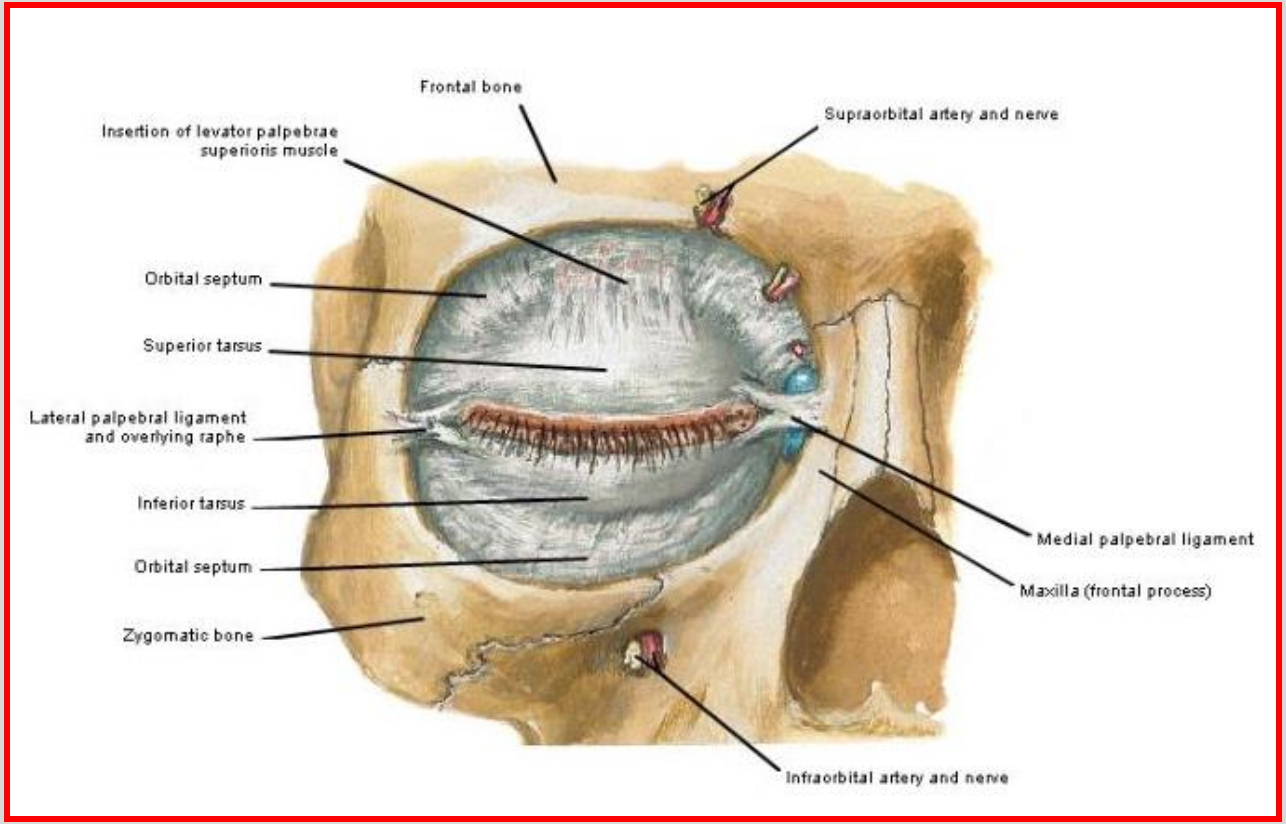
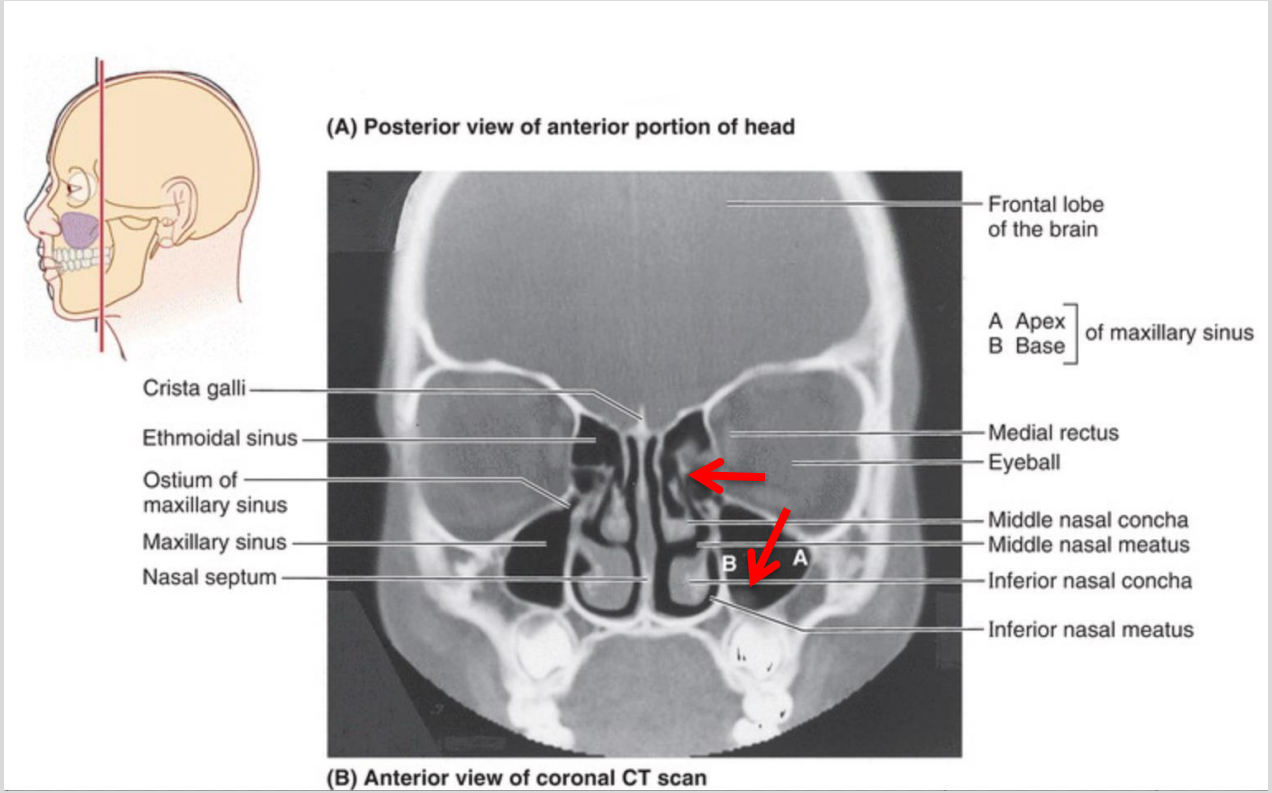


From Netter's Atlas of Anatomy

Trauma in the Orbit



From COA, Moore, Dalley, Agur, 2014

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- When under pressure orbit contents can break into surrounding spaces.
- Called blowout fractures

Levator palpebrae superioris

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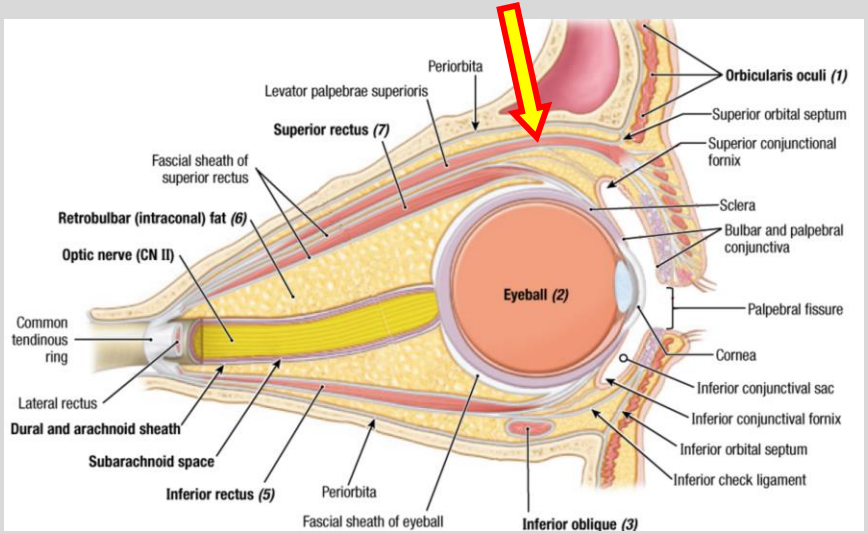
- Origin: lesser wing of sphenoid
- Insertion: superior tarsus and superficial fascia of eyelid
- Contains smooth muscle fibers (superior tarsal or Müller's muscle)



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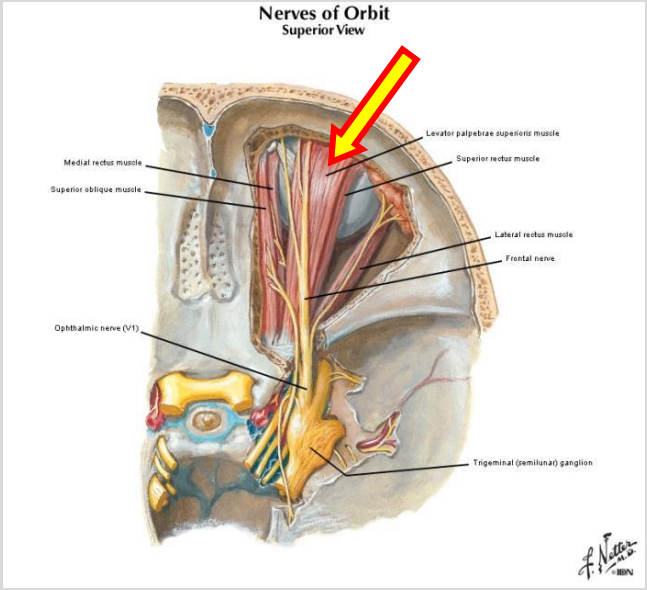

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Recti Muscles

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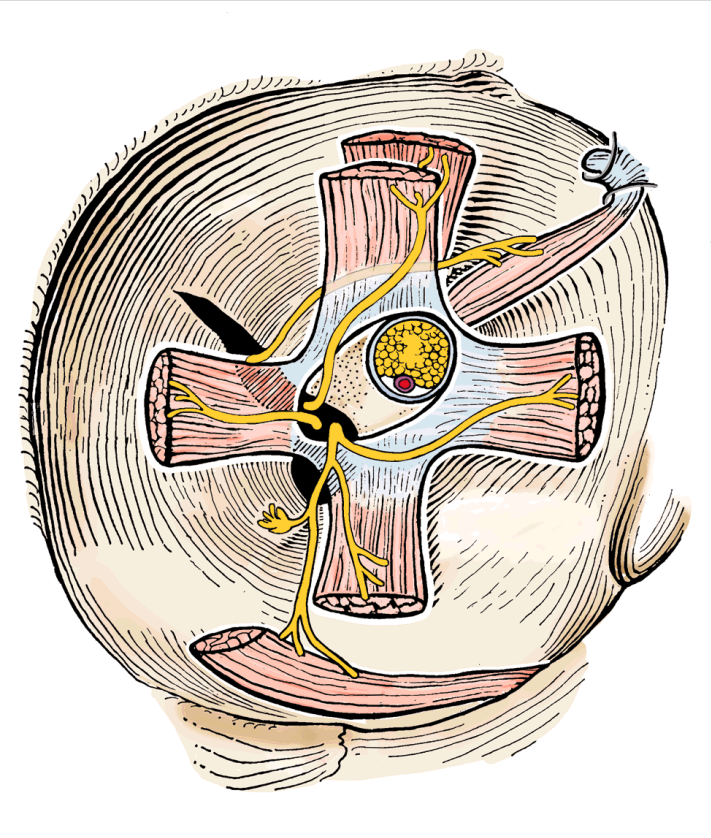

