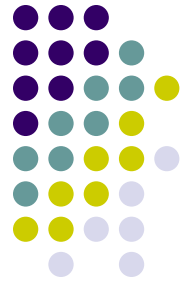


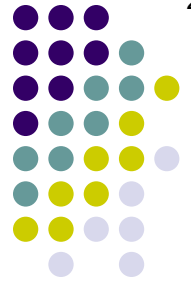
Vertical Deviations



Vertical Deviations

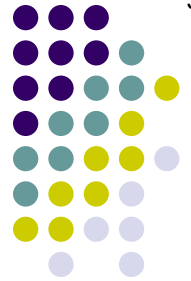
With regard to strabismus: What does the word comitant mean?

Vertical Deviations



Vertical Deviations

With regard to strabismus: What does the word comitant mean?
It means an ocular misalignment is the same in all fields of gaze

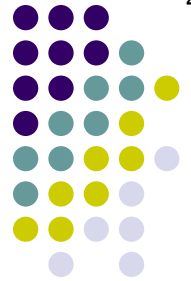


Vertical Deviations

Vertical Deviations

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Do vertical deviations tend to be comitant, or incomitant?



Vertical Deviations

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Vertical Deviations

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What is spread of comitance?



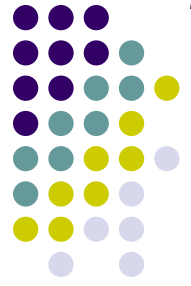
Vertical Deviations

Vertical Deviations

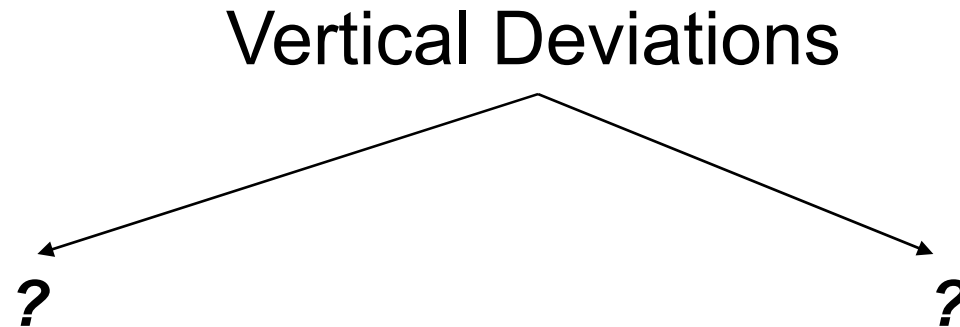
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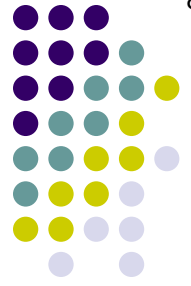
What is spread of comitance?
The neuroadaptive process in which an initially incomitant deviation gradually becomes comitant



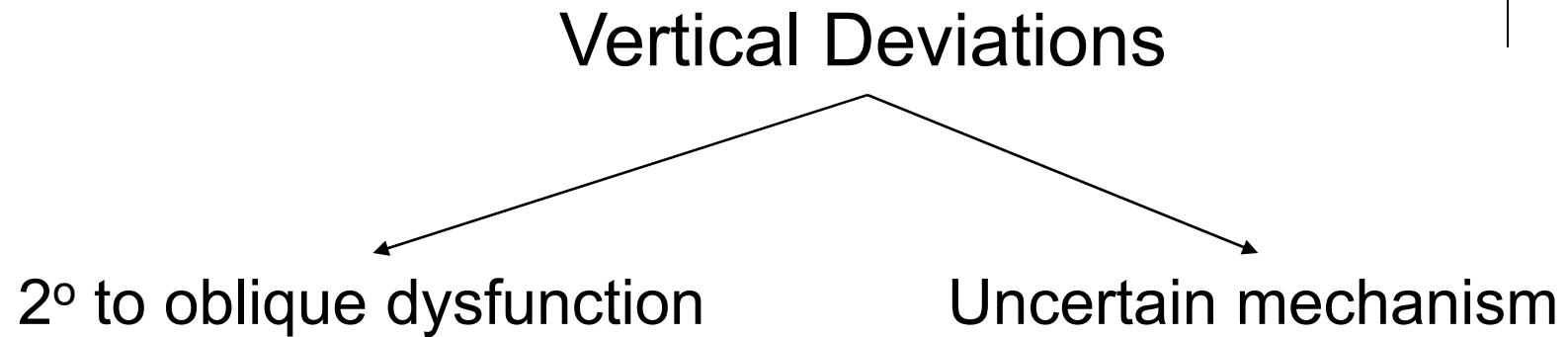
Vertical Deviations



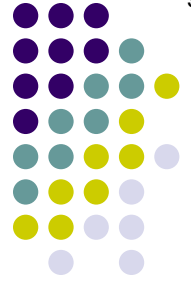
The Peds book divvies the vertical deviations into two broad categories—what are they?



Vertical Deviations



The Peds book divvies the vertical deviations into two broad categories—what are they?



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction?

Uncertain mechanism?

Which is the more common cause of vertical deviations?



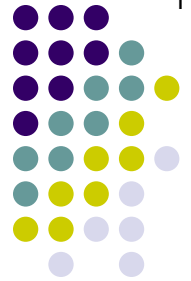
Vertical Deviations

Vertical Deviations

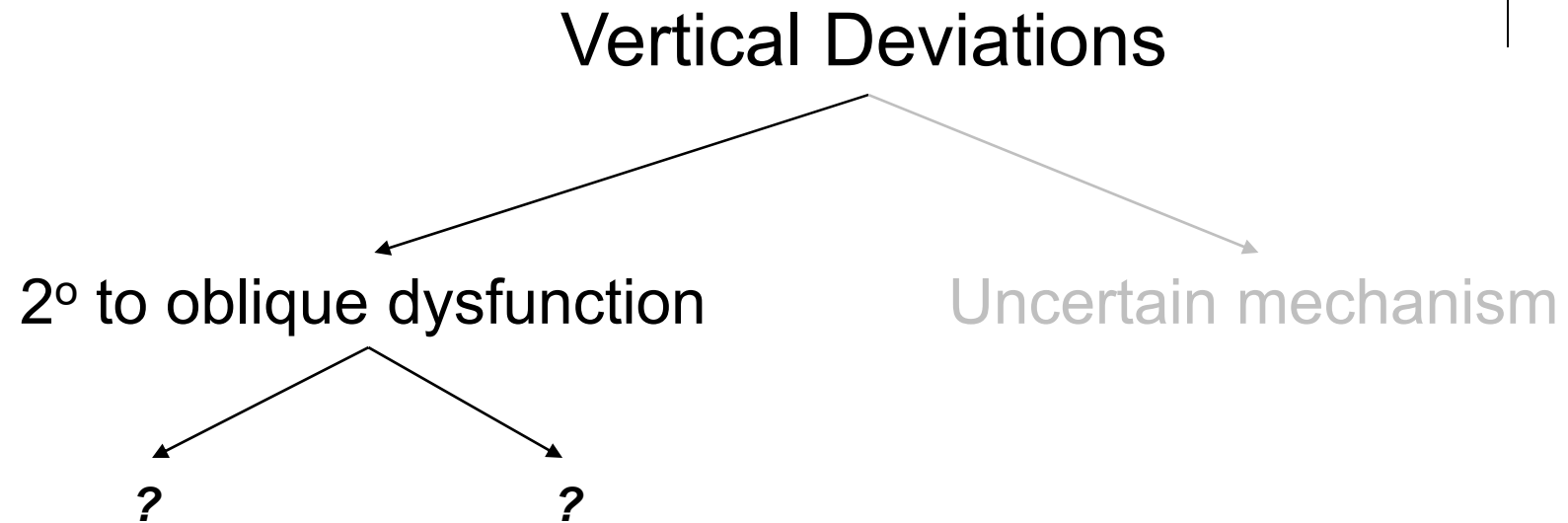
2° to oblique dysfunction

Uncertain mechanism

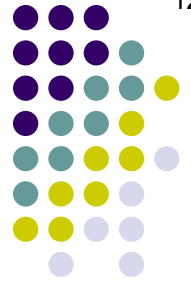
Which is the more common cause of vertical deviations?
Oblique dysfunction



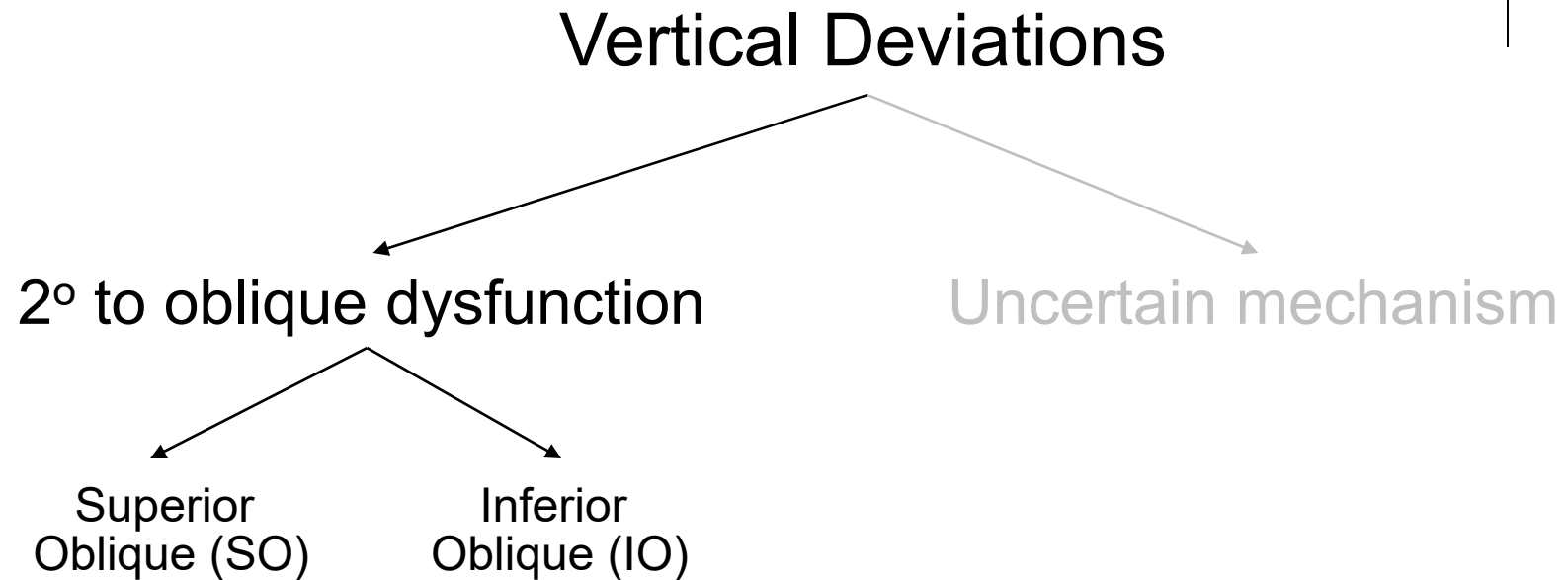
Vertical Deviations



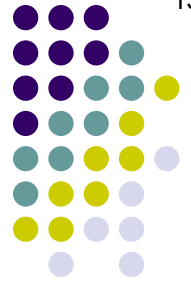
What are the two oblique muscles?



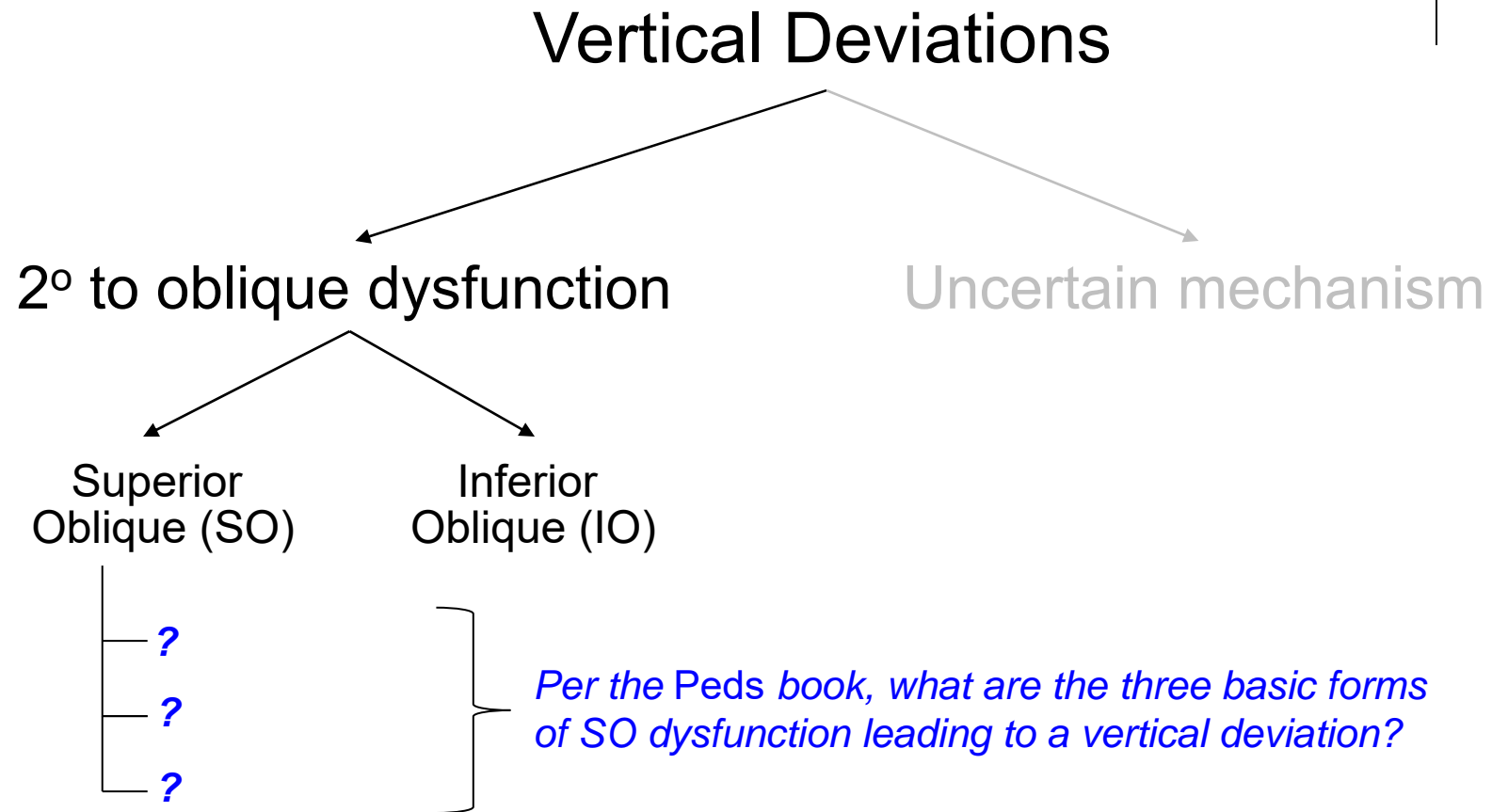
Vertical Deviations

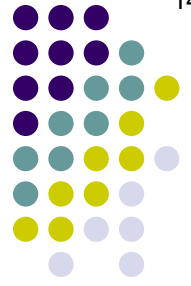


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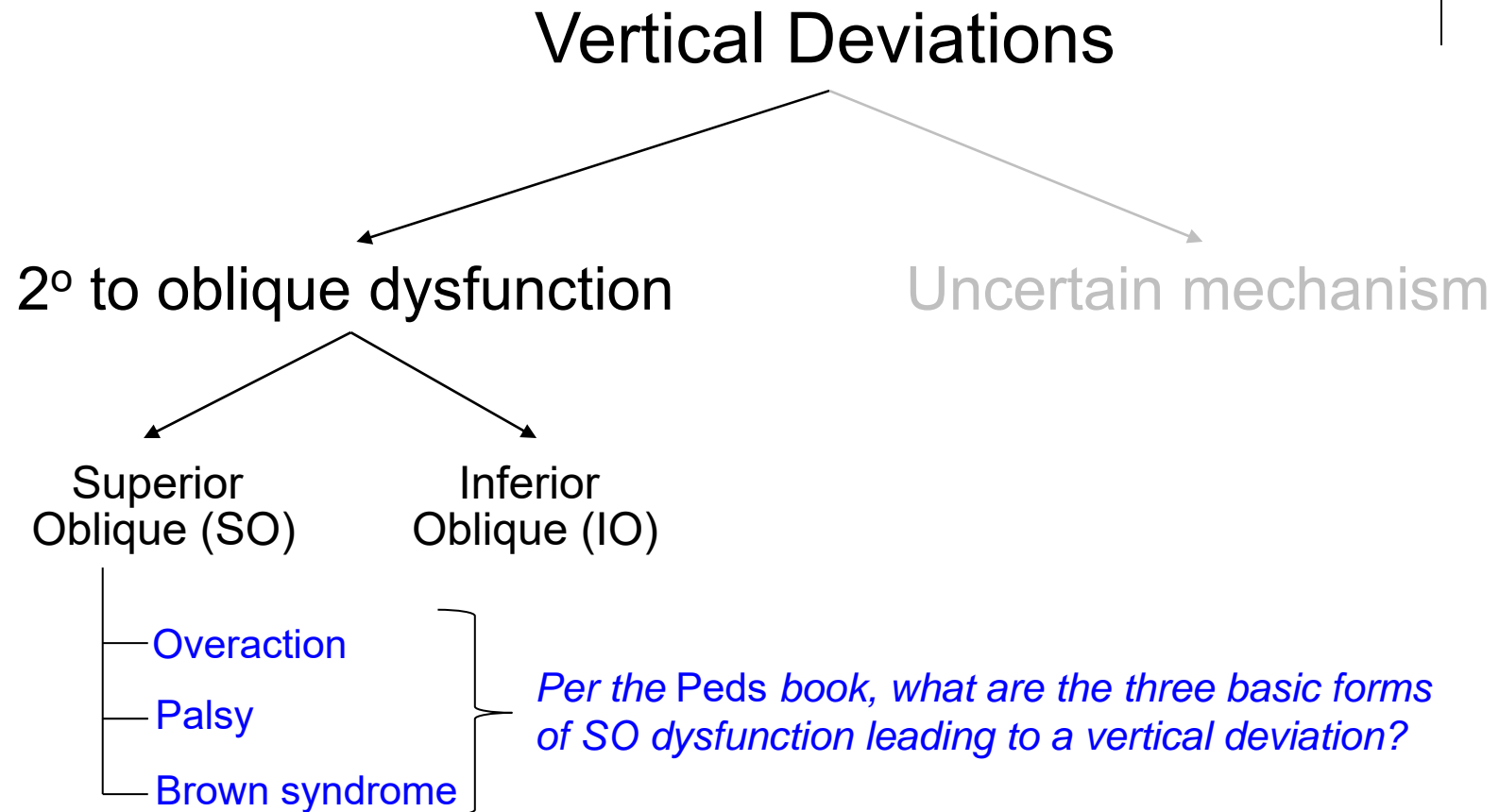


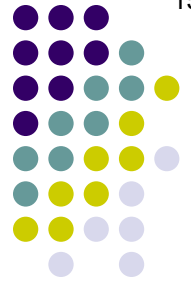
Vertical Deviations



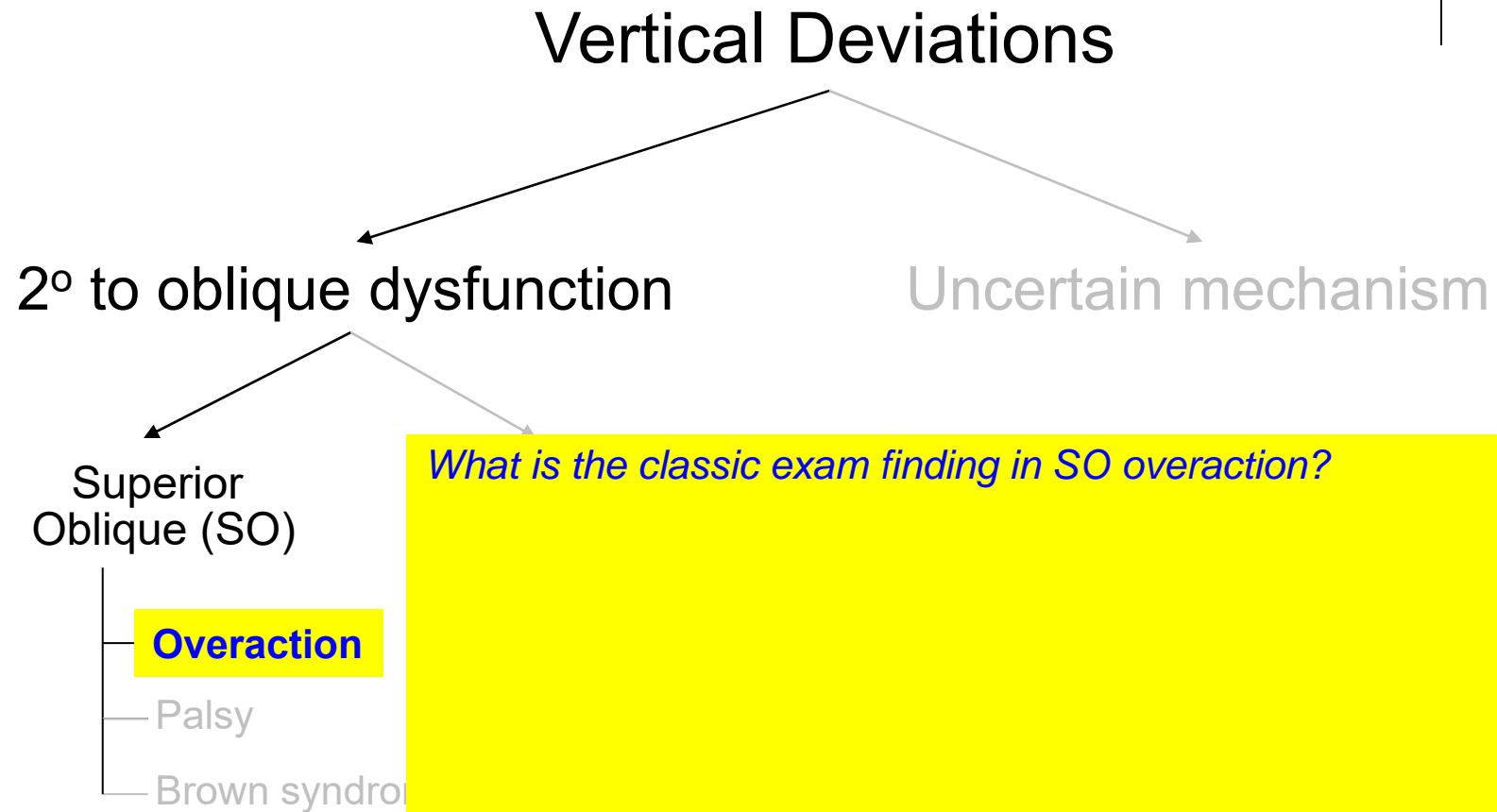


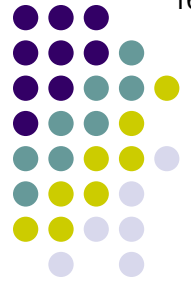
Vertical Deviations



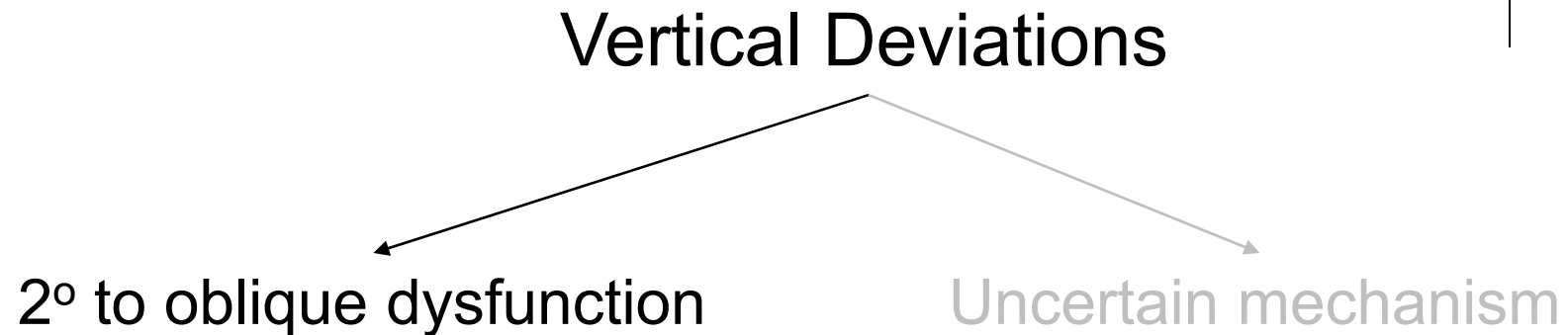


Vertical Deviations





Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

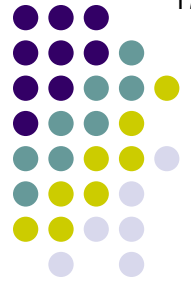
Brown syndrome

What is the classic exam finding in SO overaction?