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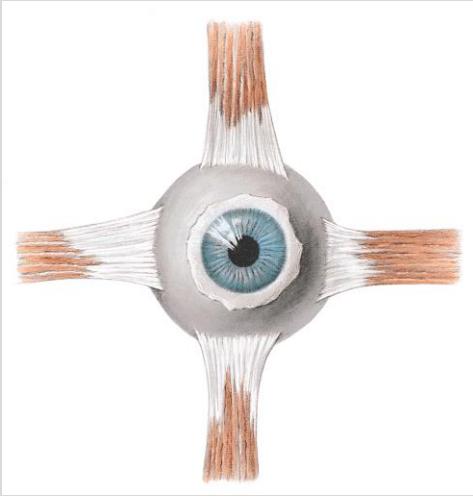

- Superior, inferior, medial, and lateral
- Originate from common tendinous ring
- Insert into sclera immediately posterior to cornea

Oblique Muscles

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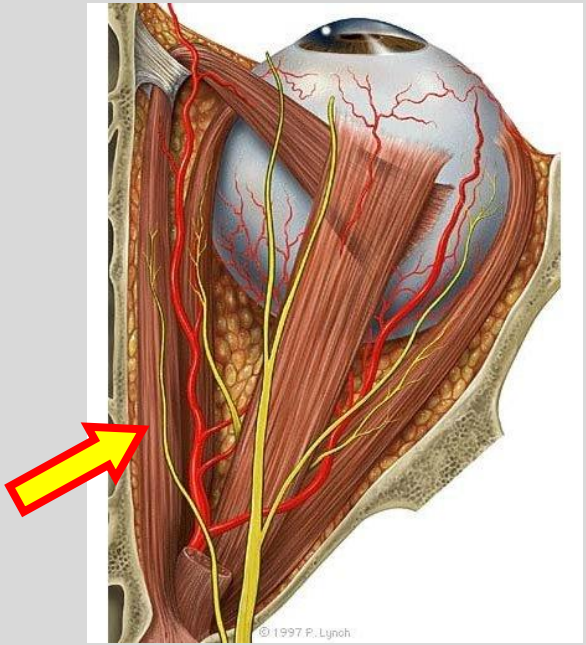
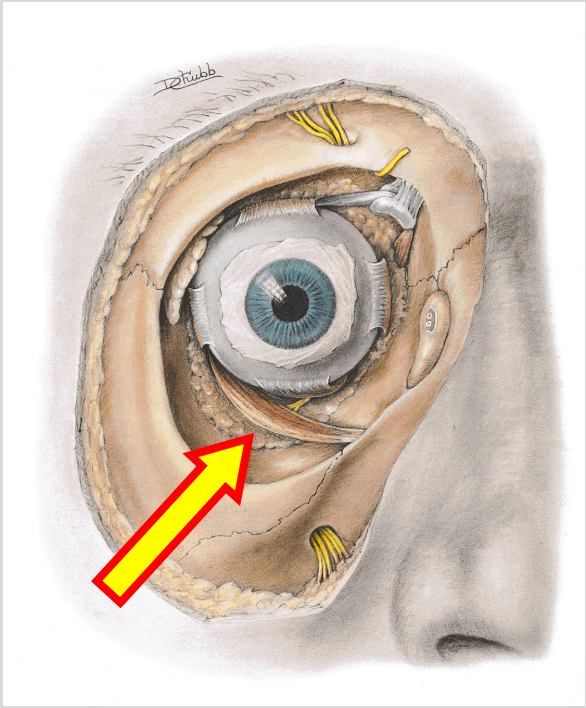
Superior oblique

- Originates from lesser wing of sphenoid
- Passes through *trochlea*
- Inserts into sclera deep to superior rectus



Inferior oblique

- Originates from medial orbital wall
- Passes posterolaterally beneath eyeball
- Inserts into sclera deep to lateral rectus



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Innervation

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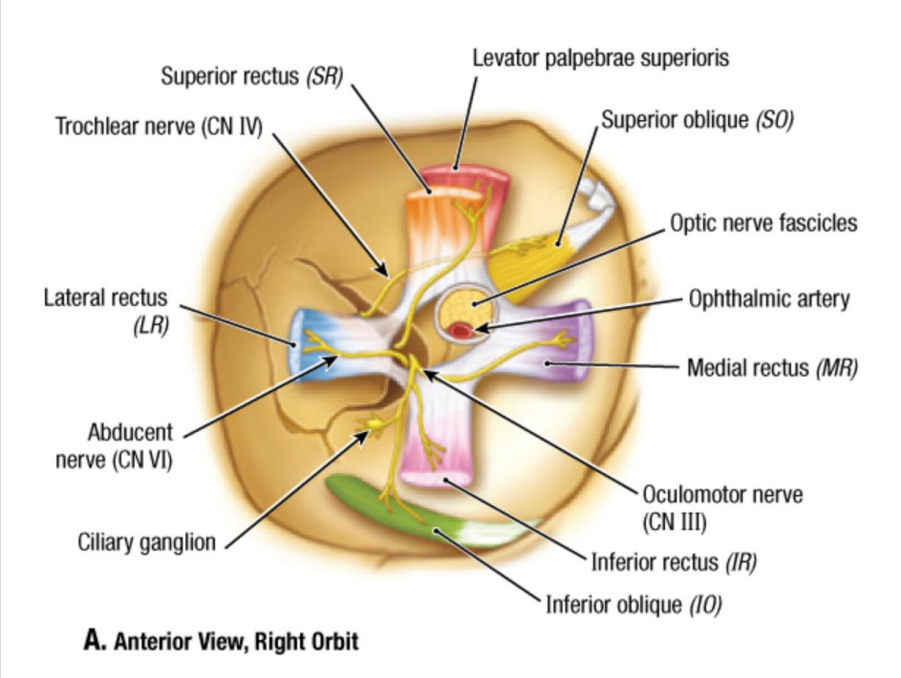

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- $SO_4LR_6AO_3$
- Superior Oblique: Trochlear n. (CNIV)
- Lateral Rectus: Abducens n. (CNVI)
- All Others: Oculomotor n. (CNIII)

- Superior Tarsal (Muller's) muscle: postganglionic sympathetics from superior cervical ganglion

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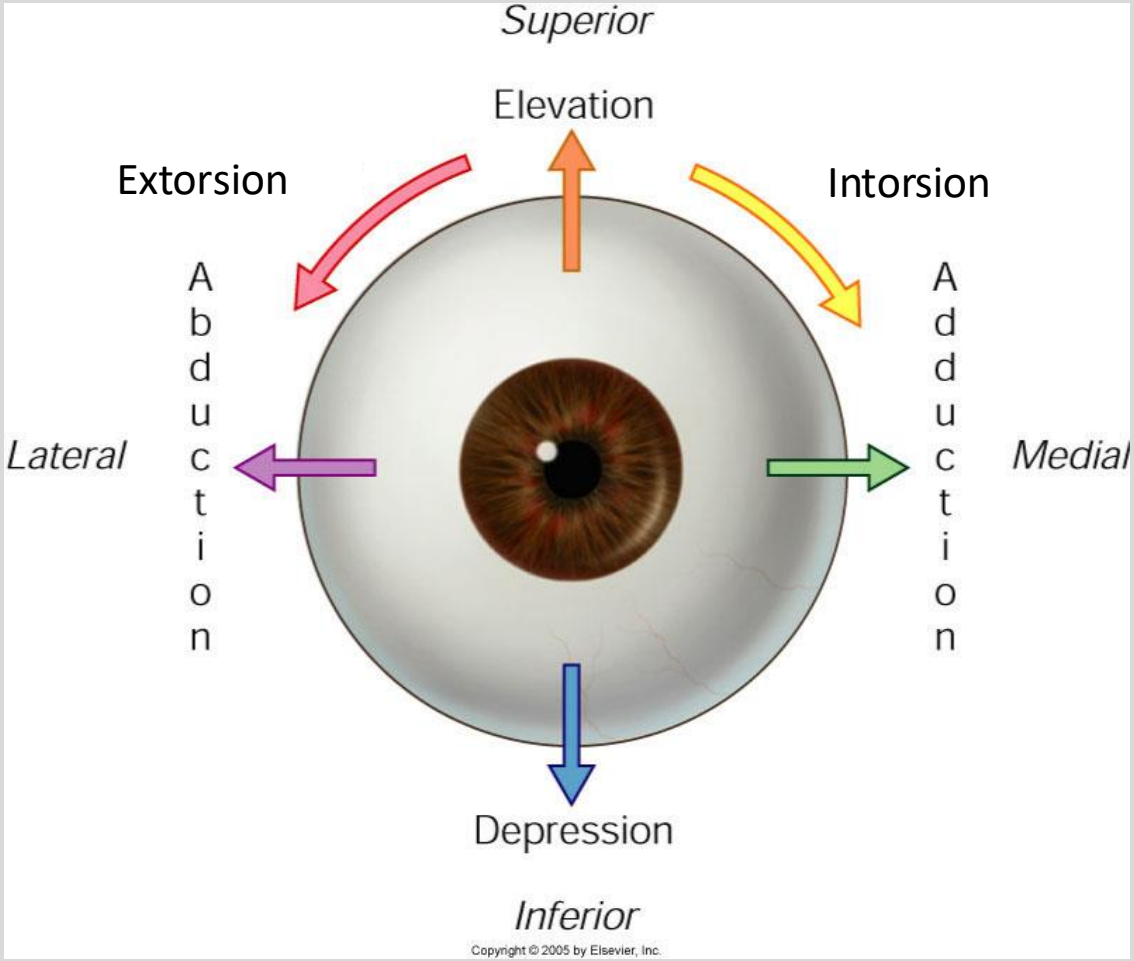
Part 2: Simple Movements of the Eye



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Actions on Eyeball

Actions vs. *functions* of extraocular muscles

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- *Action* is what it would do if acted in isolation
- A muscle's *function* is what it *actually* contributes to a particular motion
- Sometimes these are the same – example: Levator palpebrae superioris

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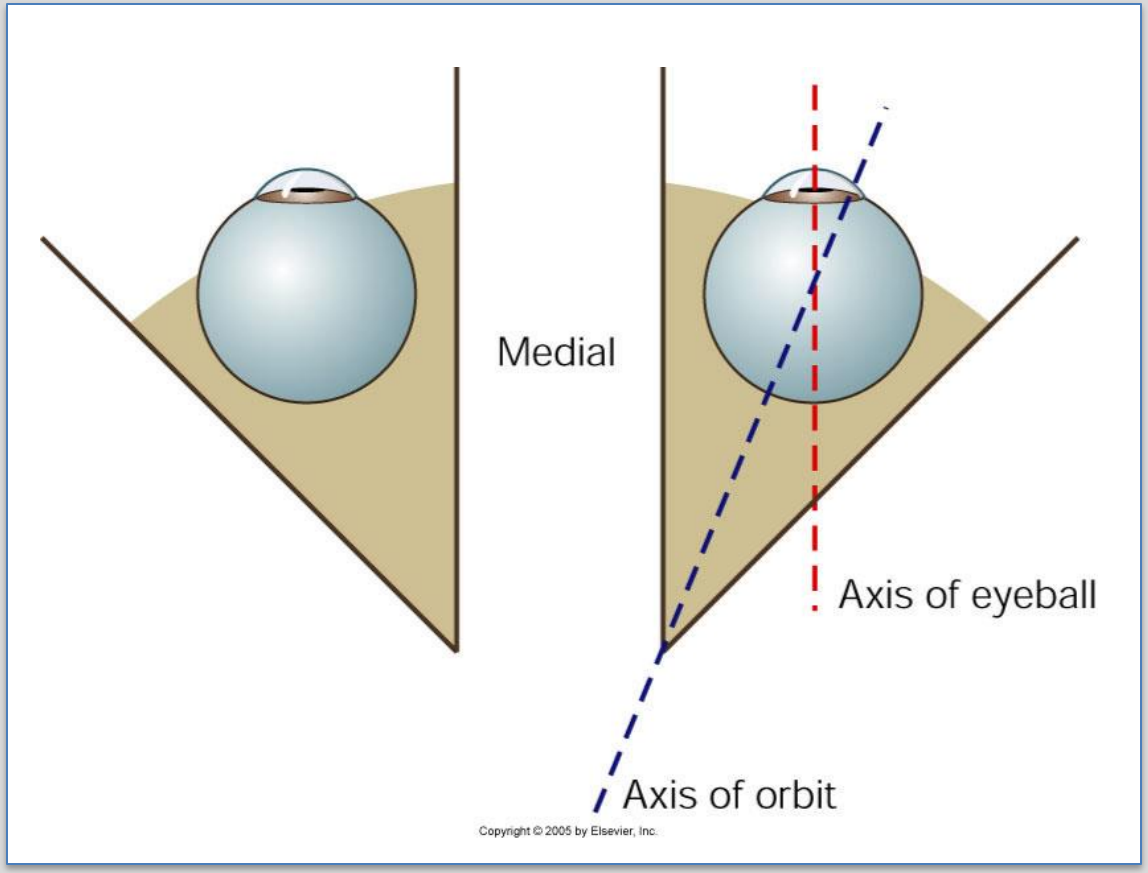

Let's start with the simple cases …

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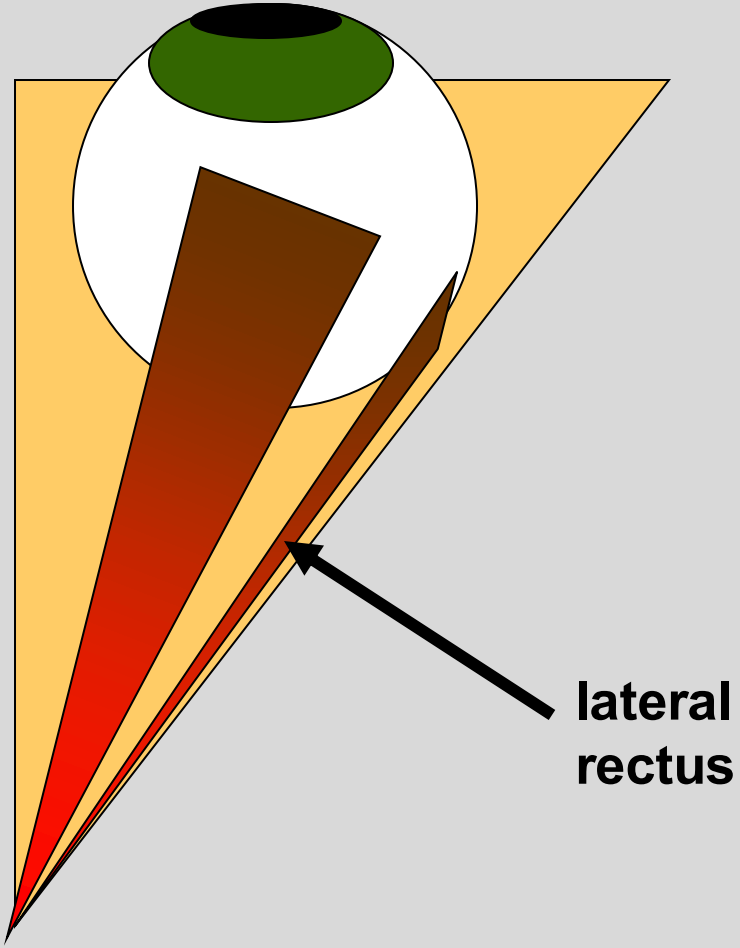
Elevation of the Abducted Eye



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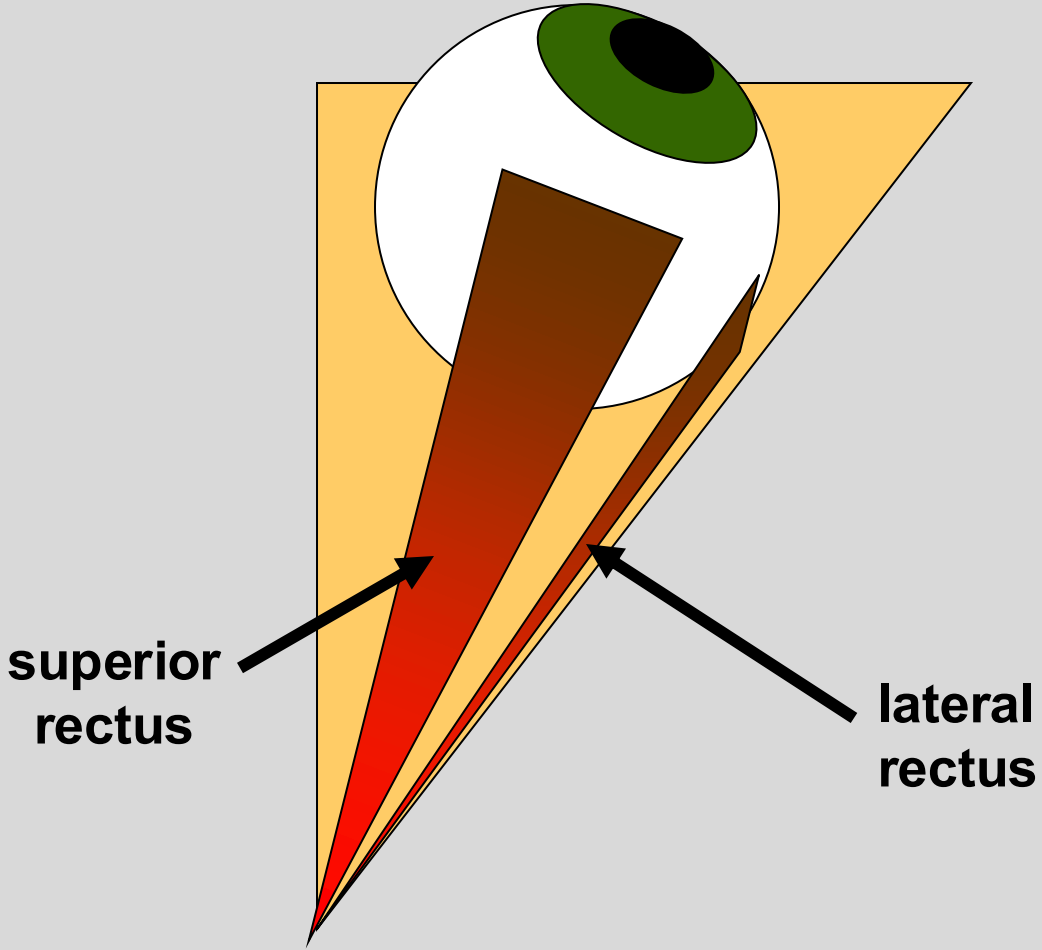
Elevation of the Abducted Eye



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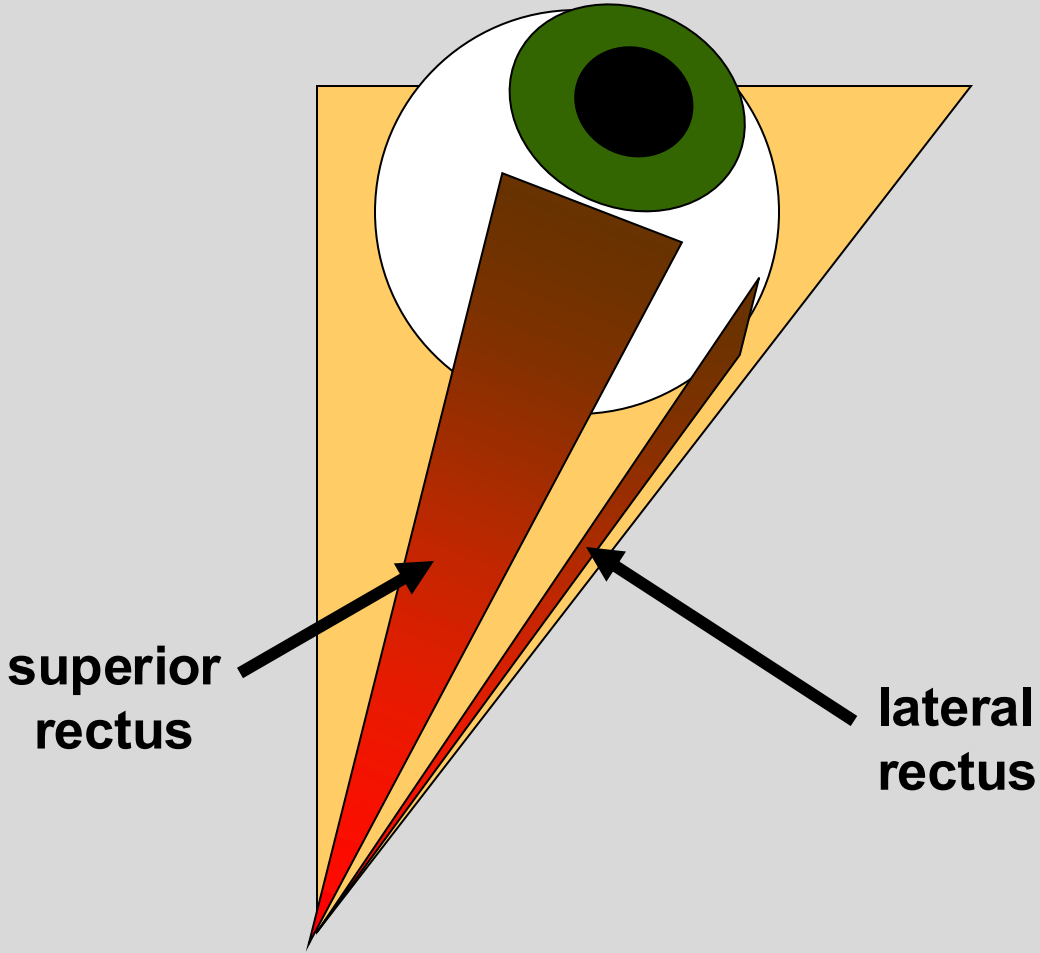
Elevation of the Abducted Eye



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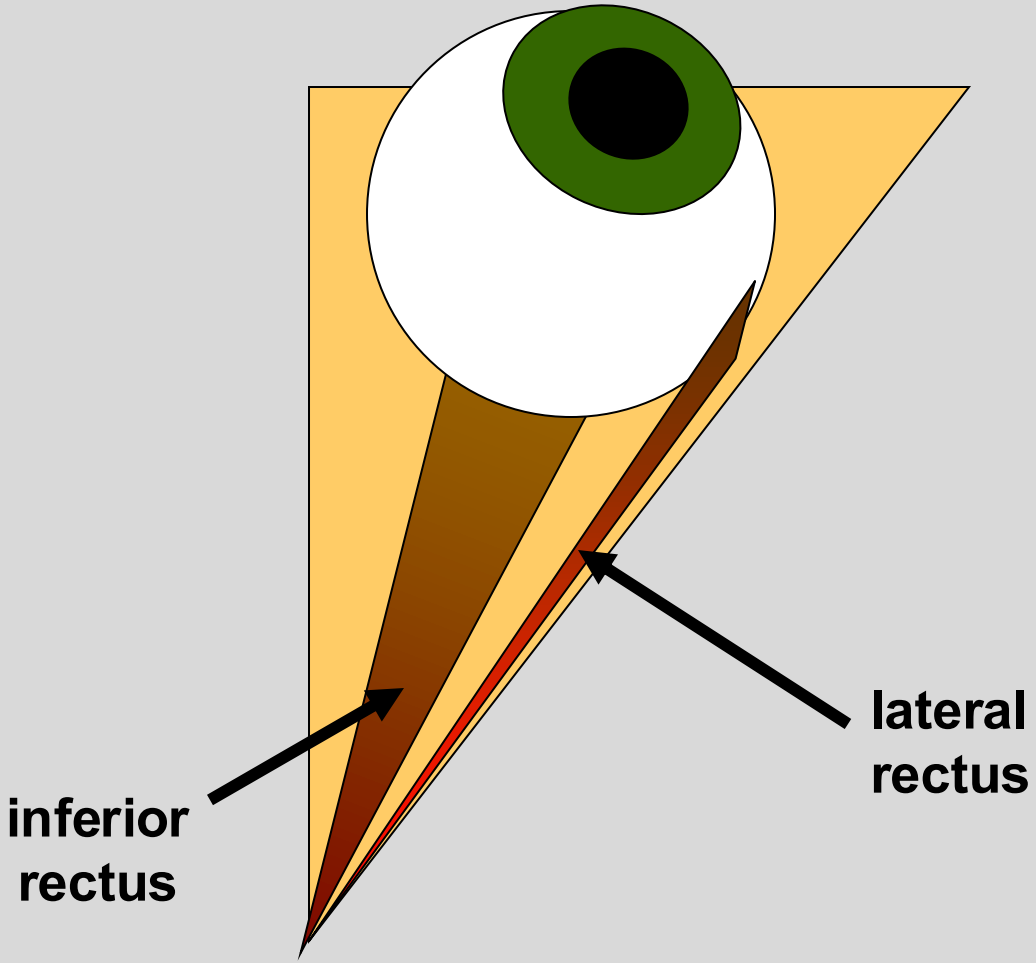
Depression of the Abducted Eye