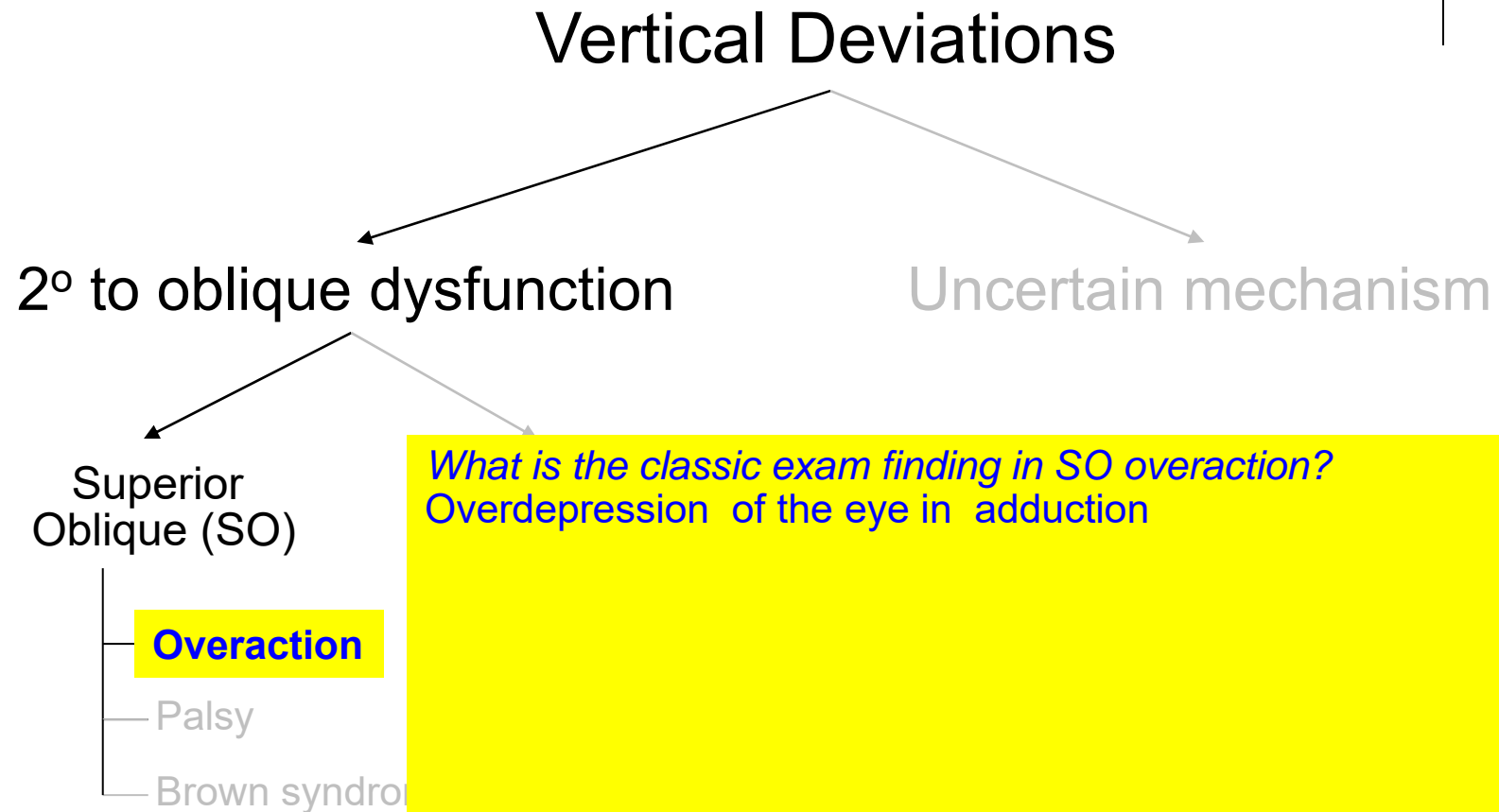
overelevation vs
overdepression

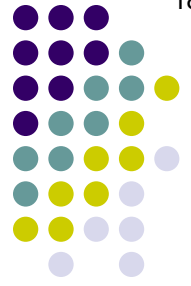
of the eye in

ABduction vs ADduction

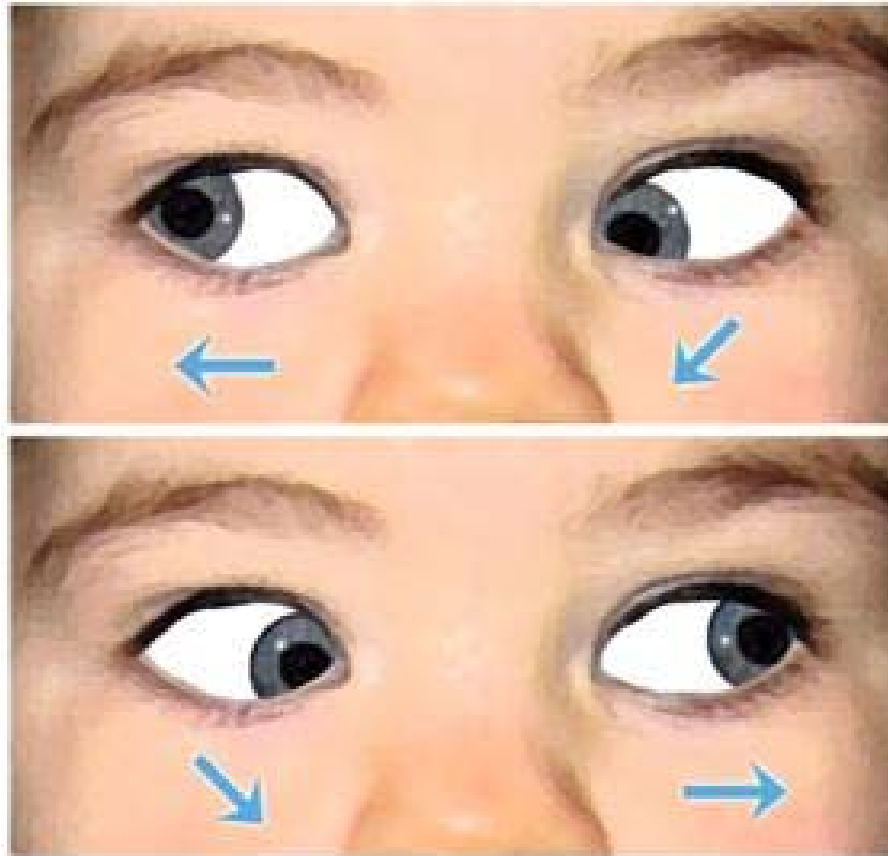


Vertical Deviations

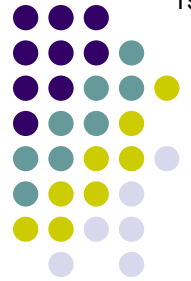




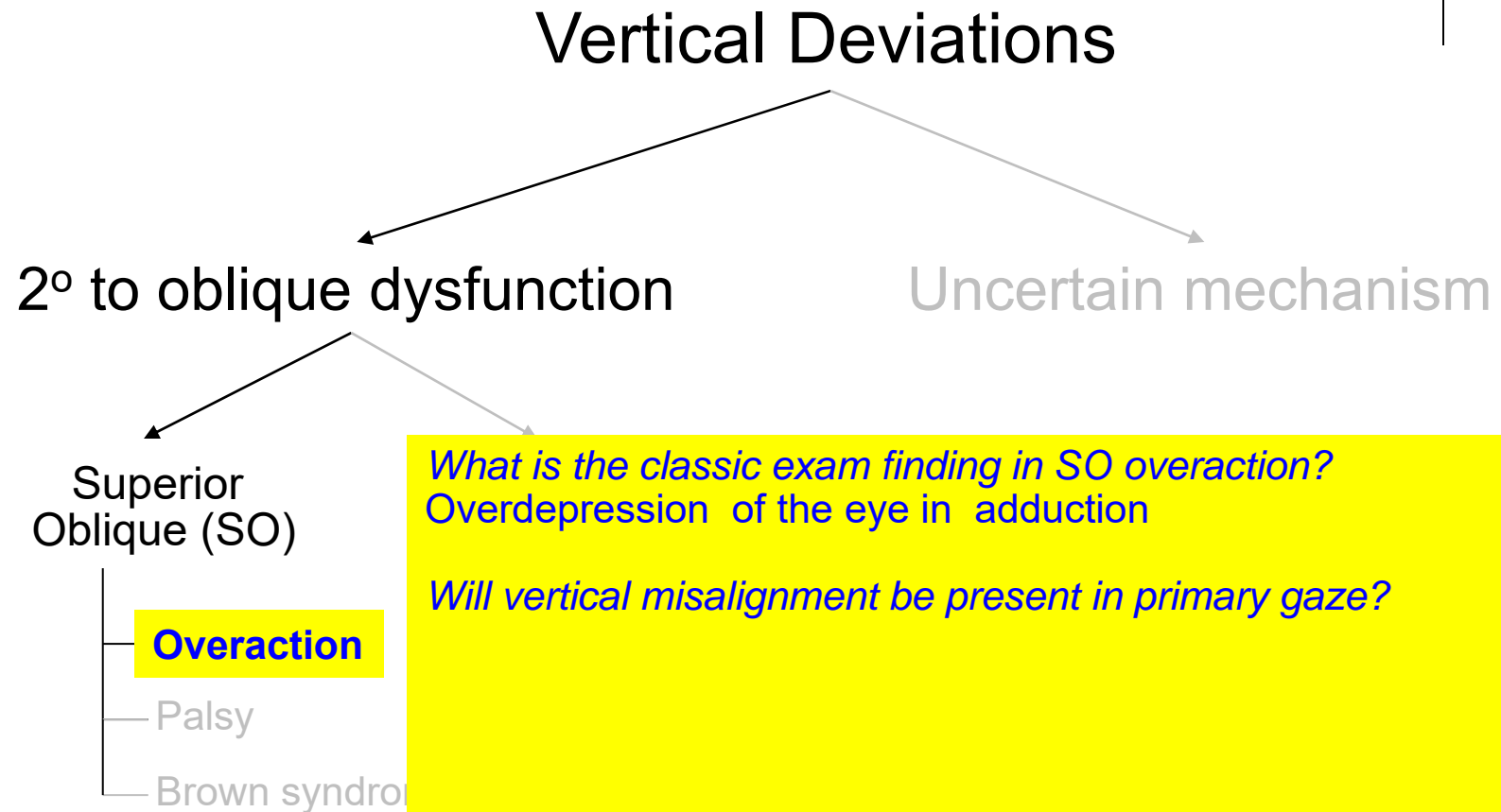
Vertical Deviations

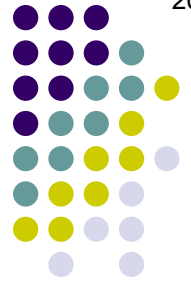


Bilateral superior oblique overaction

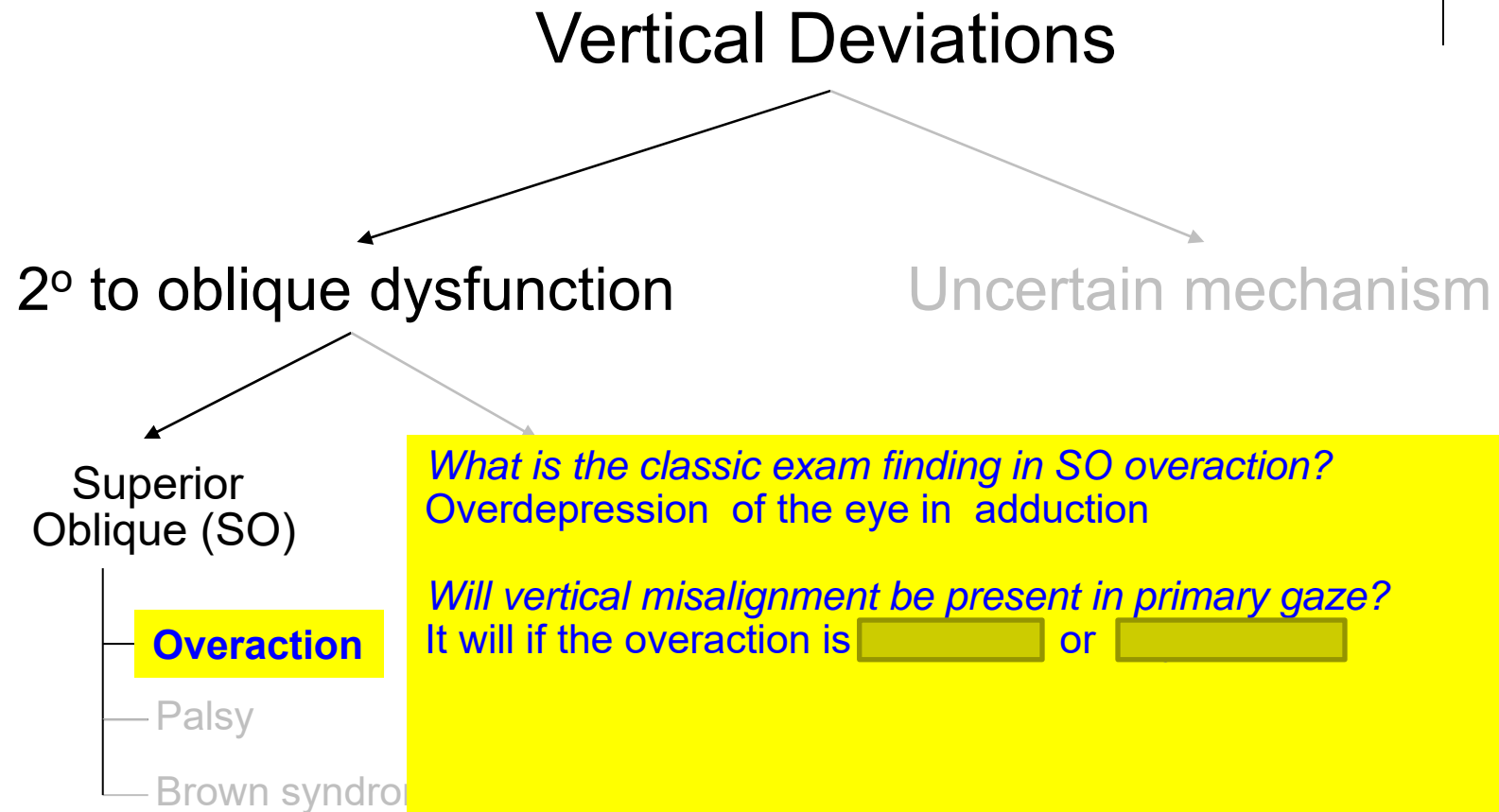


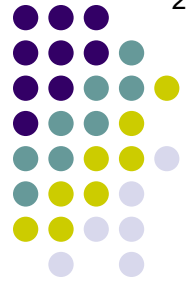
Vertical Deviations



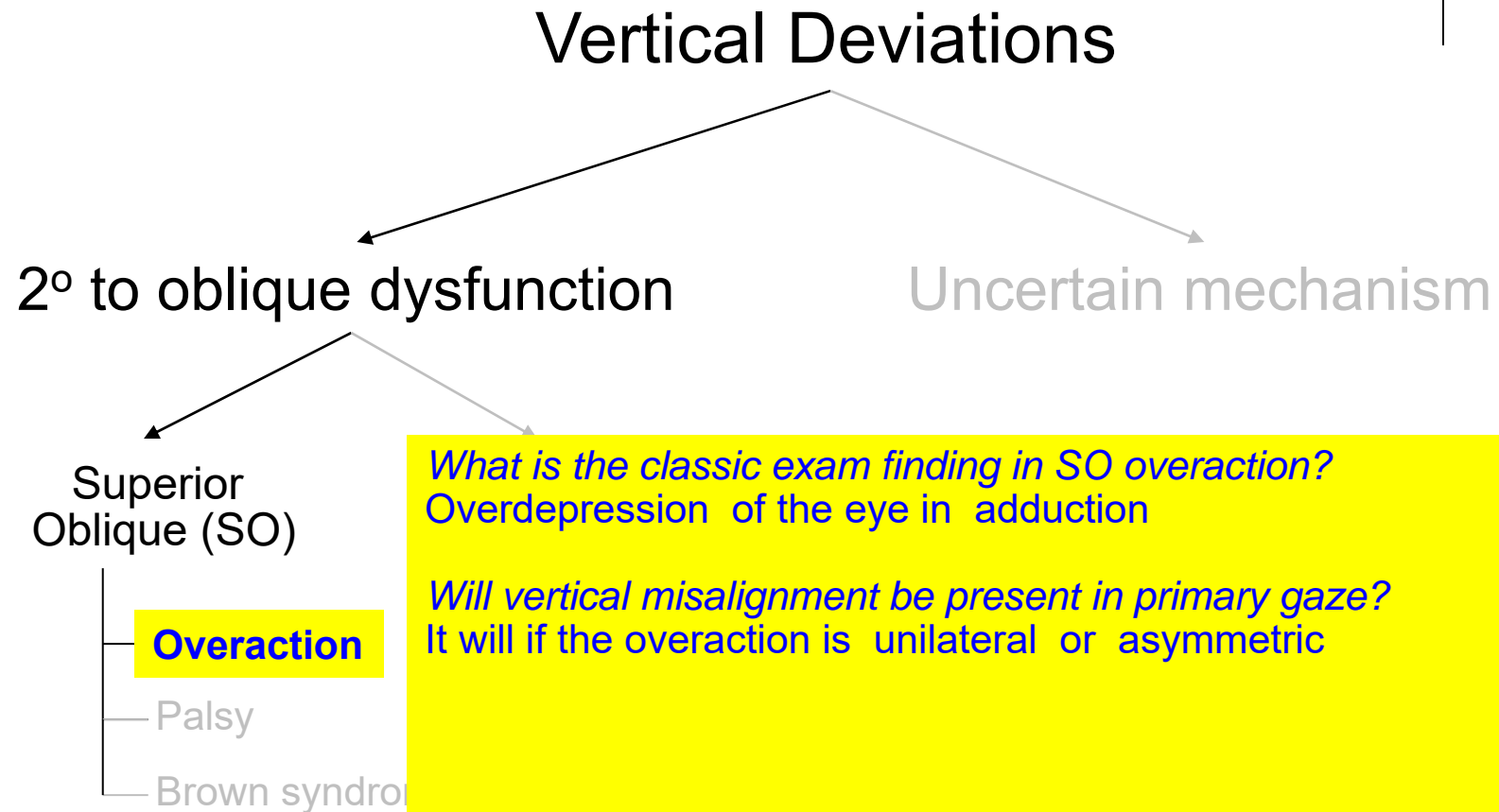


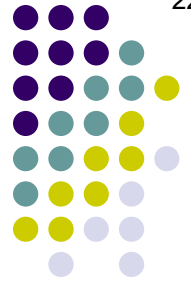
Vertical Deviations



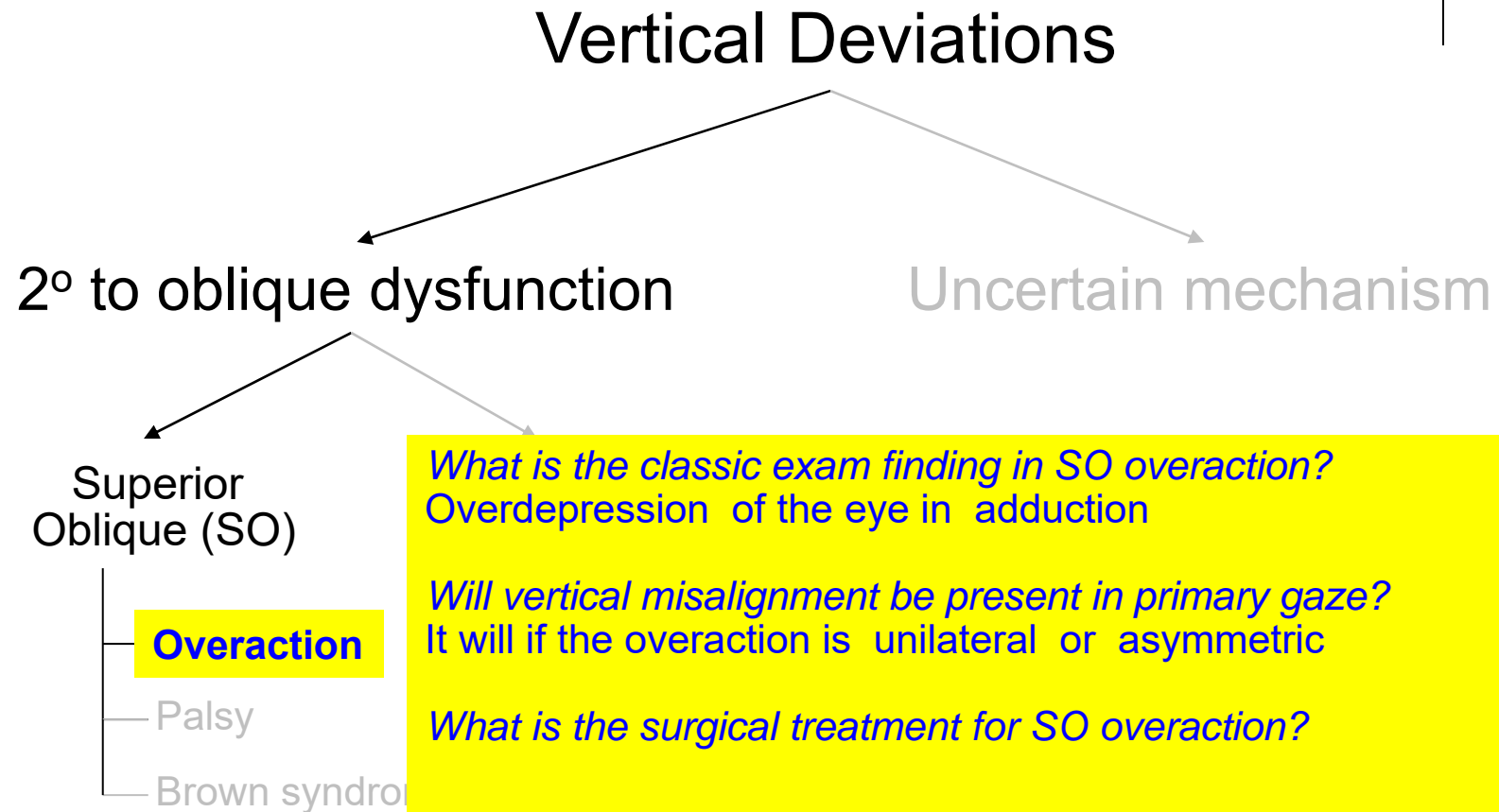


Vertical Deviations





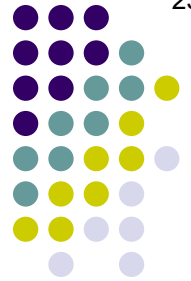
Vertical Deviations



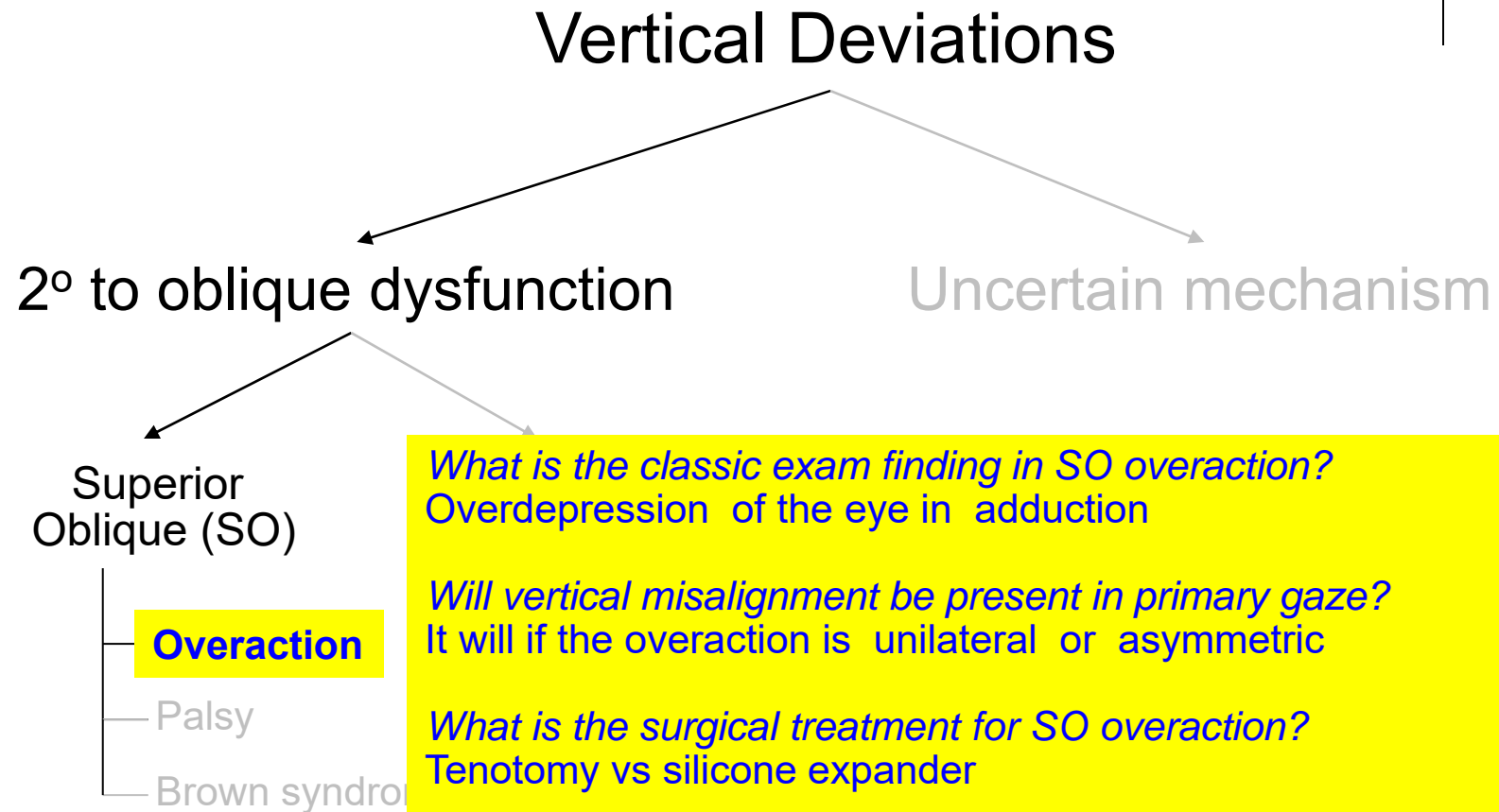
What is the classic exam finding in SO overaction?
Overdepression of the eye in adduction

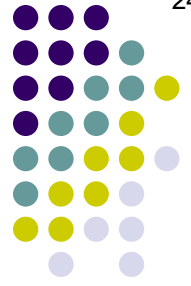
Will vertical misalignment be present in primary gaze?
It will if the overaction is unilateral or asymmetric

What is the surgical treatment for SO overaction?

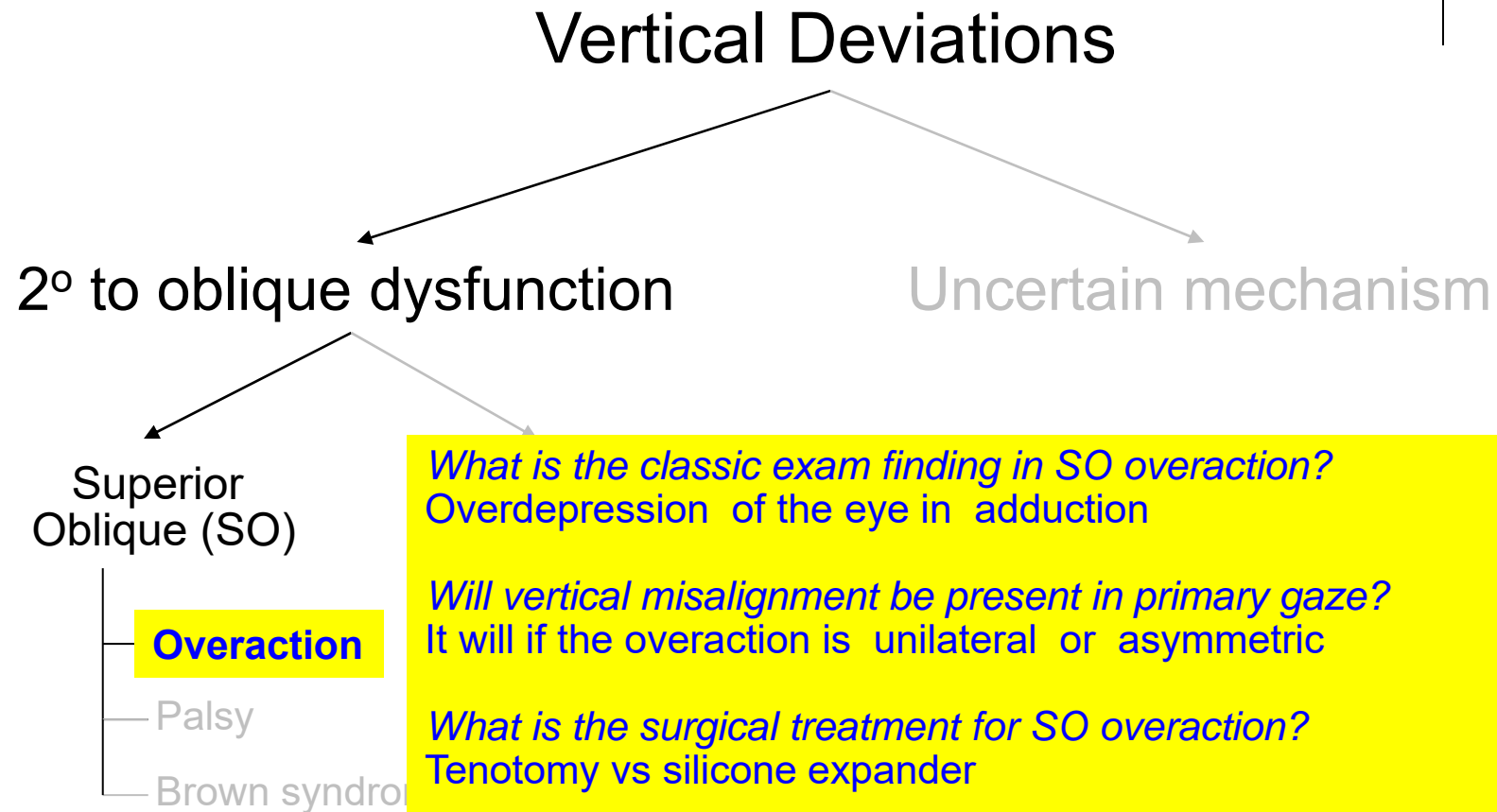


Vertical Deviations





Vertical Deviations



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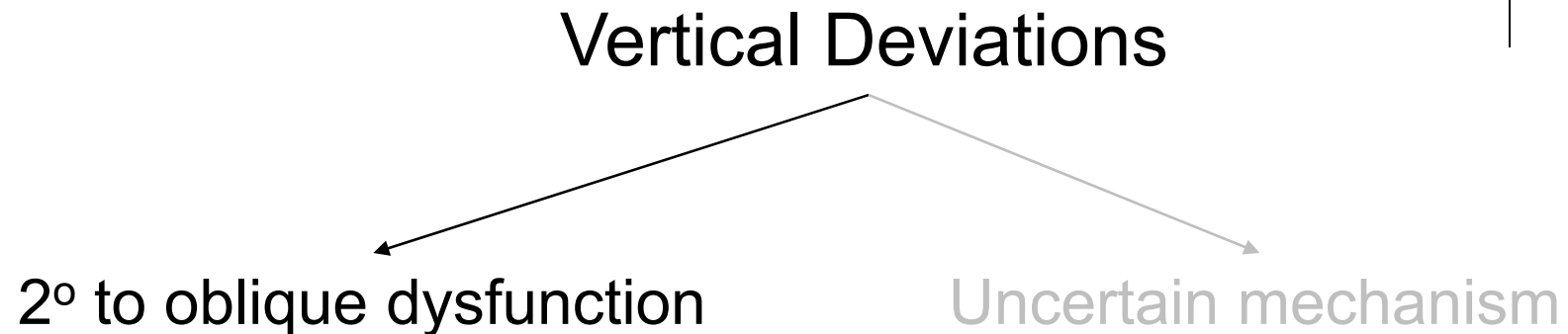
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What is the surgical treatment for SO overaction?
Tenotomy vs silicone expander

Why are surgeons reluctant to operate on a patient with bifixation?



Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

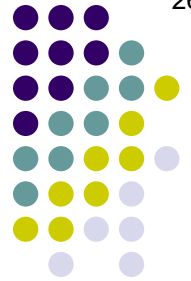
Brown syndrome

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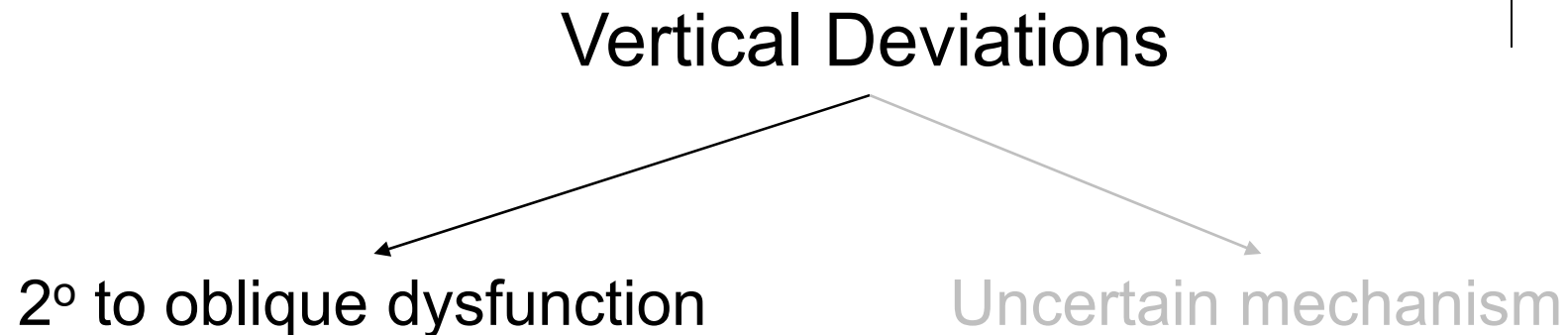
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Surgery could result in 'direction' diplopia



Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

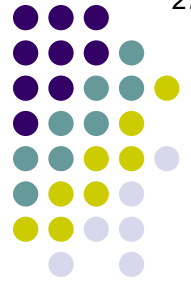
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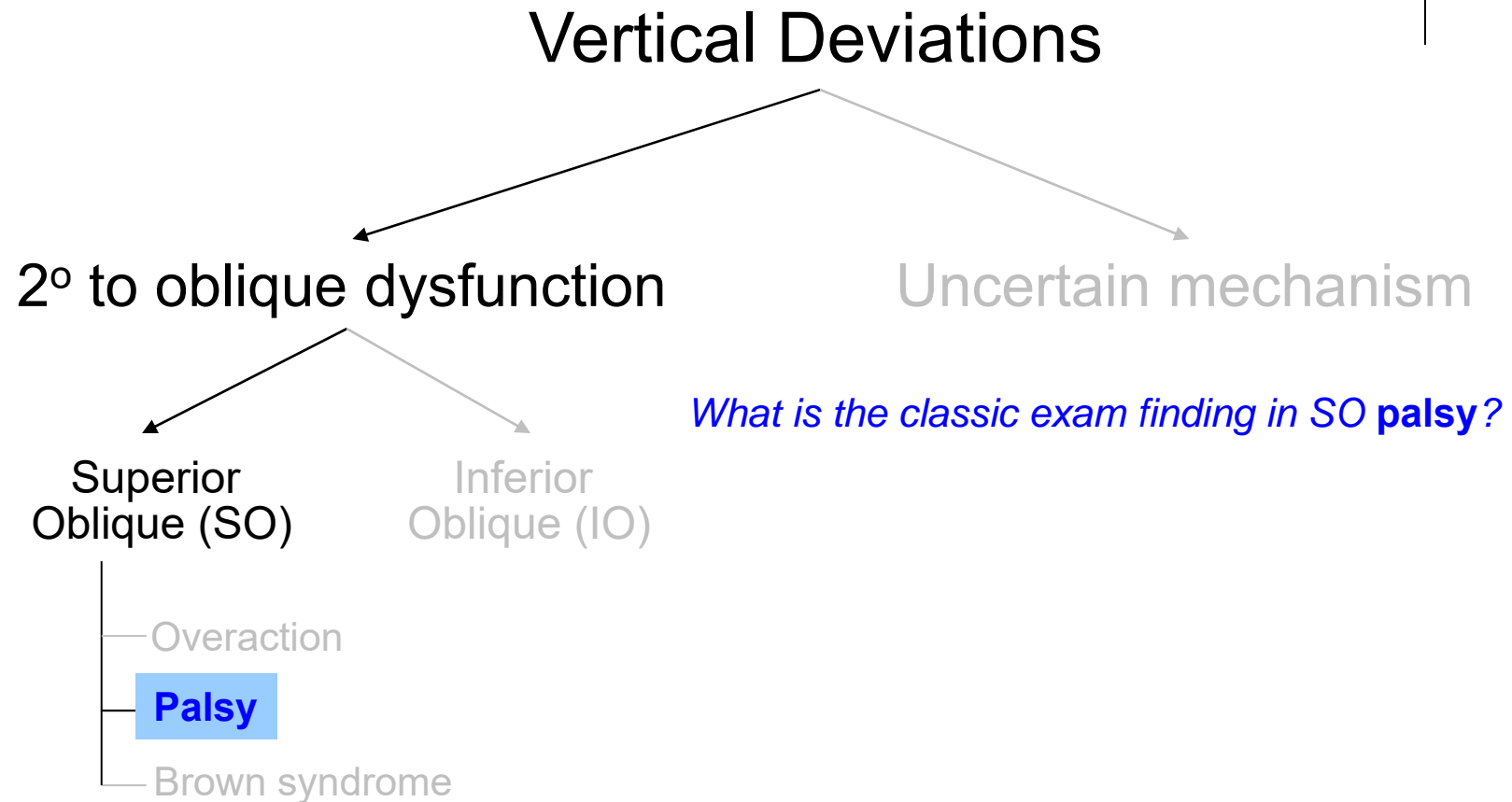
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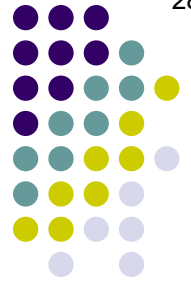
What is the surgical treatment for SO overaction?
Tenotomy vs silicone expander

Why are surgeons reluctant to operate on a patient with bifixation?
Surgery could result in **torsional** diplopia