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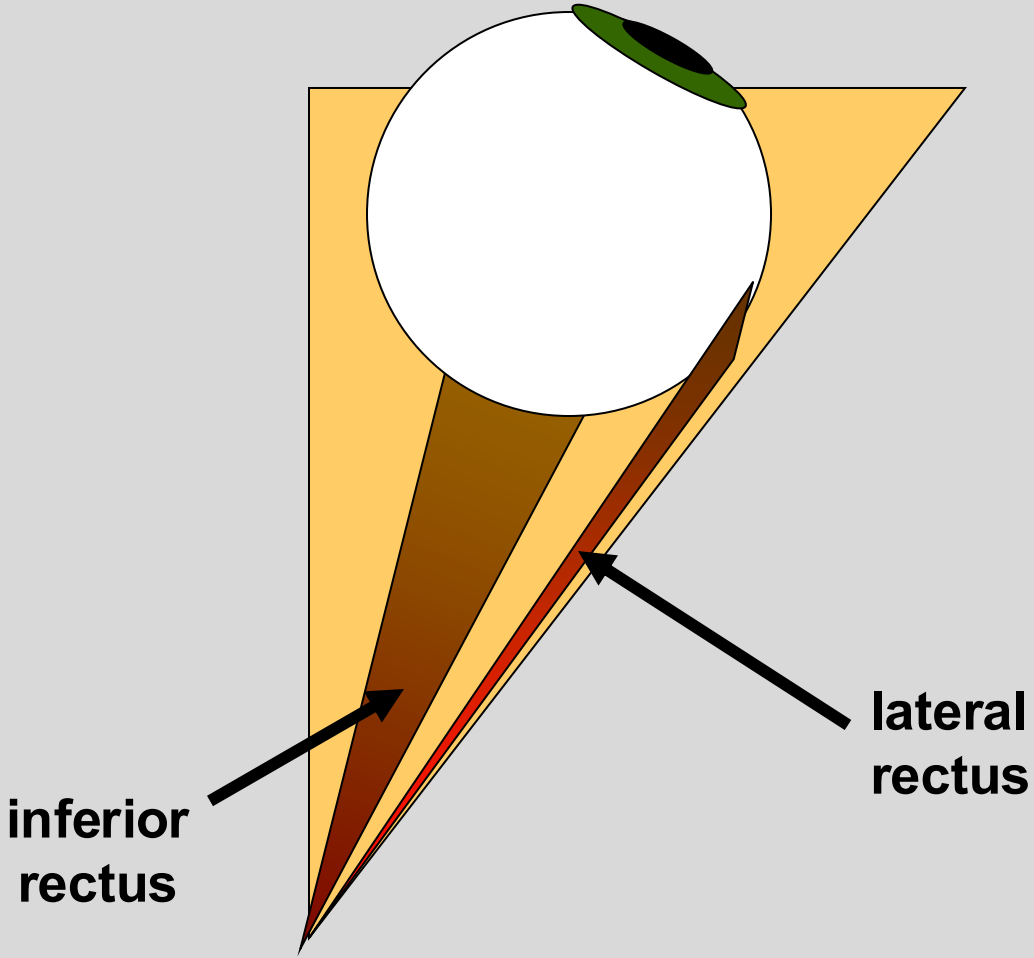
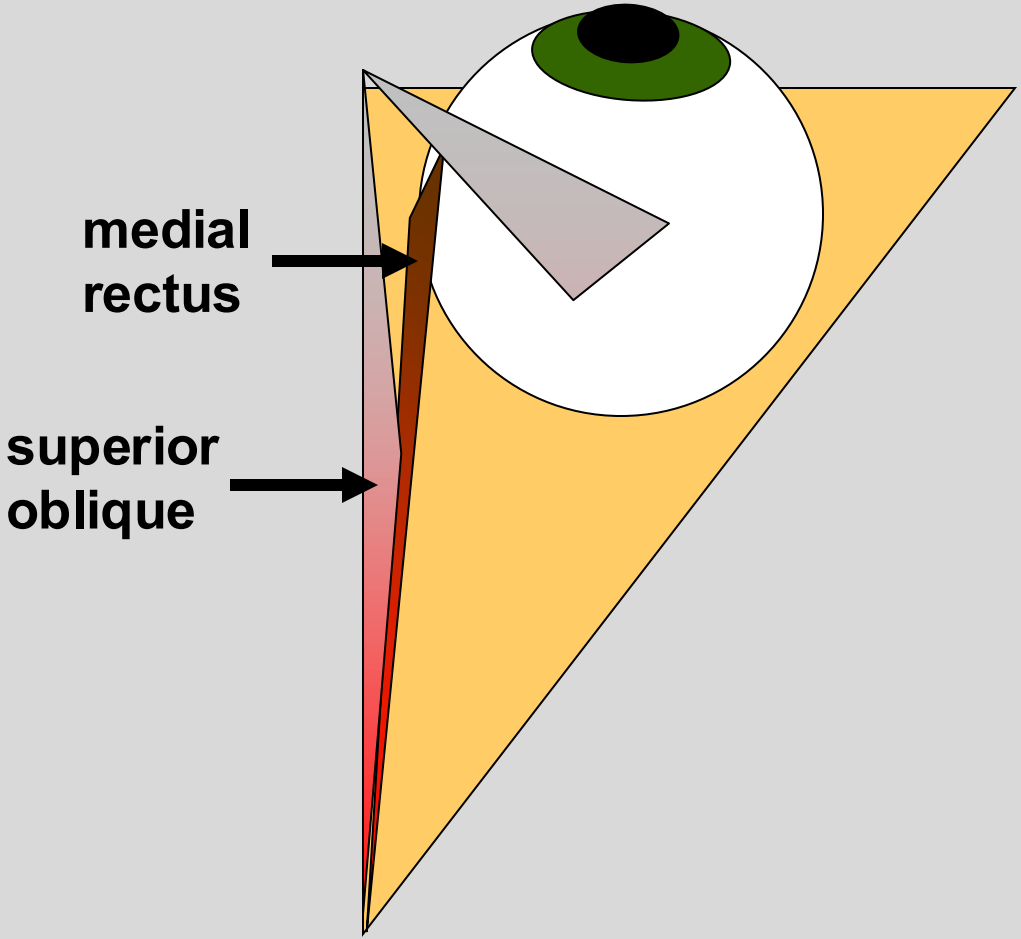
Depression of the Abducted Eye





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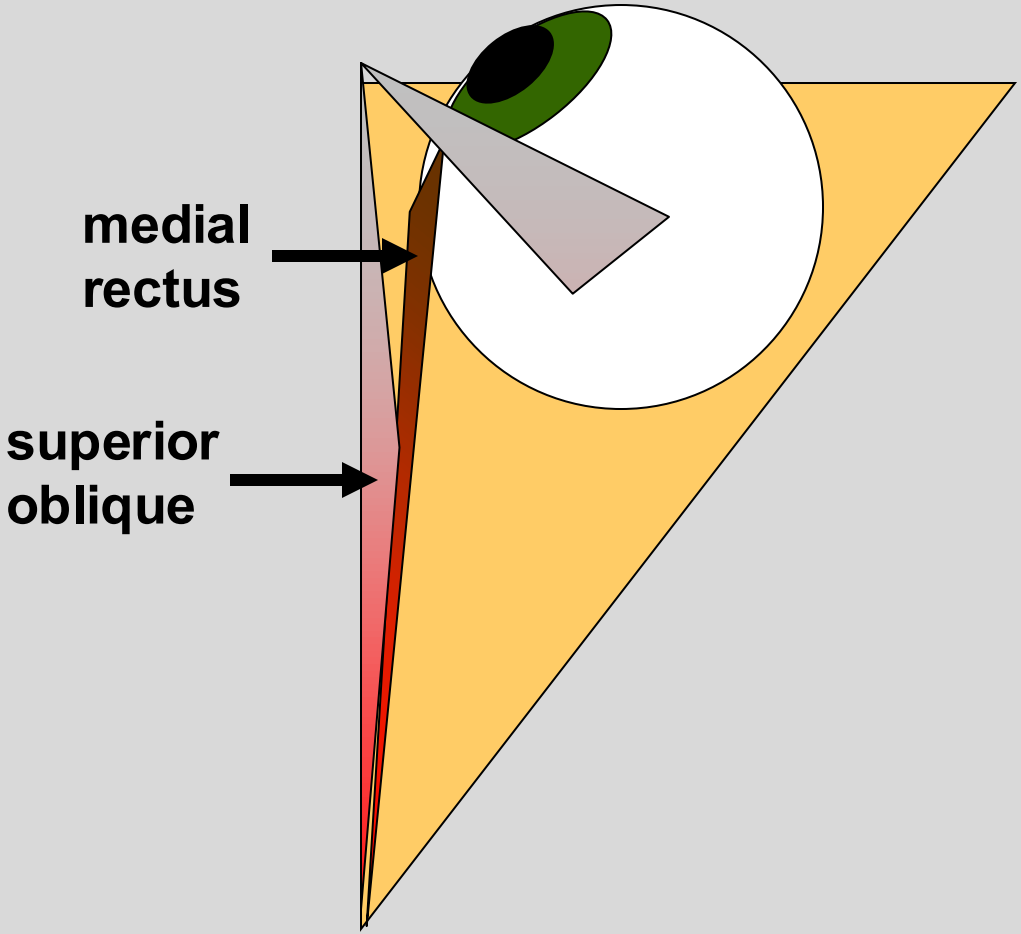
Depression of the Adducted Eye



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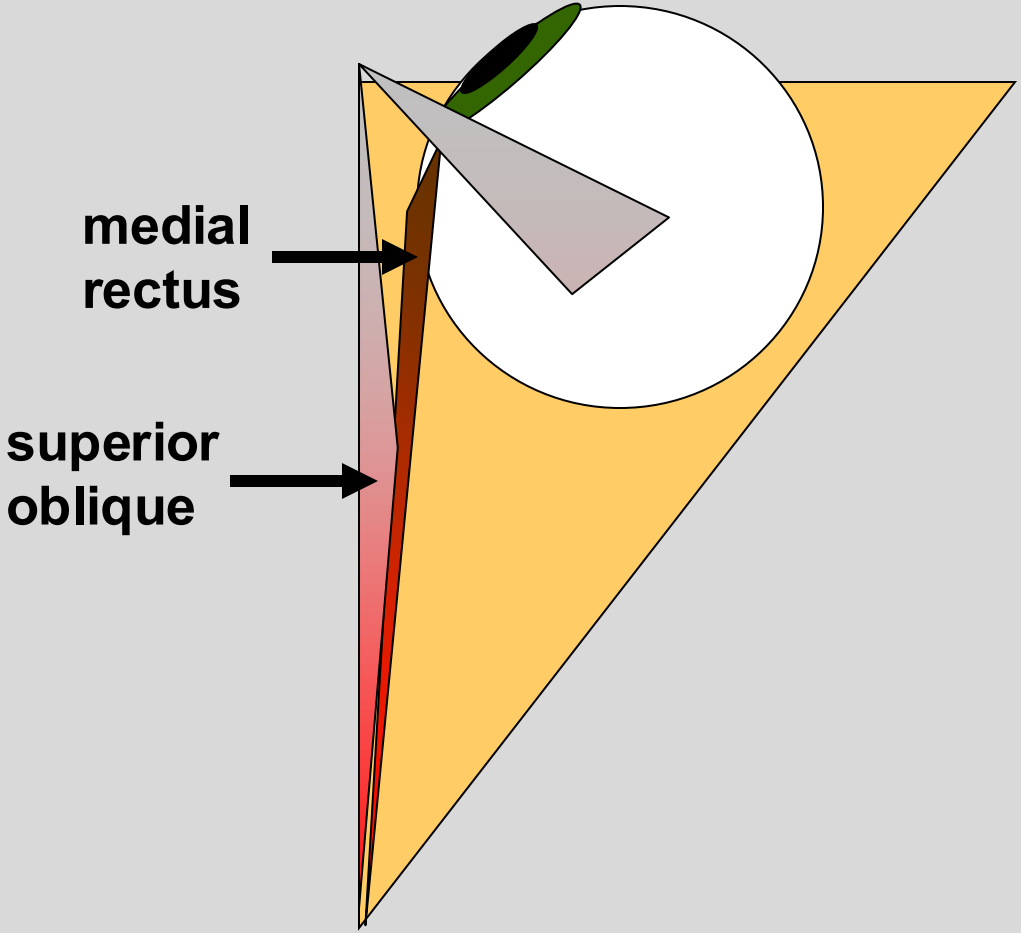
Depression of the Adducted Eye



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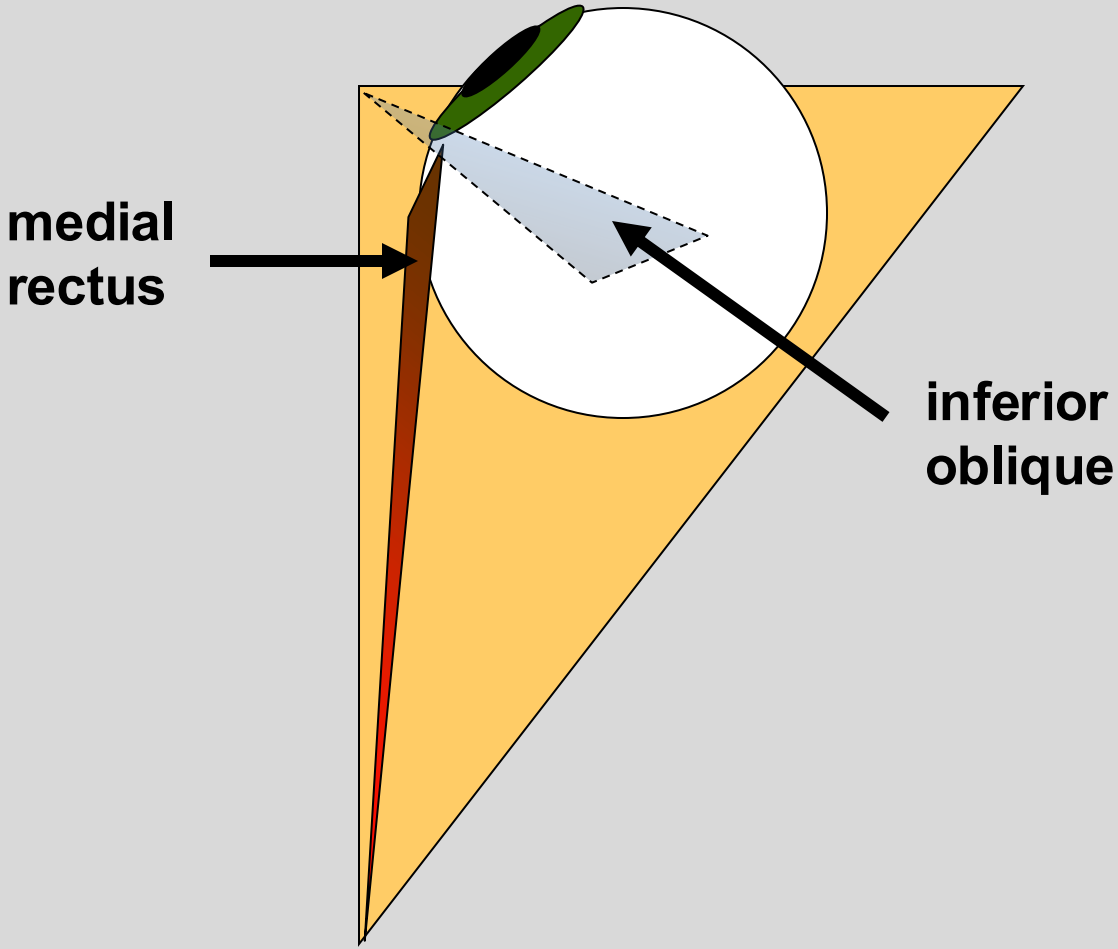
Depression of the Adducted Eye



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Elevation of the Adducted Eye

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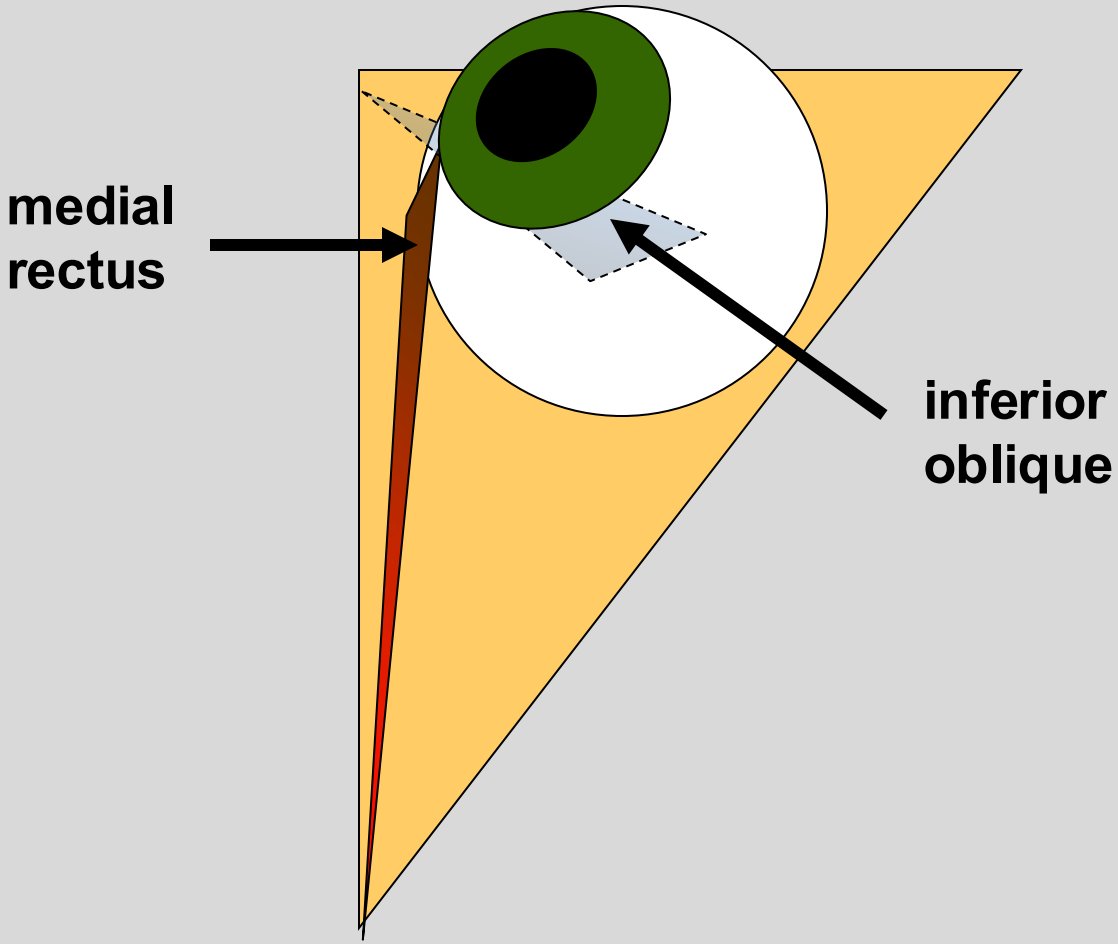

Elevation of the Adducted Eye

To Summarize…

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- Superior rectus is a *strong elevator* of the *already abducted eyeball.*
- Inferior rectus is a *strong depressor* of the *already abducted eyeball.*
- Inferior oblique is a *strong elevator* of the *already adducted eye*
- Superior oblique is a *strong depressor* of the *already adducted eye*

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Part 3: Complex Movements of the Eye