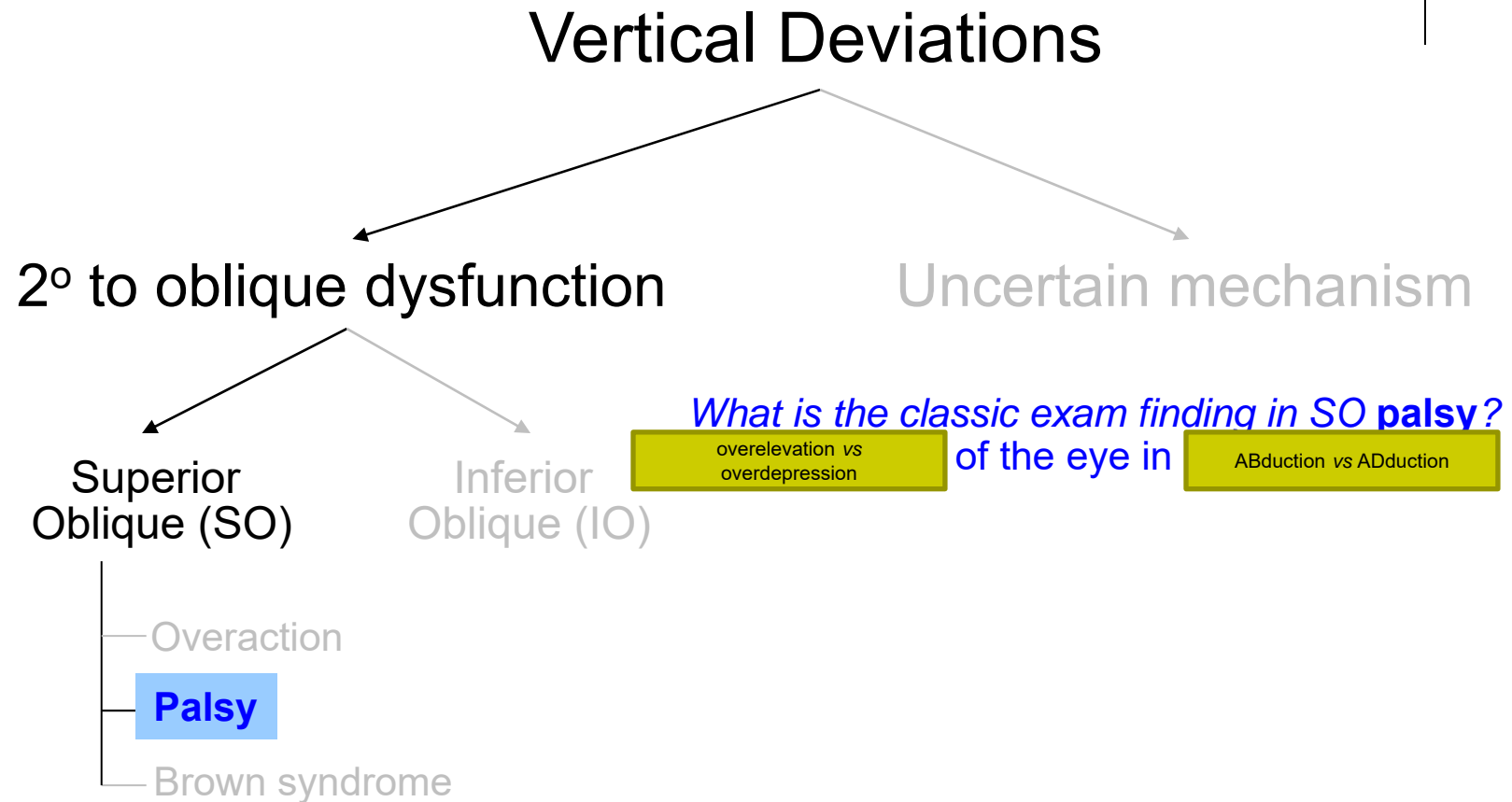


Vertical Deviations



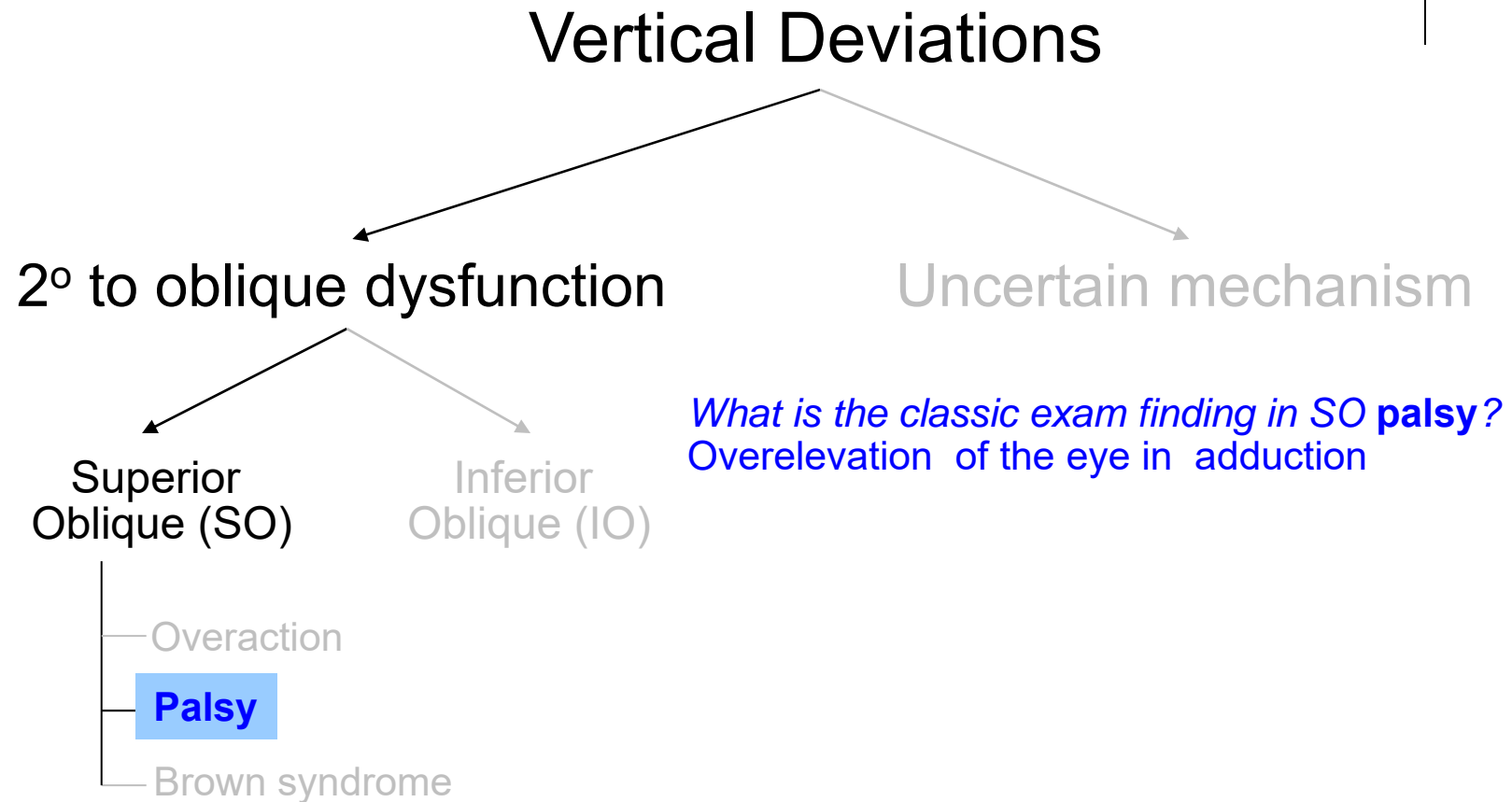


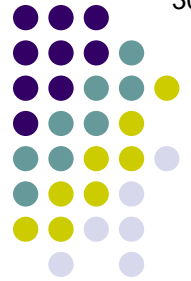
Vertical Deviations



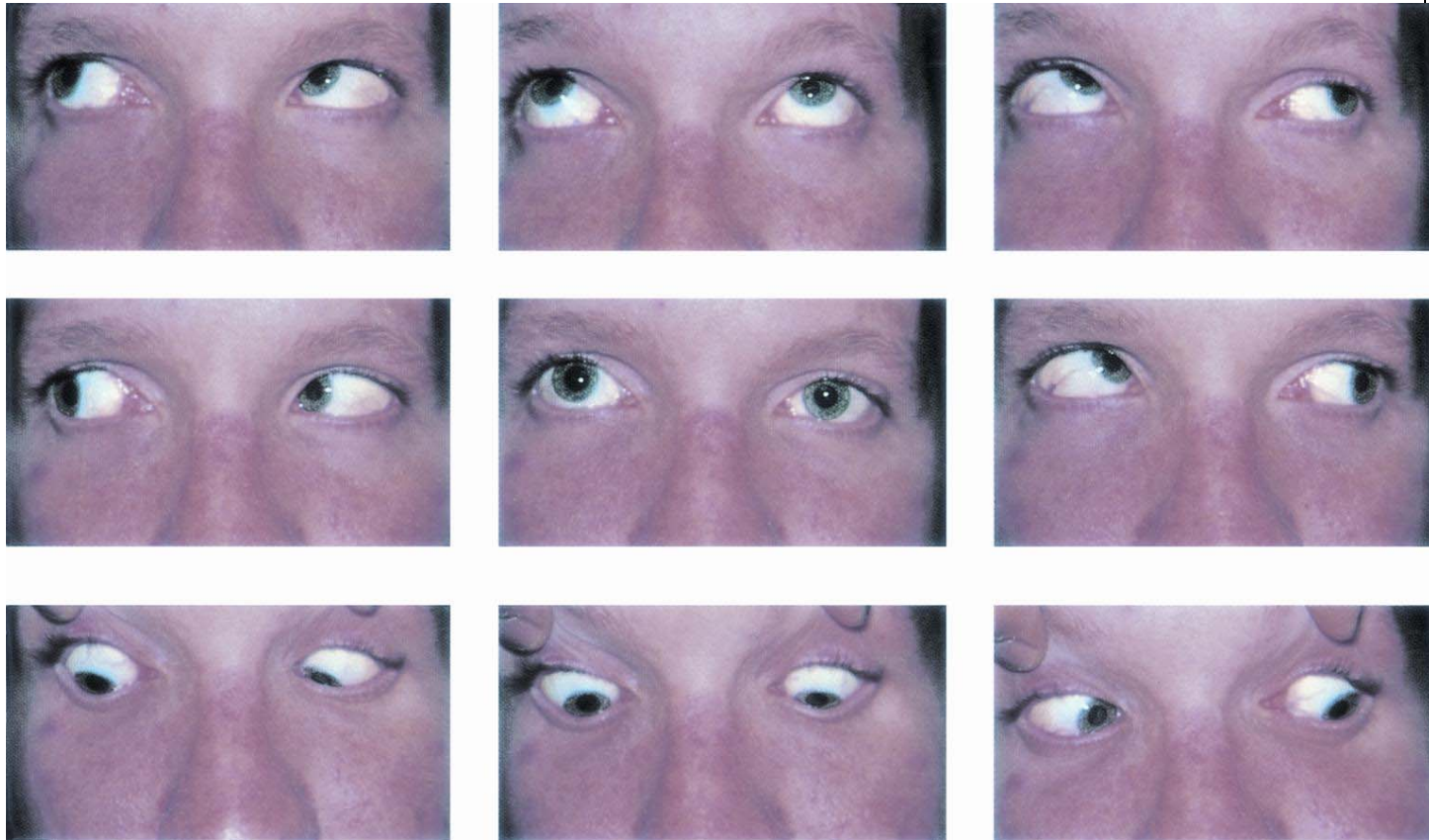


Vertical Deviations

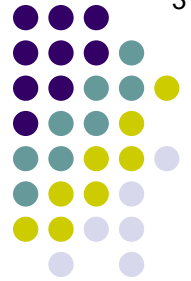




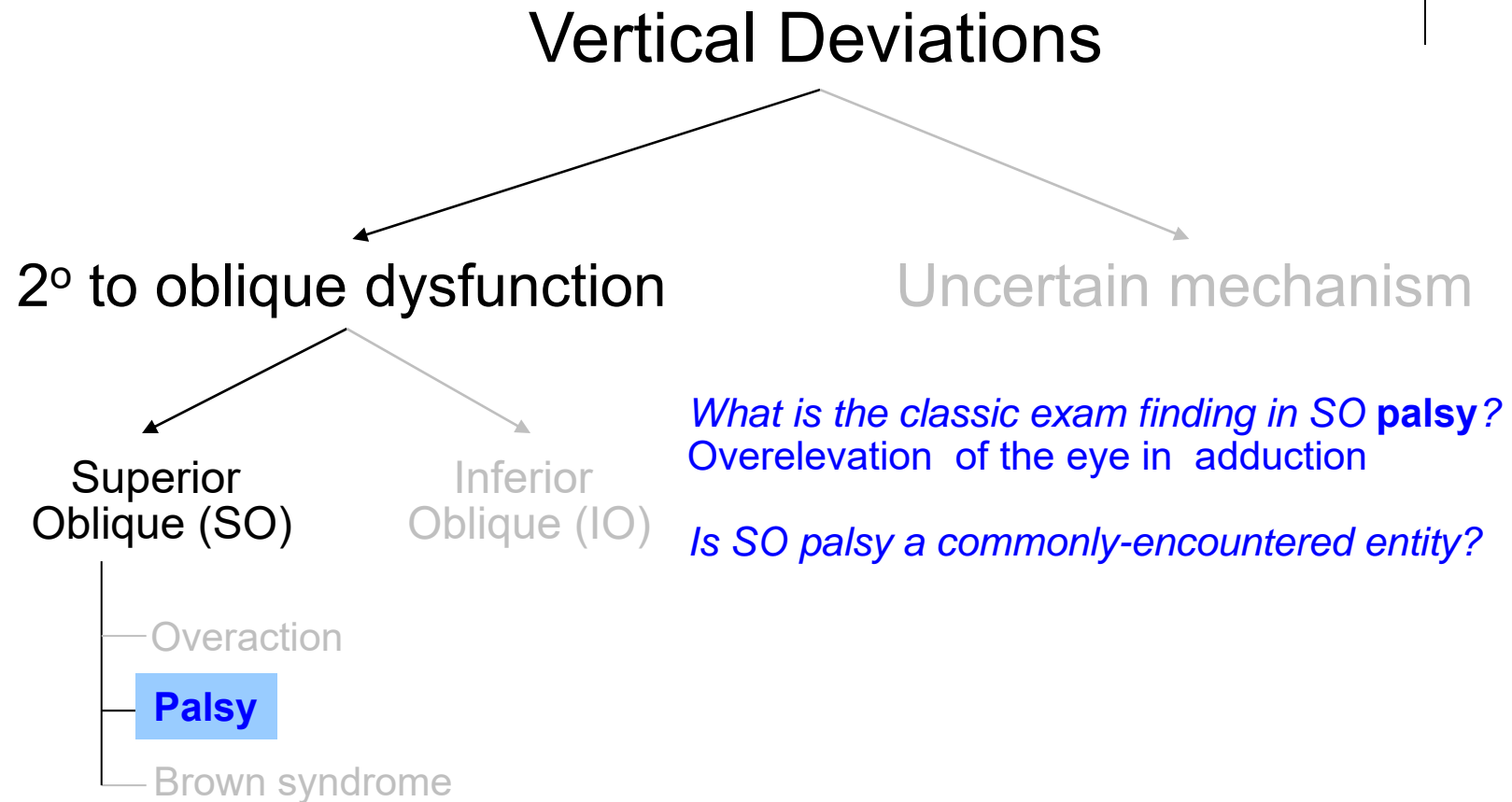
Vertical Deviations

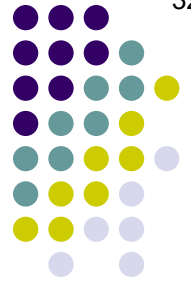


Superior oblique palsy, right

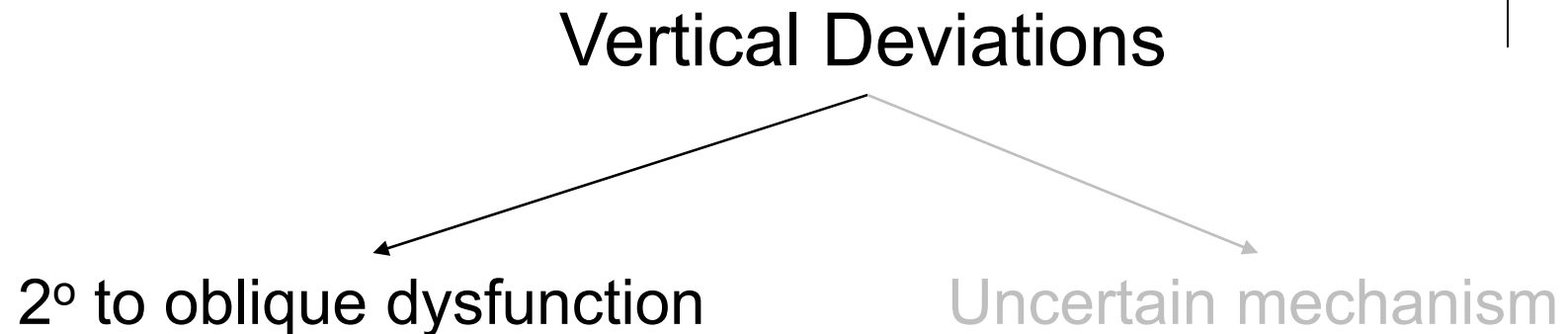


Vertical Deviations





Vertical Deviations



Superior
Oblique (SO)

Inferior
Oblique (IO)

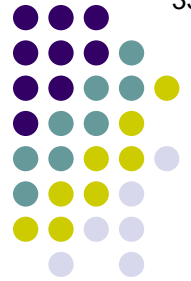
Overaction

Palsy

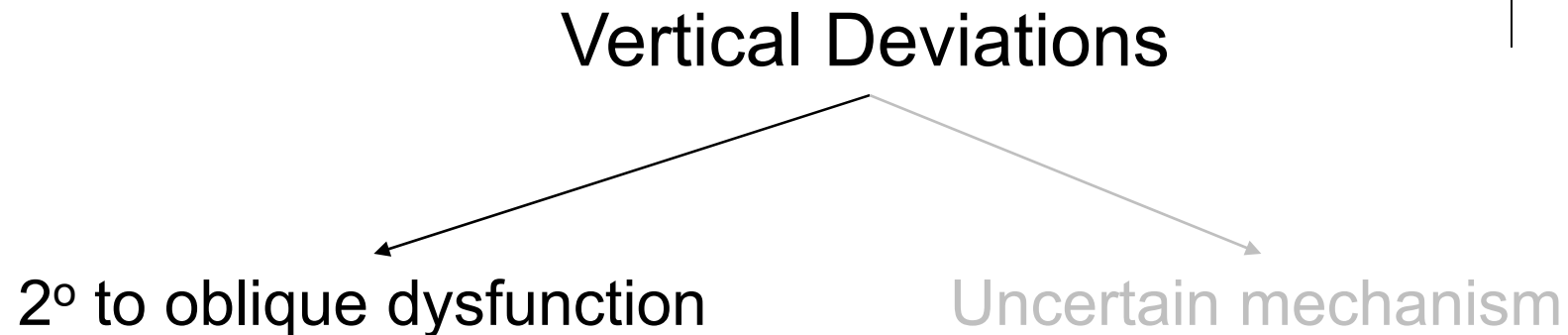
Brown syndrome

*What is the classic exam finding in SO **palsy**?*
Overelevation of the eye in adduction

Is SO palsy a commonly-encountered entity?
Yes—it is the most common paralysis of a single cyclovertical muscle



Vertical Deviations



Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

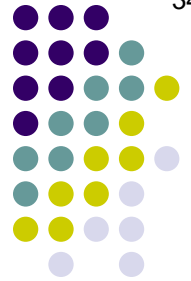
Palsy

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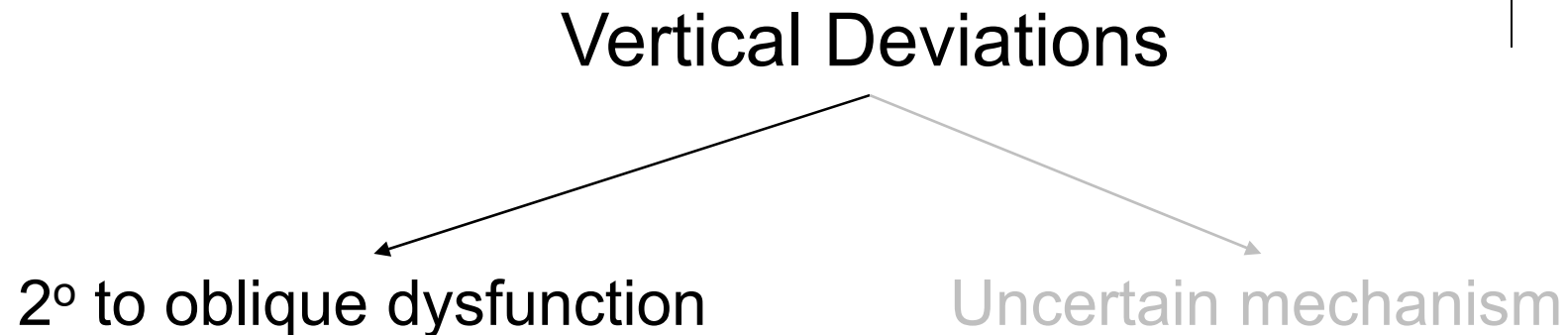
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Upon encountering a SO palsy, what question must you consider early on?



Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syndrome

Inferior
Oblique (IO)

*What is the classic exam finding in SO **palsy**?*
Overelevation of the eye in adduction

Is SO palsy a commonly-encountered entity?
Yes—it is the most common paralysis of a single cyclovertical muscle

Upon encountering a SO palsy, what question must you consider early on?
Whether the palsy is congenital, or acquired

Vertical Deviations



Regarding SO palsy: As a general rule:

--congenital SO palsy is much more likely to be uni- vs bilateral

--acquired SO palsy is much more likely to be uni- vs bilateral

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome



Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

Regarding SO palsy: As a general rule:

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Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

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What is the most common cause of acquired SO palsy?



Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

Regarding SO palsy: As a general rule:

--congenital SO palsy is much more likely to be **unilateral**

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What is the most common cause of acquired SO palsy?

Closed head trauma

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

Regarding SO palsy: As a general rule:

--congenital SO palsy is much more likely to be **unilateral**

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What is the most common cause of acquired SO palsy?

Closed head trauma

How can you confirm that a SO palsy is congenital?

1)

2)

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Overaction

Palsy

Brown syndrome

Inferior
Oblique

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What is the most common cause of acquired SO palsy?

Closed head trauma

How can you confirm that a SO palsy is congenital?

1) **Family-album biopsy** (i.e., check old photos for a

several words

2)

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

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2)

Vertical Deviations



Figure 8-11 Congenital left fourth nerve palsy. **A**, Note the left hypertropia and right head tilt as a child. **B**, Forty years later, the right head tilt is still present, but the patient describes more difficulty maintaining single, binocular vision. **C**, After eye muscle surgery, the diplopia and head tilt have resolved. (Courtesy of Lanning B. Kline, MD.)

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

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2) Assess for increased

three words exactly

Vertical Deviations

2° to oblique dysfunction

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Vertical Deviations



2° to oblique dysfunction

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Oblique (SO)

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Briefly, to what does the term vertical fusional amplitudes refer?

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

Inferior

Overaction
Palsy
Brown

Regarding SO palsy: As a general rule:

- congenital SO palsy is much more likely to be **unilateral**
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What is the most common cause of acquired SO palsy?
Closed head trauma

How can you confirm that a SO palsy is congenital?

- 1) **Family-album biopsy** (i.e., check old photos for a longstanding head tilt)
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Briefly, to what does the term vertical fusional amplitudes refer?

It refers to the amount of vertical prism a pt can take before fusion breaks down

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

Overac-

Palsy

Brown

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For pts without a history of congenital SO palsy, how much vertical prism can they accept without losing fusion?

Vertical Deviations



2° to oblique dysfunction

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Oblique (SO)

Inferior

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Palsy

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For pts without a history of congenital SO palsy, how much vertical prism can they accept without losing fusion?

Not much; # to # prism diopters or so

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

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Palsy

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For pts without a history of congenital SO palsy, how much vertical prism can they accept without losing fusion?

Not much; 2-3 prism diopters or so

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

Inferior

Overaction

Palsy

Regarding SO palsy: As a general rule:

- congenital SO palsy is much more likely to be **unilateral**
- acquired SO palsy is much more likely to be **bilateral**

What is the most common cause of acquired SO palsy?
Closed head trauma

How can you confirm that a SO palsy is congenital?

- 1) **Family-album biopsy** (i.e., check old photos for a longstanding head tilt)
- 2) Assess for increased **vertical fusional amplitudes**

Briefly, to what does the term vertical fusional amplitudes refer?

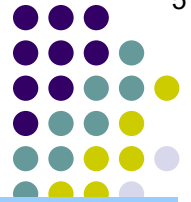
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*In contrast, how large are normal **horizontal** fusional amplitudes?*

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*In contrast, how large are normal **horizontal** fusional amplitudes?*

Much larger--in the 10-15 prism diopter range

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

Inferior

Overaction

Palsy

Brown

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How much vertical prism can pts with a congenital SO palsy take without losing fusion?

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

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Palsy

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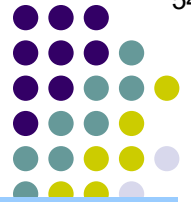
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Not much; 2-3 prism diopters or so

How much vertical prism can pts with a congenital SO palsy take without losing fusion?

A **lot** more—in the **# to #** prism diopter range

Vertical Deviations



2° to oblique dysfunction

Superior
Oblique (SO)

Overaction

Palsy

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How much vertical prism can pts with a congenital SO palsy take without losing fusion?

A **lot** more—in the 12-15 prism diopter range

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

Regarding SO palsy: As a general rule:

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What is the most common cause of acquired SO palsy?

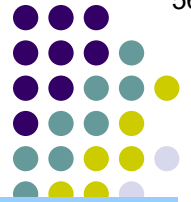
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When diagnosing a unilateral SO palsy, what must you be sure to rule out?



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When diagnosing a unilateral SO palsy, what must you be sure to rule out?

That it's not in fact an asymmetric bilateral SO palsy

Vertical Deviations

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Oblique (SO)

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Why should you care whether a palsy is unilateral vs bilateral?

Vertical Deviations

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Why should you care whether a palsy is unilateral vs bilateral?

All bilateral SO palsies should be assumed to be acquired.

Thus, absent an appropriate head-trauma hx, a **bilateral SO palsy represents an ongoing intracranial dz process until proven otherwise**. For this reason, it is absolutely vital that one establish with certainty the uni- vs bilaterality of SO palsy!

Vertical Deviations

2° to oblique dysfunction

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Oblique (SO)

Overaction

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When

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pro

one

If a bilateral SO play pt lacks an appropriate trauma hx, what should you do?

proven otherwise. For this reason, it is absolutely vital that one establish with certainty the uni- vs bilaterality of SO palsy!

Vertical Deviations

2° to oblique dysfunction

Superior
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If a bilateral SO palsy pt lacks an appropriate trauma hx, what should you do?

Image them

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Vertical Deviations



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Image them

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What findings differentiate a uni- from a bilateral SO palsy?

Vertical Deviations



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What is the most common cause of acquired SO palsy?

Key Findings in Uni- vs Bilateral SO Palsy

2° to oblique dysfunction

Superior
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Overaction

Palsy

Brown syndrome

	V-pattern ET present?		
<i>Unilateral</i> SO palsy	yes or no		
<i>Bilateral</i> SO palsy	yes or no		

Vertical Deviations



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Brown syndrome

	V-pattern ET present?		
<i>Unilateral</i> SO palsy	No		
<i>Bilateral</i> SO palsy	Yes		

Vertical Deviations



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Brown syndrome

	V-pattern ET present?	How much excyclotorsion on double Maddox rod testing?	
Unilateral SO palsy	No	Always less than <small># of degrees</small>	
Bilateral SO palsy	Yes	May be more than <small># of degrees</small>	

Vertical Deviations



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Brown syndrome

	V-pattern ET present?	How much excyclotorsion on double Maddox rod testing?	
Unilateral SO palsy	No	Always less than 10°	
Bilateral SO palsy	Yes	May be more than 10°	

Vertical Deviations



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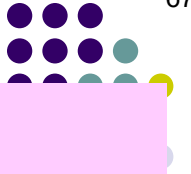
Overaction

Palsy

Brown syndrome

	V-pattern ET present?	How much excyclotorsion on double Maddox rod testing?	
Unilateral SO palsy	No	Always less than 10°	
Bilateral SO palsy	Yes	May be more than 10°	

What is *double Maddox rod testing*? I'm glad you asked...



Vertical Deviations

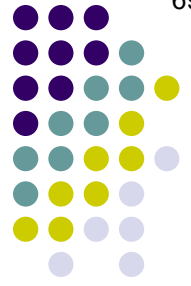
What is a Maddox rod?



Vertical Deviations

What is a Maddox rod?

A translucent disc of red plastic constructed of a set of very small cylinders aligned parallel to one another



Vertical Deviations



Maddox rod

Vertical Deviations

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In the double Maddox rod test, a separate Maddox rod is placed before each eye, and a point-source of light is presented to both eyes simultaneously.

Vertical Deviations



Sometimes a clear Maddox rod is used for one eye

Double Maddox rod setup

Vertical Deviations

What is a Maddox rod?

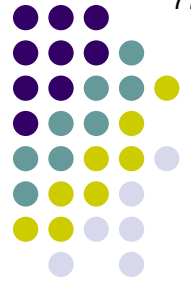
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Vertical Deviations

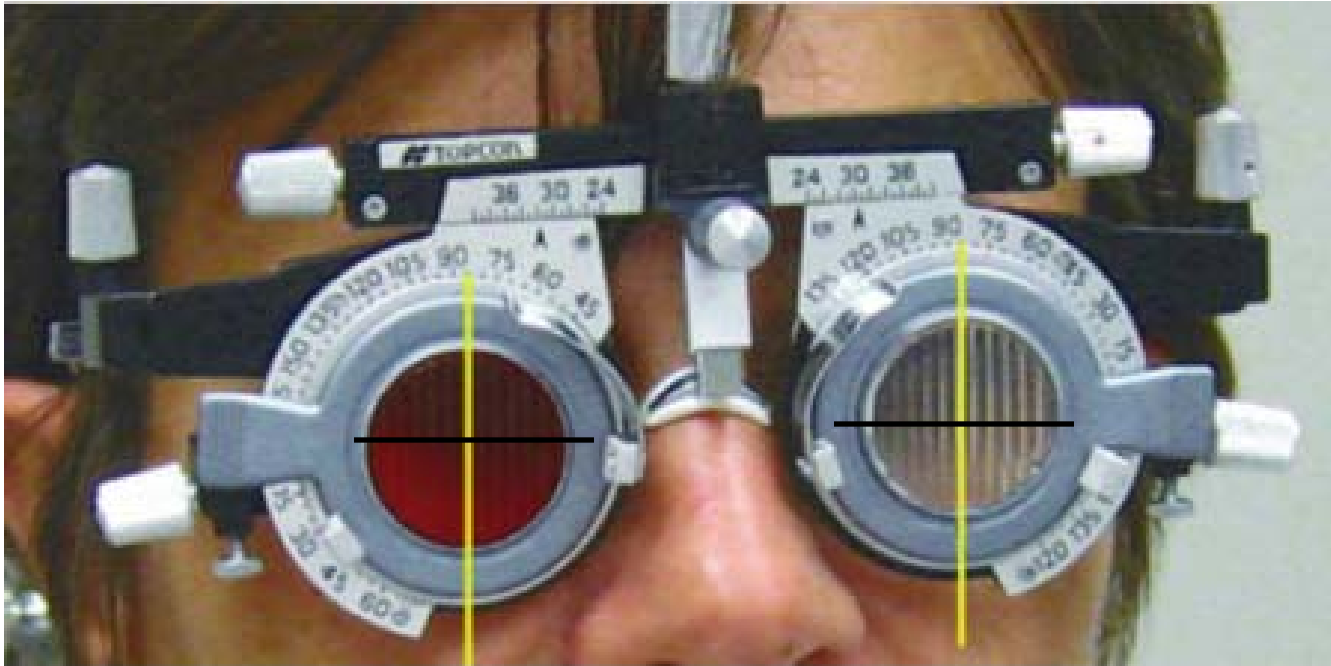


Fig. 13.38 Double Maddox rod testing in a patient with no deviation (the yellow lines show the orientation of the Maddox rods). Black lines indicate the orientation of the lines as seen by each eye.

Double Maddox rod test in individual without strabismus

Vertical Deviations

What is a Maddox rod?

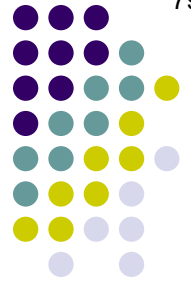
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Vertical Deviations

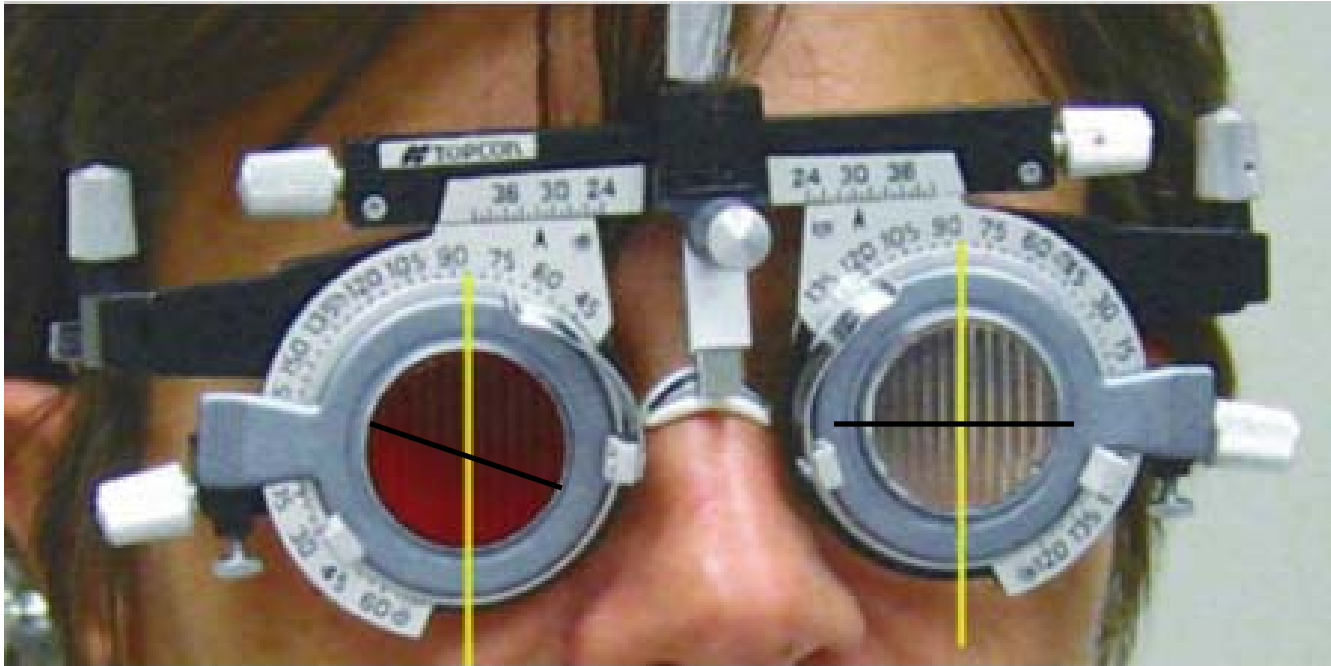


Fig. 13.38 Double Maddox rod testing ~~in a patient with a right SO palsy~~ (the yellow lines show the orientation of the Maddox rods). Black lines indicate the orientation of the lines as seen by each eye.

Double Maddox rod test in individual with a right SO palsy

Vertical Deviations

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How can double-Maddox rods be used to measure the amount of cyclotorsion?

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How can double-Maddox rods be used to measure the amount of cyclotorsion?

The Maddox-rod lenses are mounted in trial frames that allow the orientation of the cylinders to be changed, and the pt is instructed to do so until s/he perceives the lines to be parallel. The difference in degrees between the orientation of the two sets of cylinders is the size of the excyclotorsion.

Vertical Deviations

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How can the size of the excyclotorsion be used to differentiate between unilateral and bilateral SO palsies?

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How can the size of the excyclotorsion be used to differentiate between unilateral and bilateral SO palsies?

The maximum amount of excyclotorsion that can result from *unilateral* SO palsy is # deg. Thus, if more than this amount is present, bilateral palsies **must** be present.

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How can the size of the excyclotorsion be used to differentiate between unilateral and bilateral SO palsies?

The maximum amount of excyclotorsion that can result from *unilateral* SO palsy is 10 deg. Thus, if more than this amount is present, bilateral palsies **must** be present.

Vertical Deviations

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How can the size of the excyclotorsion be used to differentiate between unilateral and bilateral SO palsies?

The maximum amount of excyclotorsion that can result from *unilateral* SO palsy is 10 deg

That is, if more than this amount is present, the torsion must be bilateral

This means that if less than 10 deg is present, the palsy must be unilateral, right?

Vertical Deviations

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A translucent disc of red plastic constructed of a set of very small cylinders aligned parallel to one another

What does a pt see when shown a point-source of light through a Maddox rod?

The point of light is seen as a line oriented 90° from the orientation of the cylinders

Ok, so what is double Maddox-rod testing, and how is it used to identify and quantify excyclotorsion?

In the double Maddox rod test, a separate Maddox rod is placed before each eye, and a point-source of light is presented to both eyes simultaneously. Thus, each eye sees its own line, courtesy of its Maddox rod. In individuals for whom their eyes have identical rotational orientation, the line seen by each eye will be perceived as parallel to the other. However, because an eye with a SO palsy is excyclotorted, the line produced by its Maddox rod will be in a different orientation than that experienced by its non-torted fellow eye. (Bear in mind that it's not the orientation of the line itself that's off; rather, it's the orientation of the retina *perceiving* the line that's off.)

How can double-Maddox rods be used to measure the amount of cyclotorsion?

The Maddox-rod lenses are mounted in trial frames that allow the orientation of the cylinders to be changed, and the pt is instructed to do so until s/he perceives the lines to be parallel. The difference in degrees between the orientation of the two sets of cylinders is the size of the excyclotorsion.

How can the size of the excyclotorsion be used to differentiate between unilateral and bilateral SO palsies?

The maximum amount of excyclotorsion that can result from unilateral SO palsy is 10 deg

That is, if there is no other cause of excyclotorsion.

This means that if less than 10 deg is present, the palsy must be unilateral, right?

Slow ya roll, bruh. It's true that if only one eye is excyclotorted, the total measured excyclotorsion is always 10 deg or less. However, if both eyes are only mildly palsied—say, 4 degree's worth each—the total excyclotorsion (in this case 8 deg) *could* be less than 10. Thus, whereas >10 deg rules out unilateral SO palsy, <10 does not rule it in.

Vertical Deviations

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Therefore, if the amount of excyclotorsion is greater than 10 deg, it must be bilateral.

This means that if less than 10 deg is present, the palsy must be unilateral, right?

Slow ya roll, bruh. It's true that if only one eye is excyclotorted, the total measured excyclotorsion is always 10 deg or less. However, if both eyes are only mildly palsied—

s All that said, it is very unusual for a *bilateral* SO palsy to present with less than # deg of torsion

(in case 8 deg) could be less also.

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Slow ya roll, bruh. It's true that if only one eye is excyclotorted, the total measured excyclotorsion is always 10 deg or less. However, if both eyes are only mildly palsied—

s All that said, it is very unusual for a *bilateral* SO palsy to present with less than 5 deg of torsion

(in case 8 deg) could be less also. **<10 does not rule it in.**

Vertical Deviations

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TLDR

>10 excyclotorsion is always bilateral

<5 (but greater than 0, duh) is *almost* always unilateral

5-10 is indeterminate

How can double-Maddox

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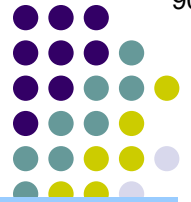
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All that said, it is very unusual for a *bilateral* SO palsy (in case 8 deg) *could* be less than 10 deg. Therefore, <10 does not rule it in.

Vertical Deviations



Regarding SO palsy: As a general rule:

- congenital SO palsy is much more likely to be **unilateral**
- acquired SO palsy is much more likely to be **bilateral**

What is the most common cause of acquired SO palsy?

Key Findings in Uni- vs Bilateral SO Palsy

2° to oblique dysfunction

Superior
Oblique (SO)

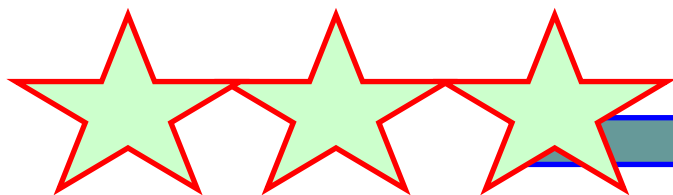
Inferior
Oblique

Overaction

Palsy

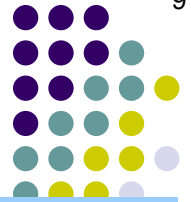
Brown syndrome

	V-pattern ET present?	How much excyclotorsion on double Maddox rod testing?	Head-tilt test?
Unilateral SO palsy	No	Always less than 10°	Positive to which side(s)?
Bilateral SO palsy	Yes	May be more than 10°	Positive to which side(s)?



Next question!

Vertical Deviations



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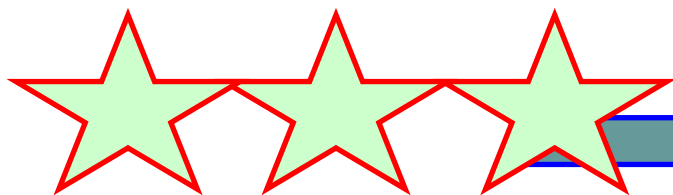
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Next question!

Vertical Deviations



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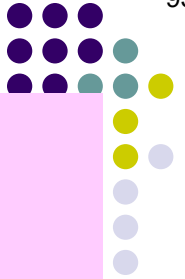
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What is the *head-tilt test*? I'm glad you asked...

Vertical Deviations

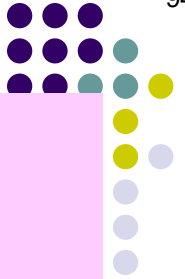
The *head-tilt test* is also known by what eponymous name?



Vertical Deviations

The *head-tilt test* is also known by what eponymous name?

The Beilschowsky head-tilt test

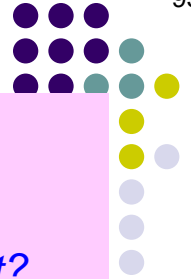


Vertical Deviations

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The *head-tilt test* is actually a single component of what double-eponymous 3-step test?



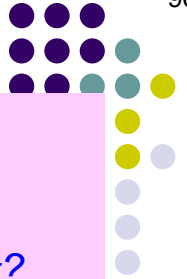
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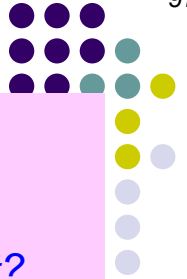
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To identify the EOM function muscle responsible for a direction deviation

Vertical Deviations

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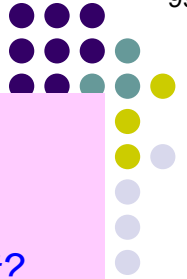
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To identify the cyclovertical muscle responsible for a vertical deviation



Vertical Deviations

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Generally speaking, what is the purpose/goal of the Parks-Bielschowsky 3-step test?

To identify the cyclovertical muscle responsible for a vertical deviation*

Note: The Parks-Bielschowsky test works **if and only if weakness of a **single** muscle is responsible for the vertical deviation in question!*

Vertical Deviations

The head-tilt test is also known by what eponymous name?

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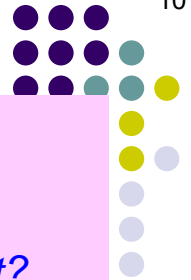
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How is the head-tilt test performed?



Vertical Deviations

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How is the head-tilt test performed?

The pt is told to tilt their head first to one side, then to the other, while you observe their eyes. A SO palsy is present if the eye on the side toward which the head is tilted responds to the tilt by drifting up v down (ie, by becoming hyper- v hypotropic).

Vertical Deviations

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Vertical Deviations



Left SO palsy: Positive head tilt test

Vertical Deviations

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Why does a head-tilt cause an SO palsy eye to become hyperopic?

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It has to do with a 'righting reflex' in the ocular control system. When the head is tilted to one side, the eyes attempt to remain level (= superior poles pointing toward the ceiling) by counter-torting in the other direction.

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So for example, when the head is tilted to the right, to stay upright the right eye will in- vs excyclotort (ie, the superior pole will tort toward vs away from the midline), while the left eye will in- vs excyclotort (ie, the superior pole will tort toward vs away from the midline).

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Recall that the intorters of the eye are the **EOM** and the **EOM**

Vertical Deviations

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Recall that the intorters of the eye are the superior rectus and the superior oblique (you can remember this with the mnemonic **SIN**, which stands for **Superiors INTort**). Thus, when an eye attempts to intort, both the SR and the SO fire. Note that the SR and the SO also have equal-but-opposite *vertical* components to their actions—the SR *elevates* the eye, while the SO *depresses* it. So when both muscles fire simultaneously, their vertical components cancel each other out, and the eye simply intorts.

Vertical Deviations

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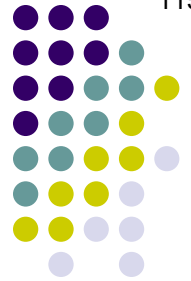
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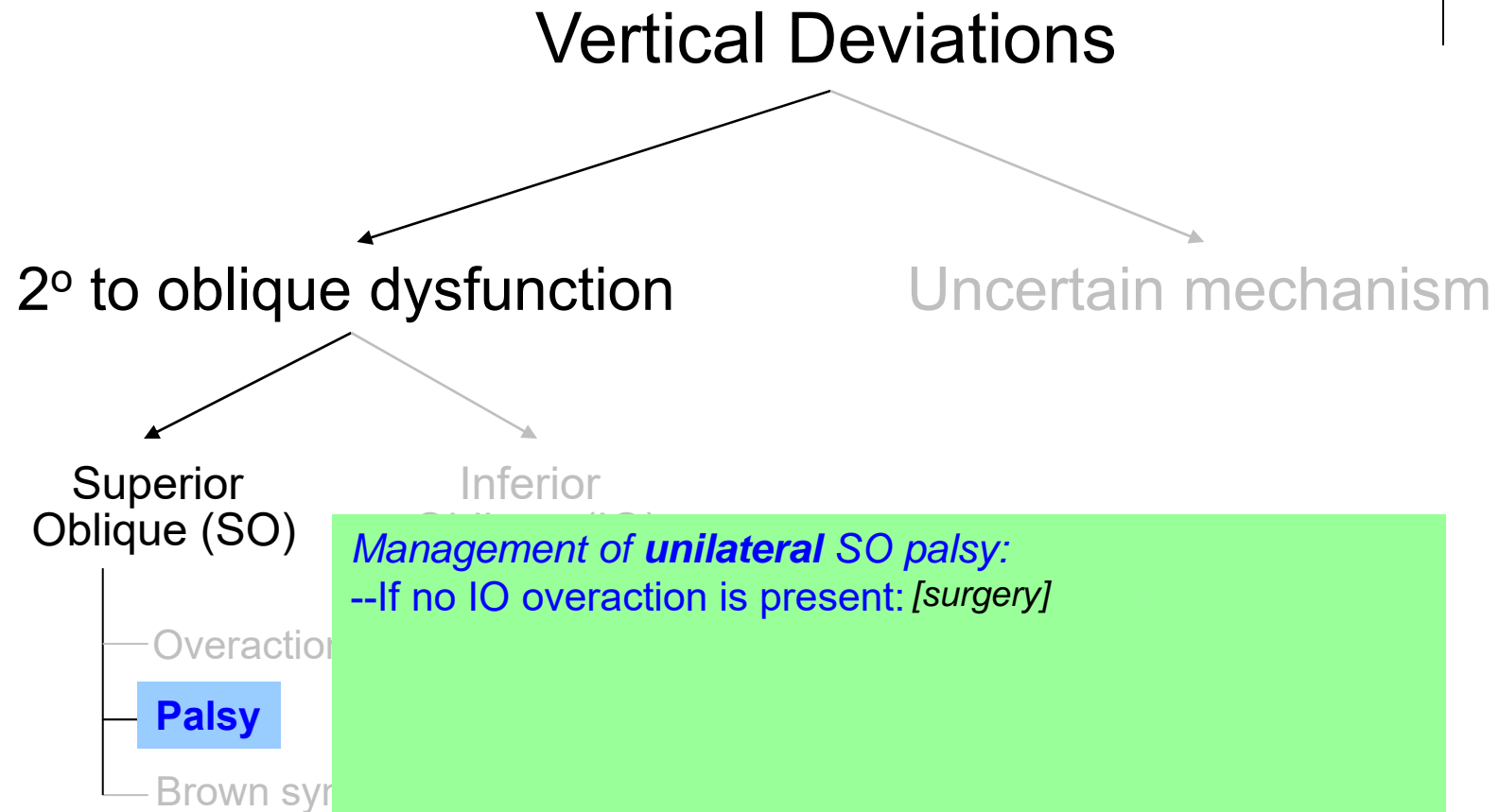
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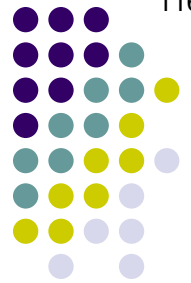
Now consider what happens upon head tilt if the eye on that side has a SO palsy. Attempted intorsion results in contraction of the SR only (because the palsied SO cannot contract). Thus, the vertical component of the SR contraction is unopposed, and because it is unopposed, the eye elevates. **This** is why an eye with a SO palsy demonstrates a hypertropia upon head tilt to that side!