Textbook Actions of Extraocular Muscles

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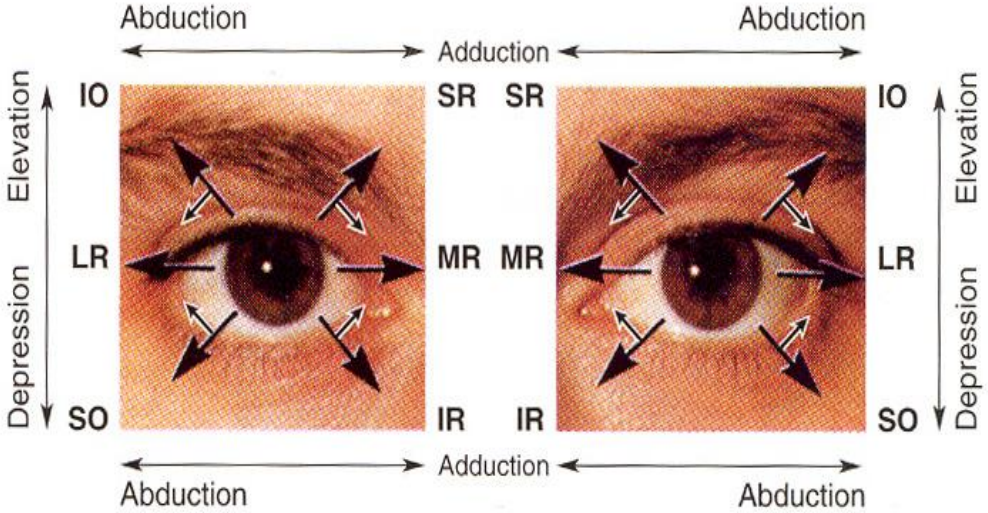
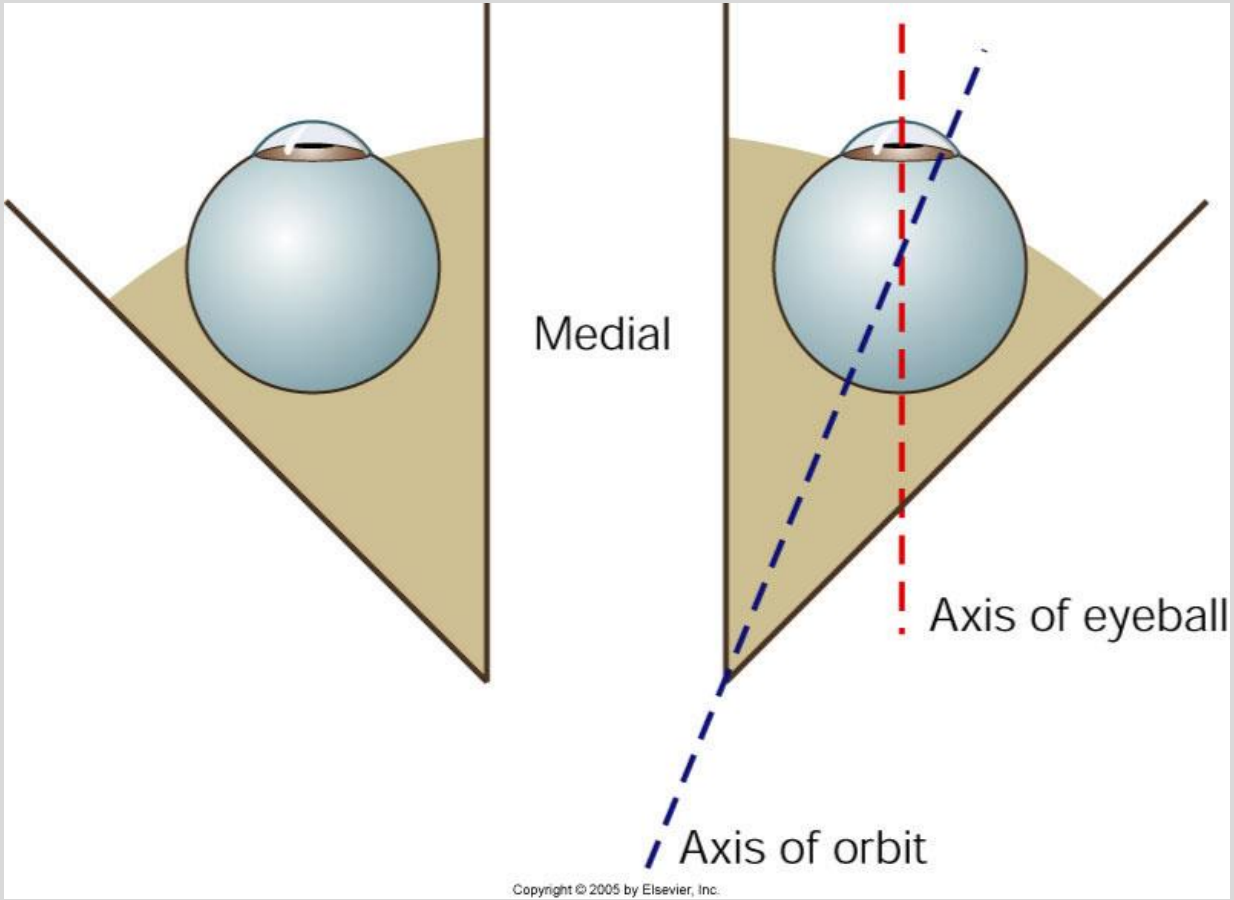
Agur & Dalley 2005

TABLE 8.5. MUSCLES OF ORBIT



- Eye is in PRIMARY POSITION



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Torsion Often Accompanies Actions of Extraocular Muscles

Axes of Rotation of Extraocular Muscles

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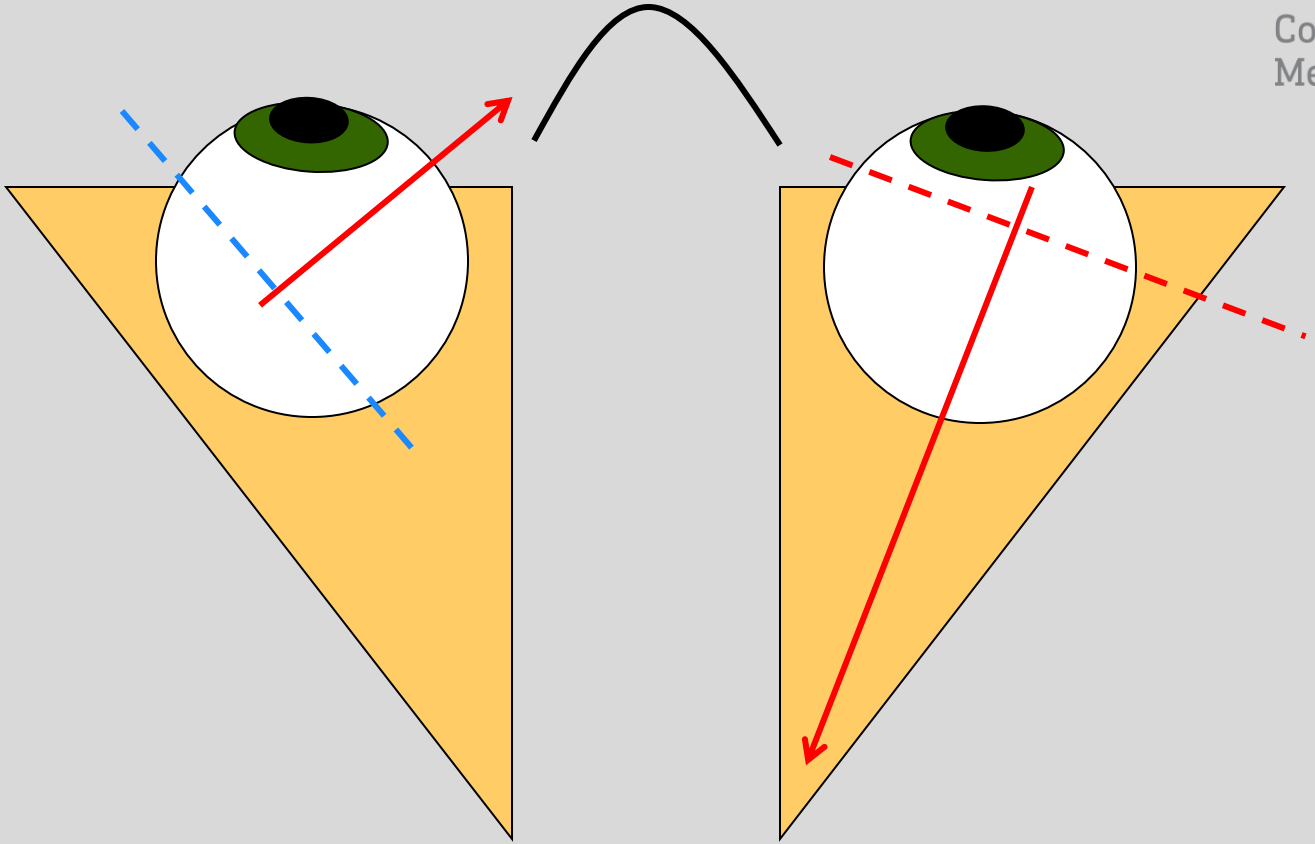

Axes of Rotation of Extraocular Muscles

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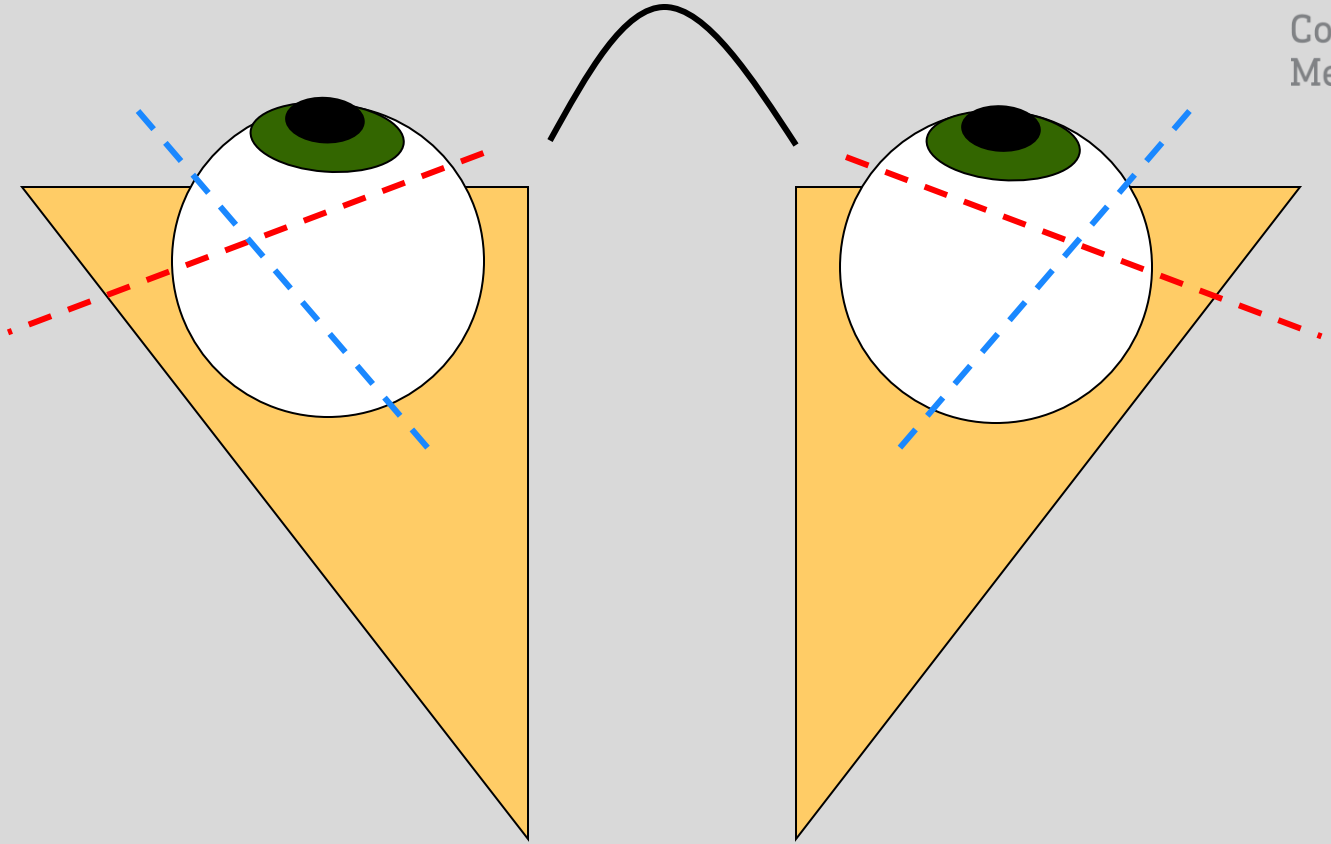