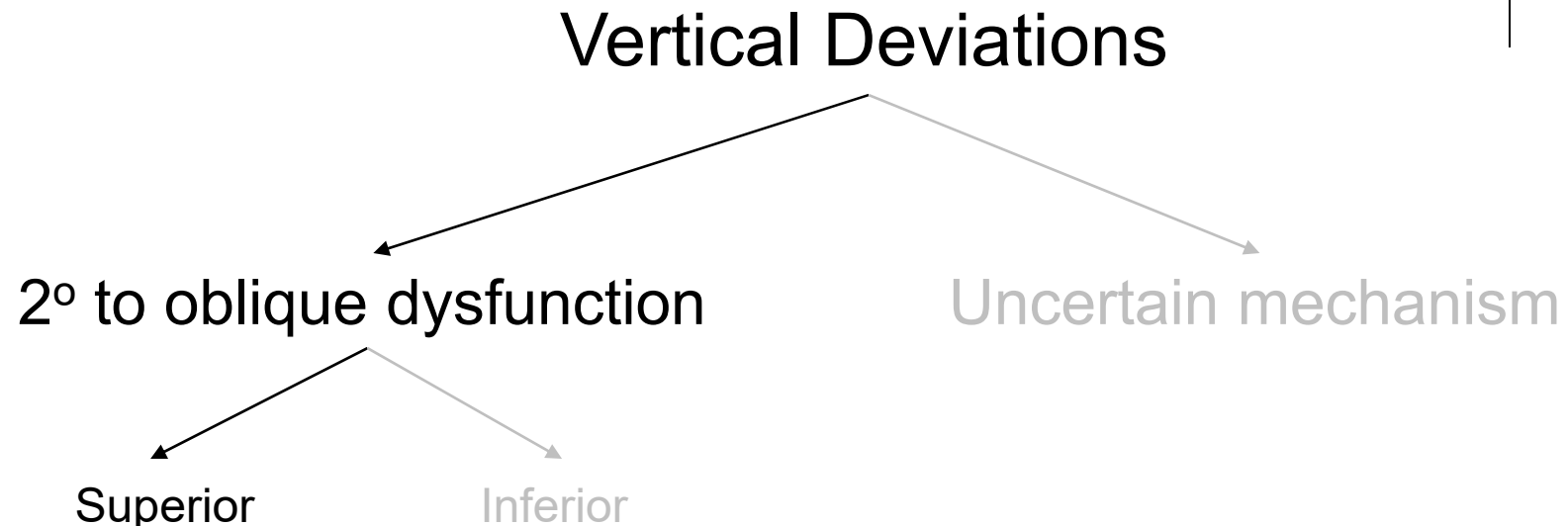
Vertical Deviations



*Management of **unilateral** SO palsy:*
 --If no IO overaction is present: *[surgery]*



Vertical Deviations



Superior
Oblique (SO)

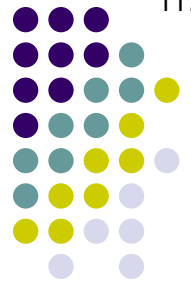
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Palsy

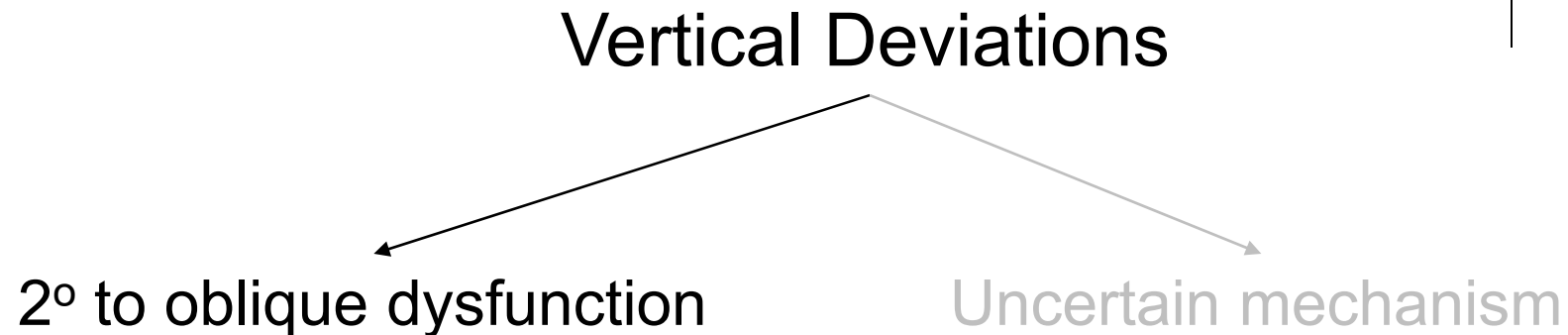
Brown syn

*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**



Vertical Deviations



Superior
Oblique (SO)

Inferior

*Management of **unilateral** SO palsy:*

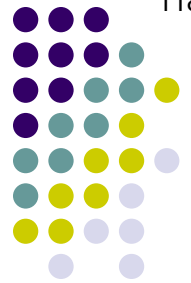
*--If no IO overaction is present: **Contralateral IR recession***

Overaction

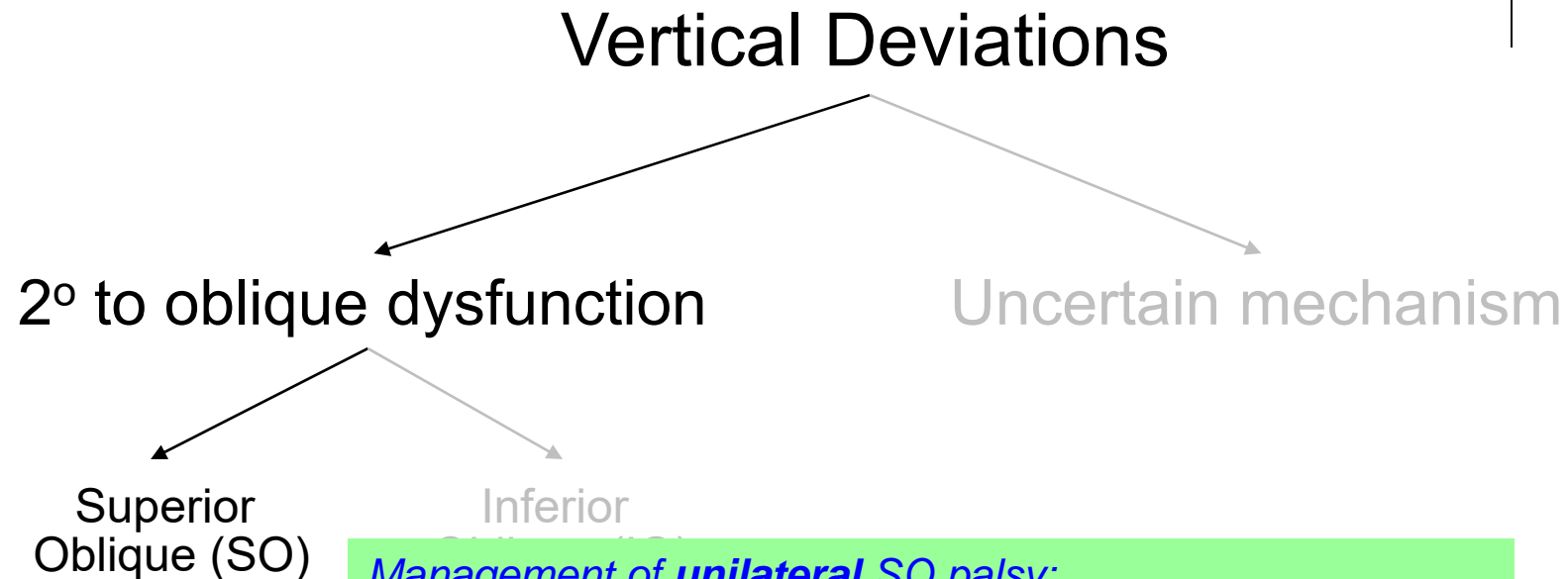
Palsy

Brown sy

Wha? Why perform contralateral IR recession for unilateral SO palsy?



Vertical Deviations



Overaction

Palsy

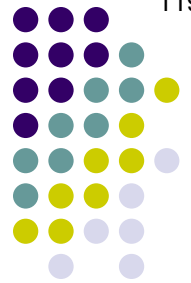
Brown sy

*Management of **unilateral** SO palsy:*

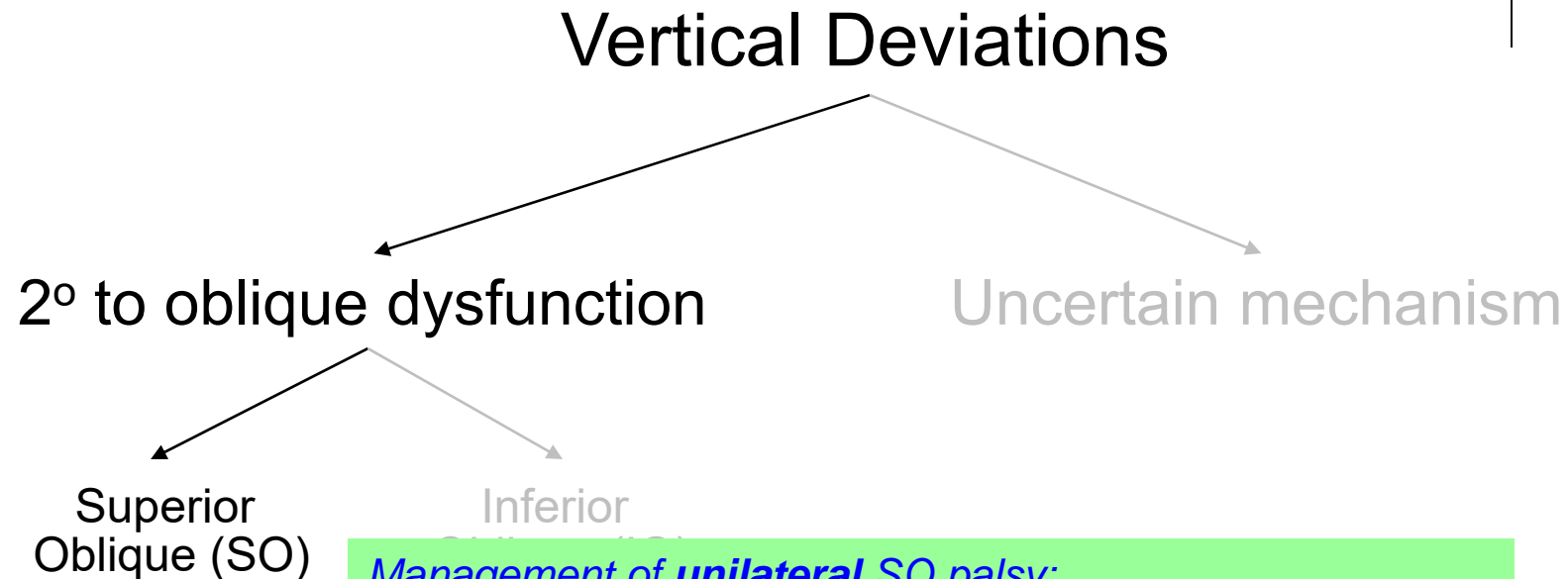
--If no IO overaction is present: **Contralateral IR recession**

Wha? Why perform contralateral IR recession for unilateral SO palsy?

Patients with an SO palsy c/o diplopia in downgaze. This is because the unaffected eye can depress fully, but the eye with the SO palsy cannot. The contralateral IR is the yoke muscle for the palsied SO. By recessing the contralateral IR, you inhibit that eye's ability to depress, thereby eliminating the source of diplopia (i.e., the asymmetry in depression).



Vertical Deviations



Overaction

Palsy

Brown sy

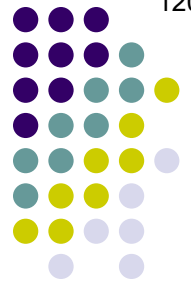
*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

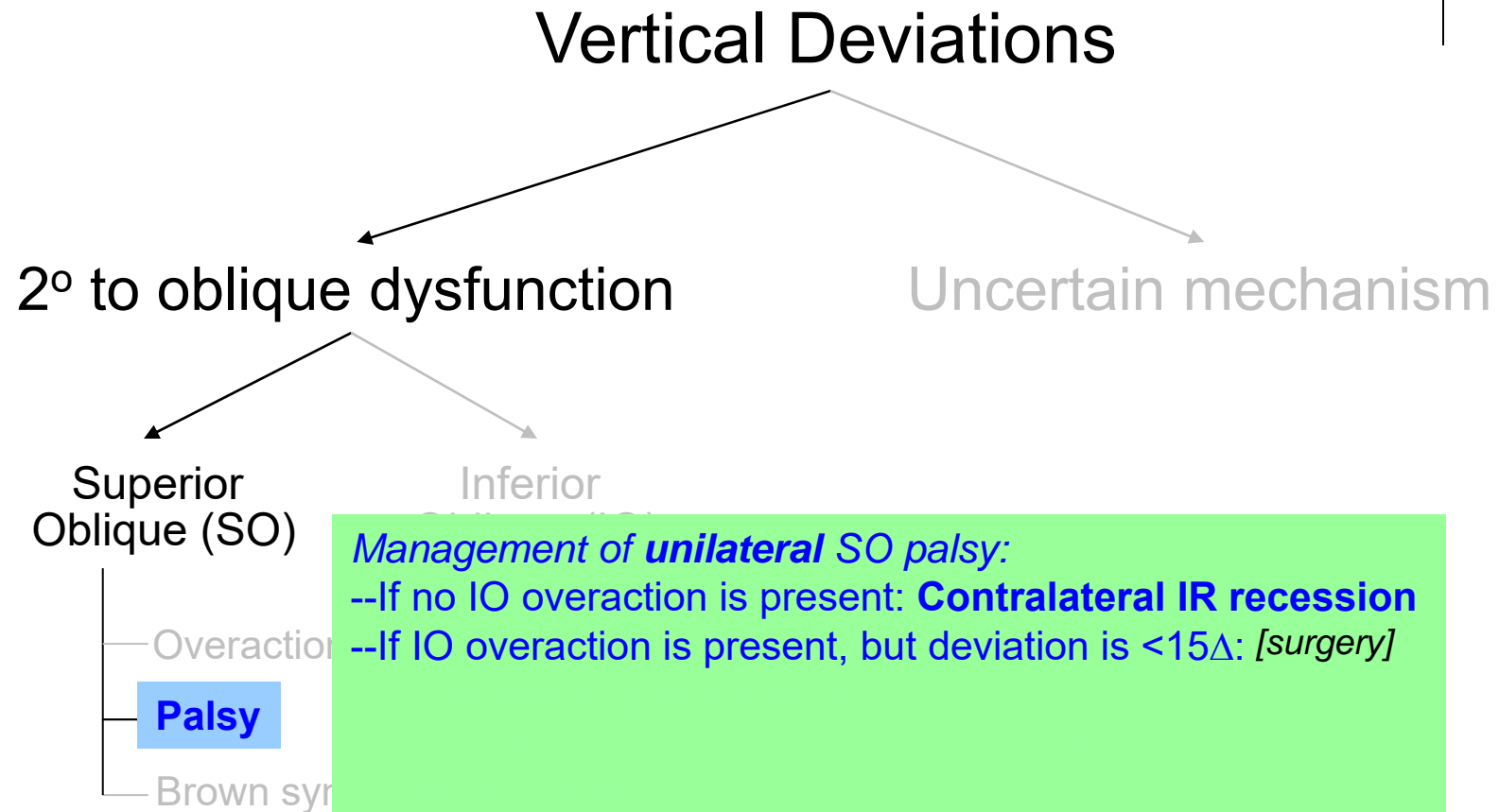
Wha? Why perform contralateral IR recession for unilateral SO palsy?

Patients with an SO palsy c/o diplopia in downgaze. This is because the unaffected eye can depress fully, but the eye with the SO palsy cannot. The contralateral IR is the yoke muscle for the palsied SO. By recessing the contralateral IR, you inhibit that eye's ability to depress, thereby eliminating the source of diplopia (i.e., the asymmetry in depression).

In essence, you treat a *unilateral* motility problem by giving the patient a *bilateral* motility problem.