Elevation Without Torsion

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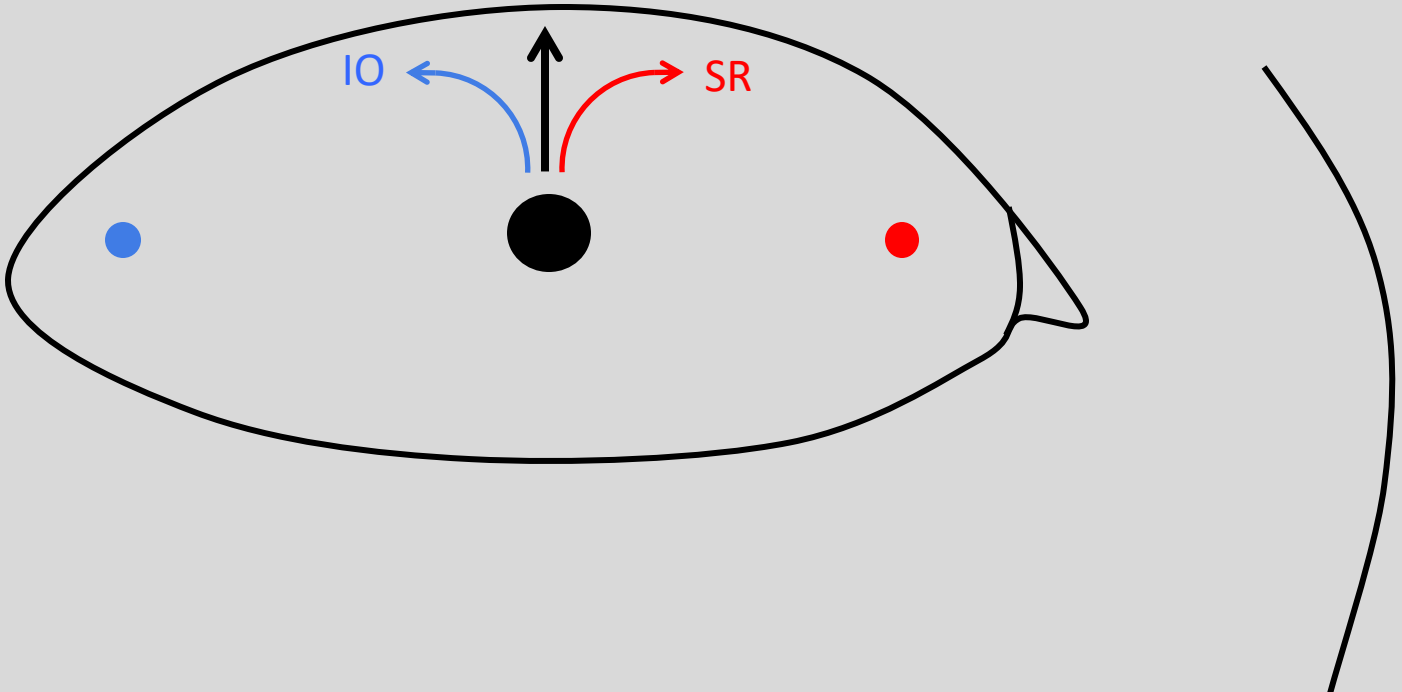

Elevation (right eye)

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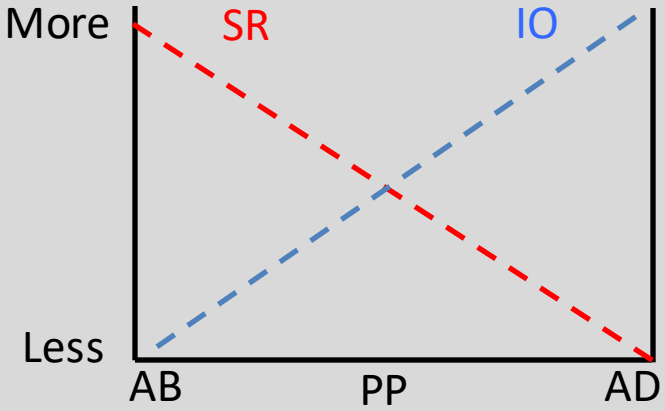

Elevation (left eye)

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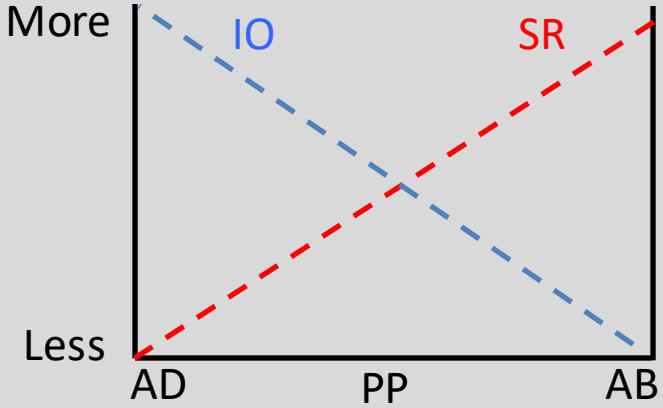

Depression Without Torsion

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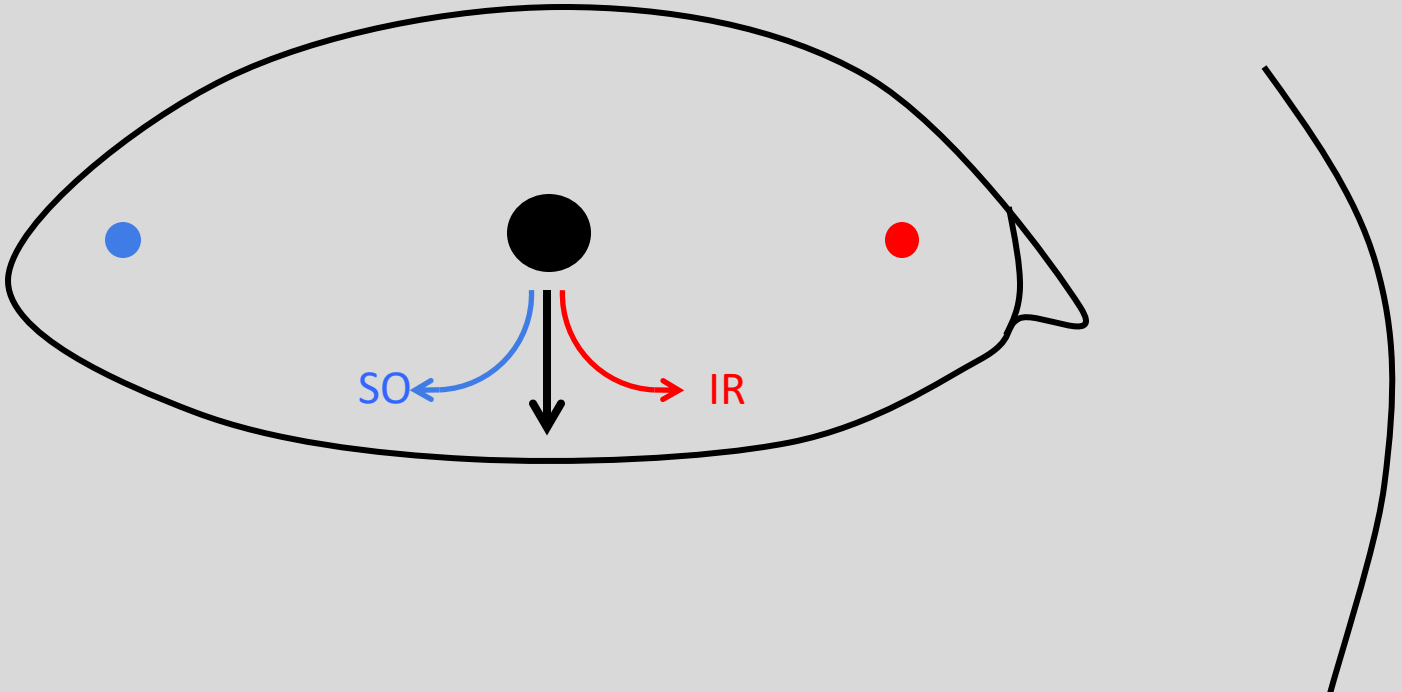

Intorsion Without Elevation or Depression

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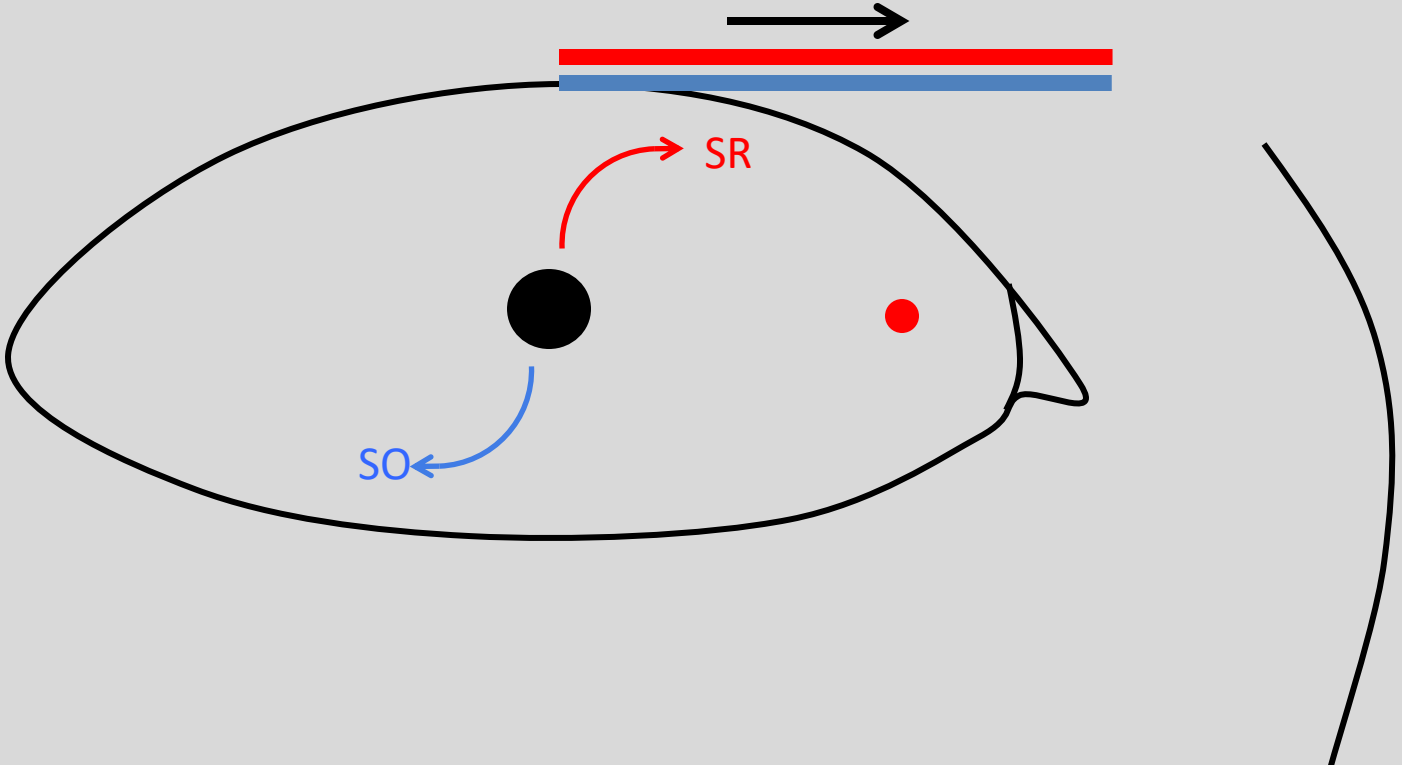

Extorsion Without Elevation or Depression

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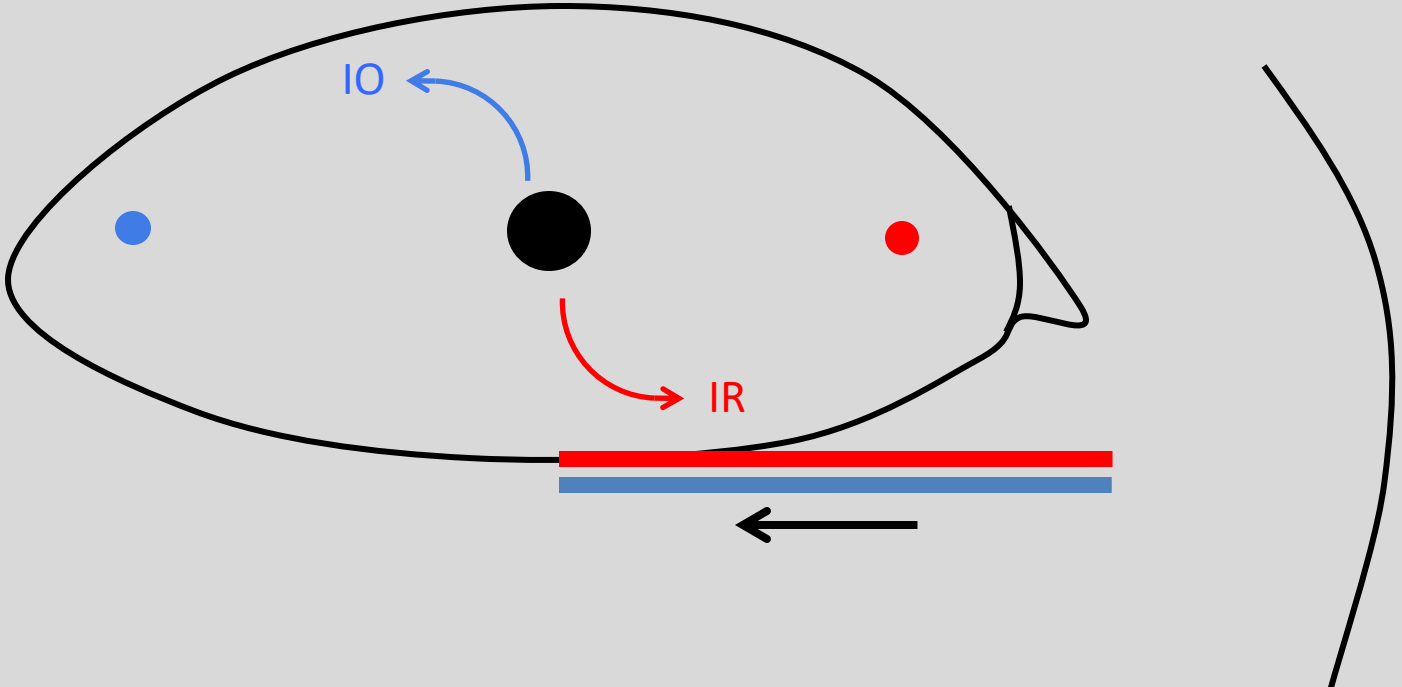

Extorsion Without Elevation or Depression

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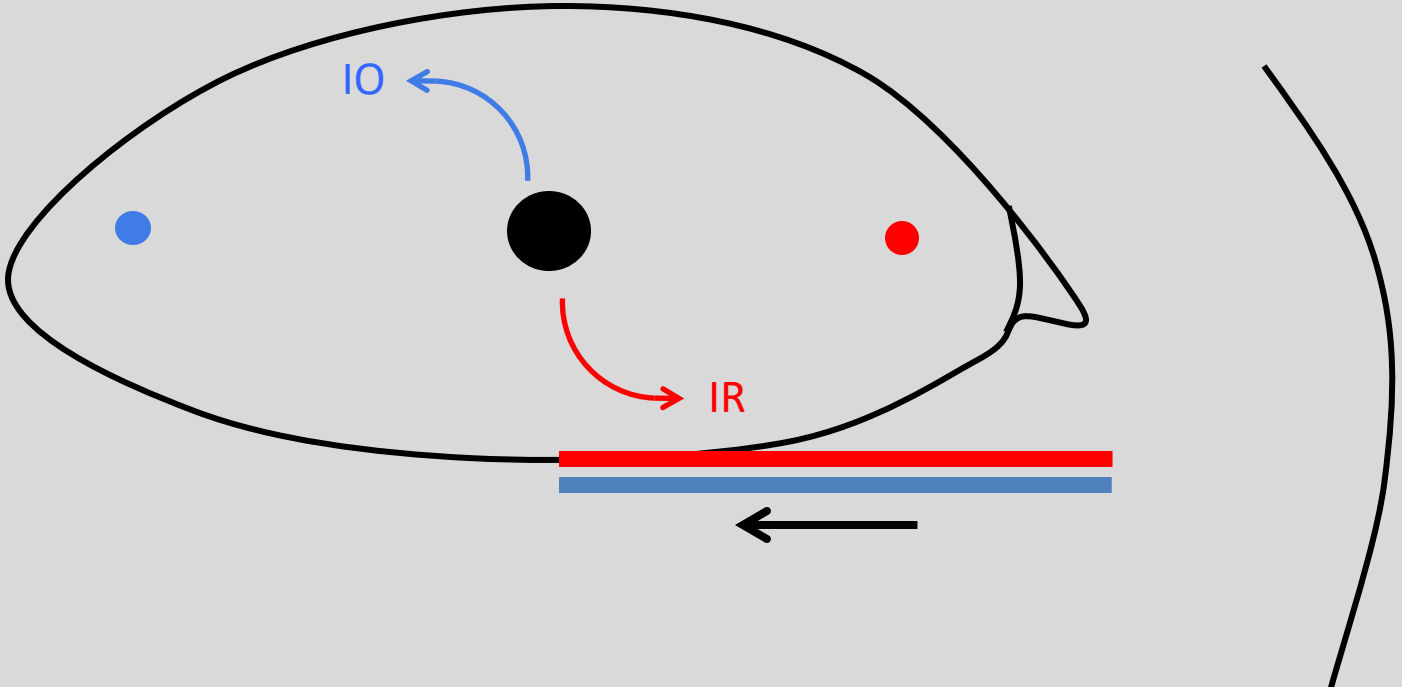

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Part 4: Nerve lesions affecting extraocular muscles

Testing Extraocular Muscles and the Nerves that Innervate Them

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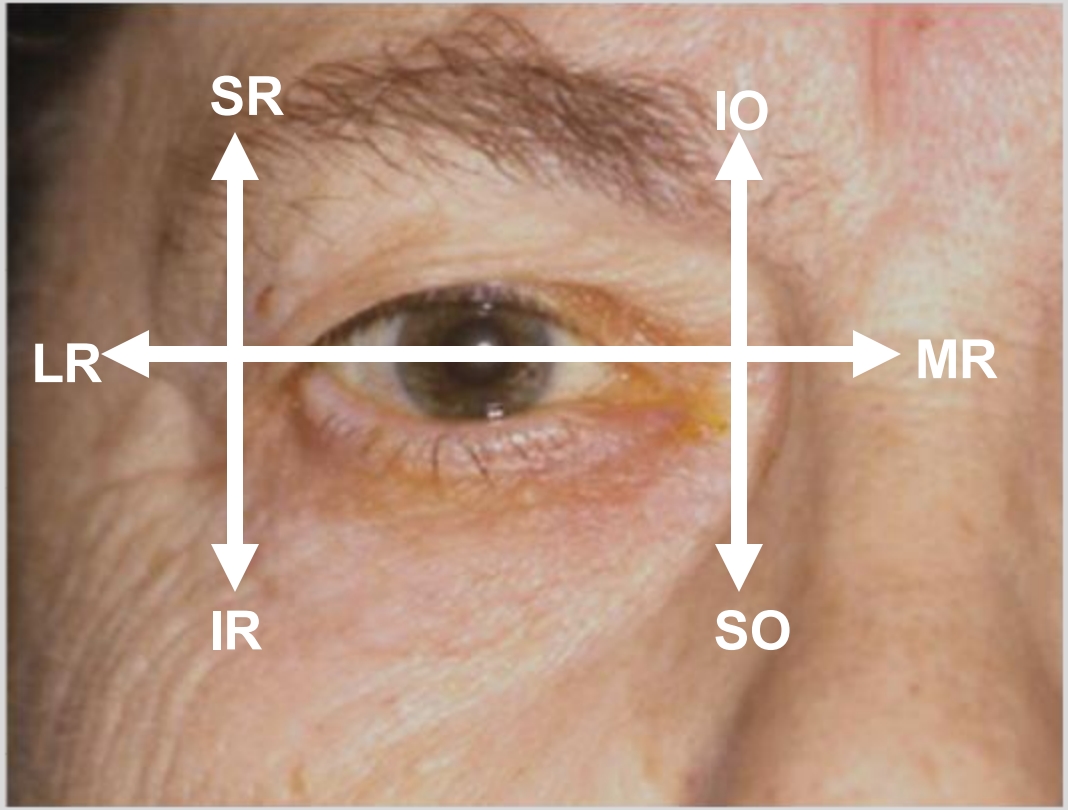

- “H” shaped pattern is used to test the extraocular muscles
- “Forcing” function = action

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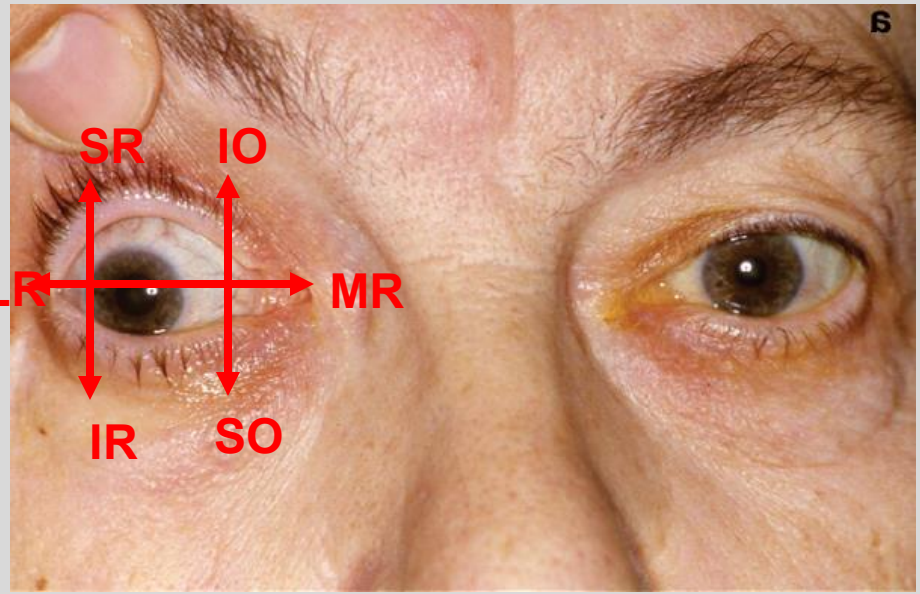
Patient presents with....

"Down and out"



Patient presents with....

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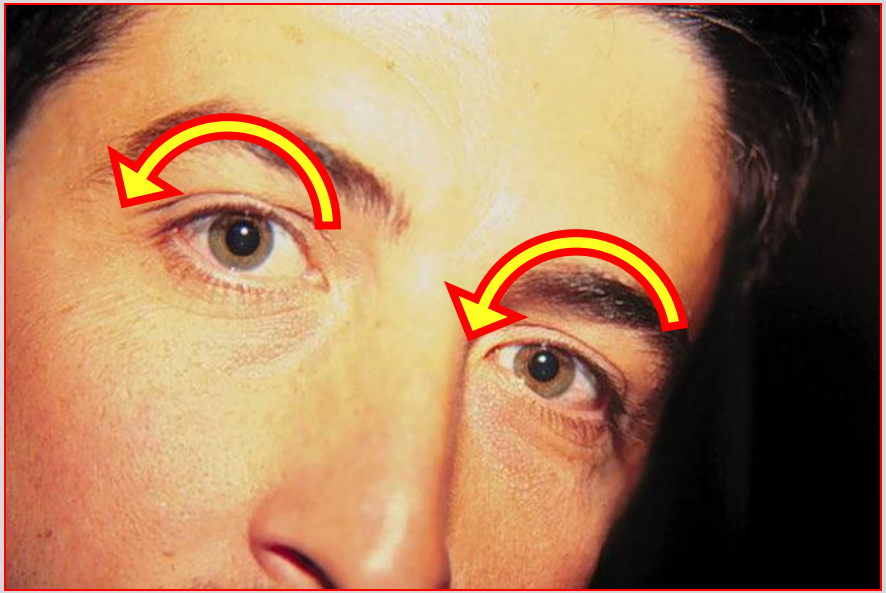
Bielschowsky's sign



From www.eyeatlas.com

Summary Slide

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- Contents of the orbit are not compressible. Thus pressure requires defects in its base or walls.
- Action and Function often mean very different things for extraocular muscles.
- Torsion occurs when the optic axis is at an angle to axis of the orbit.
- Torsion is helpful when tilting the head.
- Action and Function are usually described relative to primary position. Obviously the eye can be looking elsewhere.
- Extraocular muscle function is tested by having the patient NOT in primary position.

Lecture Feedback Form:

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https://comresearchdata.nyit.edu/redcap/surveys/?s=HRCY448FWYXREL4R