Vertical Deviations

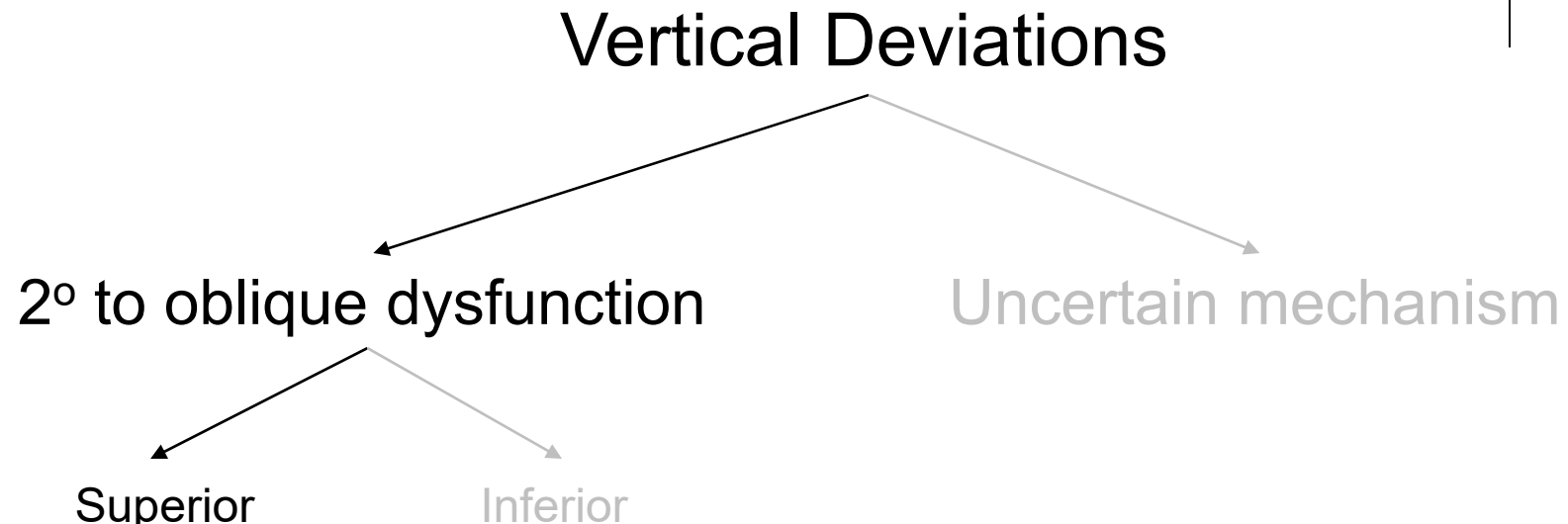
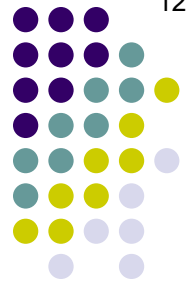


*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

--If IO overaction is present, but deviation is $<15\Delta$: *[surgery]*

Vertical Deviations



Overaction

Palsy

Brown syndrome

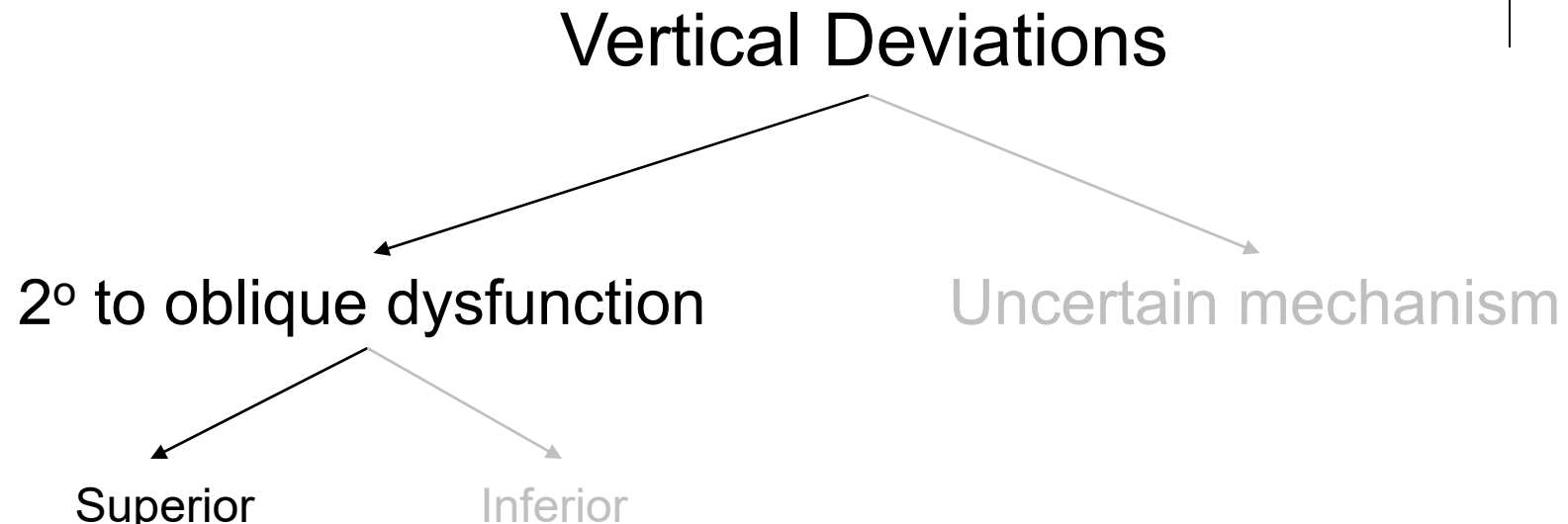
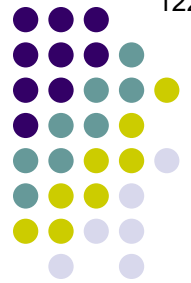
*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

--If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syn

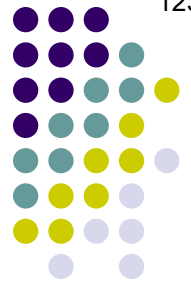
*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

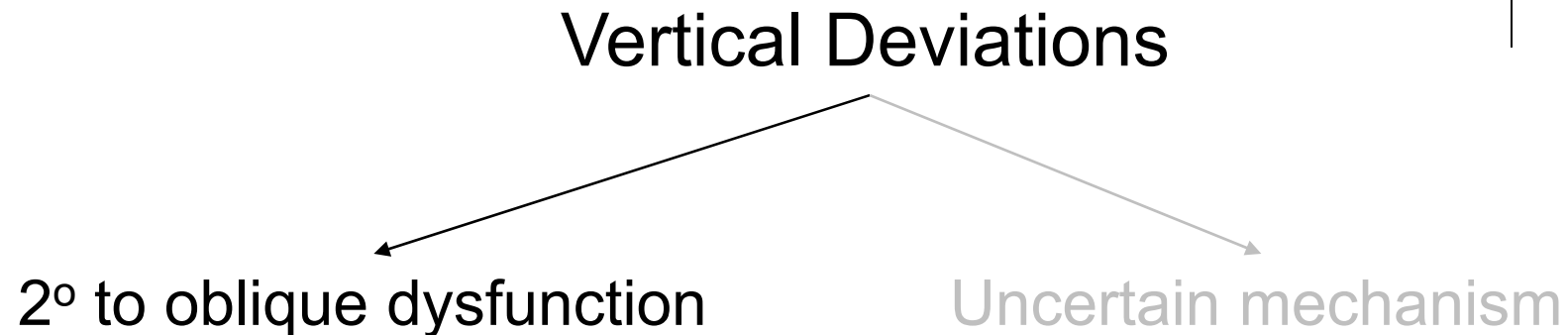
--If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

--If IO overaction is present and the deviation is $>15\Delta$: *[surgery]*



Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syn

Inferior

*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

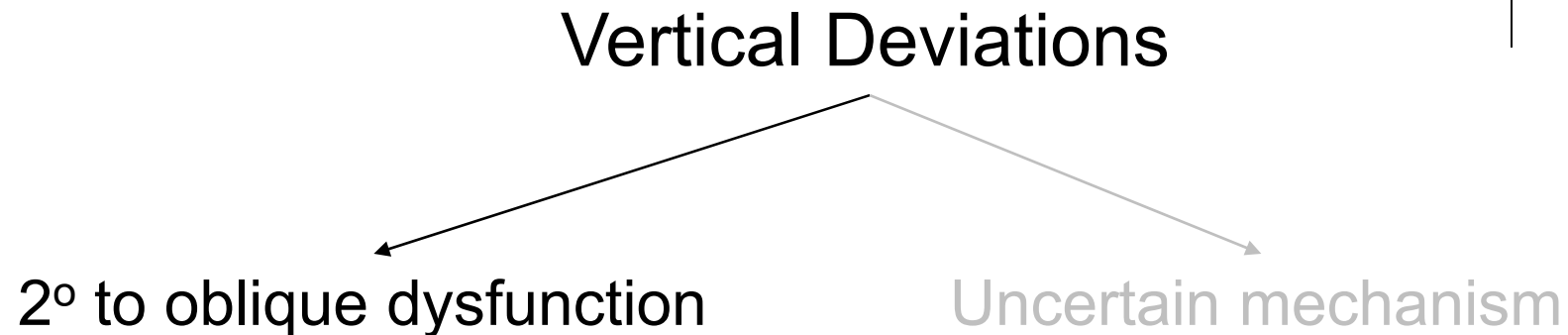
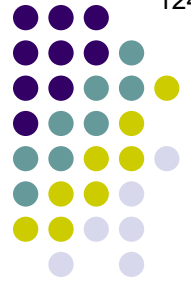
--If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

--If IO overaction is present and the deviation is $>15\Delta$:

Perform both

Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syn

Inferior

*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

--If IO overaction is present, but deviation is $<15\Delta$:

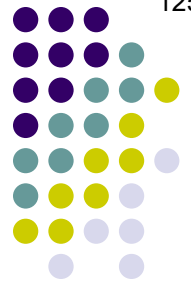
IO weakening procedure

--If IO overaction is present and the deviation is $>15\Delta$:

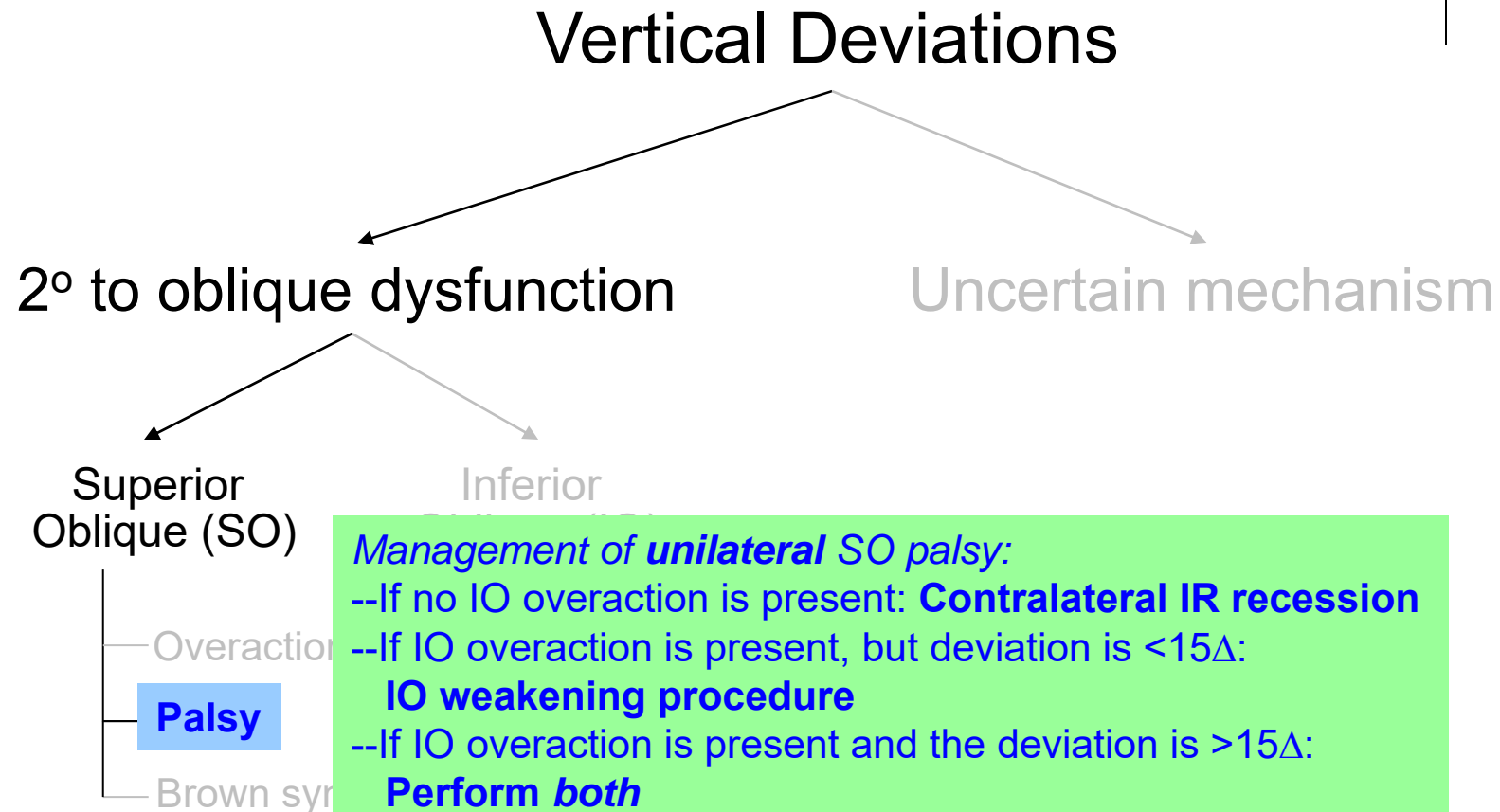
Perform both

*Management of **bilateral** SO palsy:*

--If main c/o is torsional diplopia: [surgery]



Vertical Deviations



*Management of **unilateral** SO palsy:*

--If no IO overaction is present: **Contralateral IR recession**

--If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

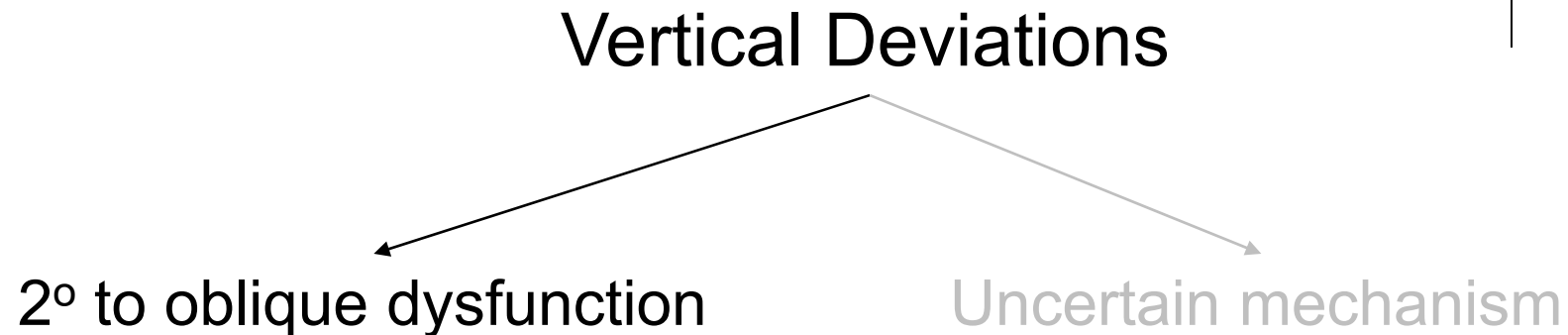
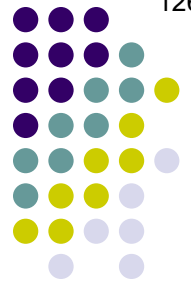
--If IO overaction is present and the deviation is $>15\Delta$:

Perform both

*Management of **bilateral** SO palsy:*

--If main c/o is torsional diplopia: **Harada-Ito procedure**

Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syndrome

Inferior

*Management of **unilateral** SO palsy:*

–If no IO overaction is present: **Contralateral IR recession**

–If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

–If IO overaction is

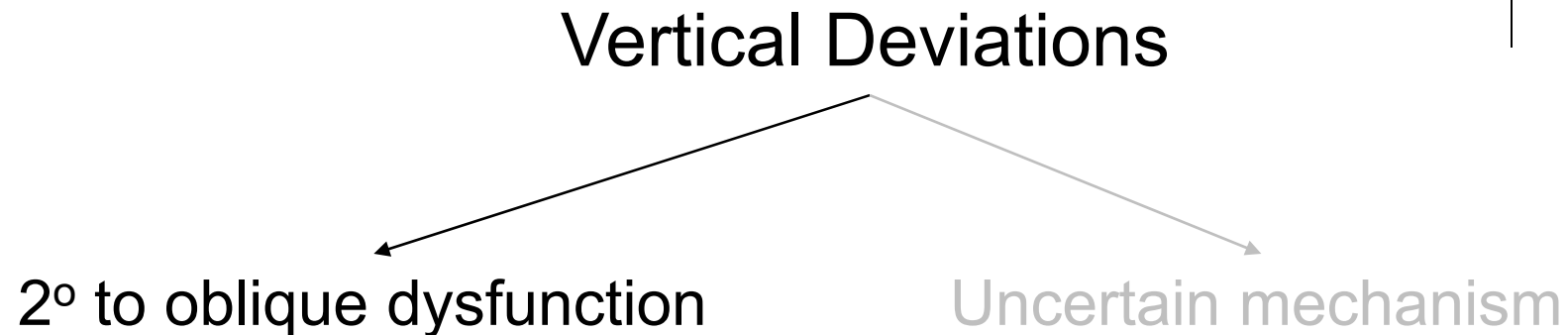
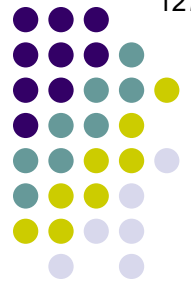
Perform both

*Briefly, what is the **Harada-Ito** procedure?*

*Management of **bilateral** SO palsy:*

–If main c/o is torsional diplopia: **Harada-Ito procedure**

Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syndrome

Inferior

Management of unilateral SO palsy:

–If no IO overaction is present: **Contralateral IR recession**

–If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

–If IO overaction is

Perform both

Briefly, what is the Harada-Ito procedure?

Both SO tendons are split, and the anterior portion of each is repositioned

direction

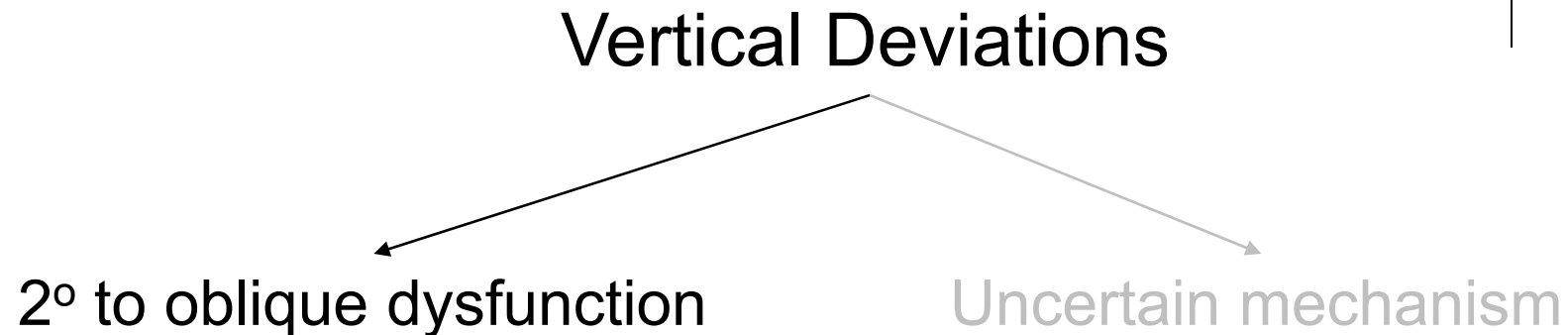
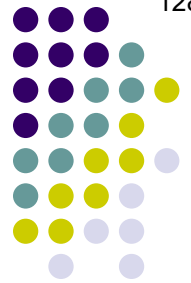
and

direction

Management of bilateral SO palsy:

–If main c/o is torsional diplopia: **Harada-Ito procedure**

Vertical Deviations



Superior
Oblique (SO)

Overaction

Palsy

Brown syn

Inferior

Management of unilateral SO palsy:

–If no IO overaction is present: **Contralateral IR recession**

–If IO overaction is present, but deviation is $<15\Delta$:

IO weakening procedure

–If IO overaction is

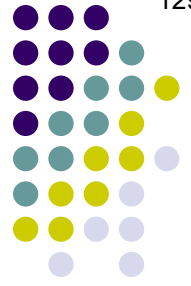
Perform both

*Briefly, what is the **Harada-Ito procedure**?*

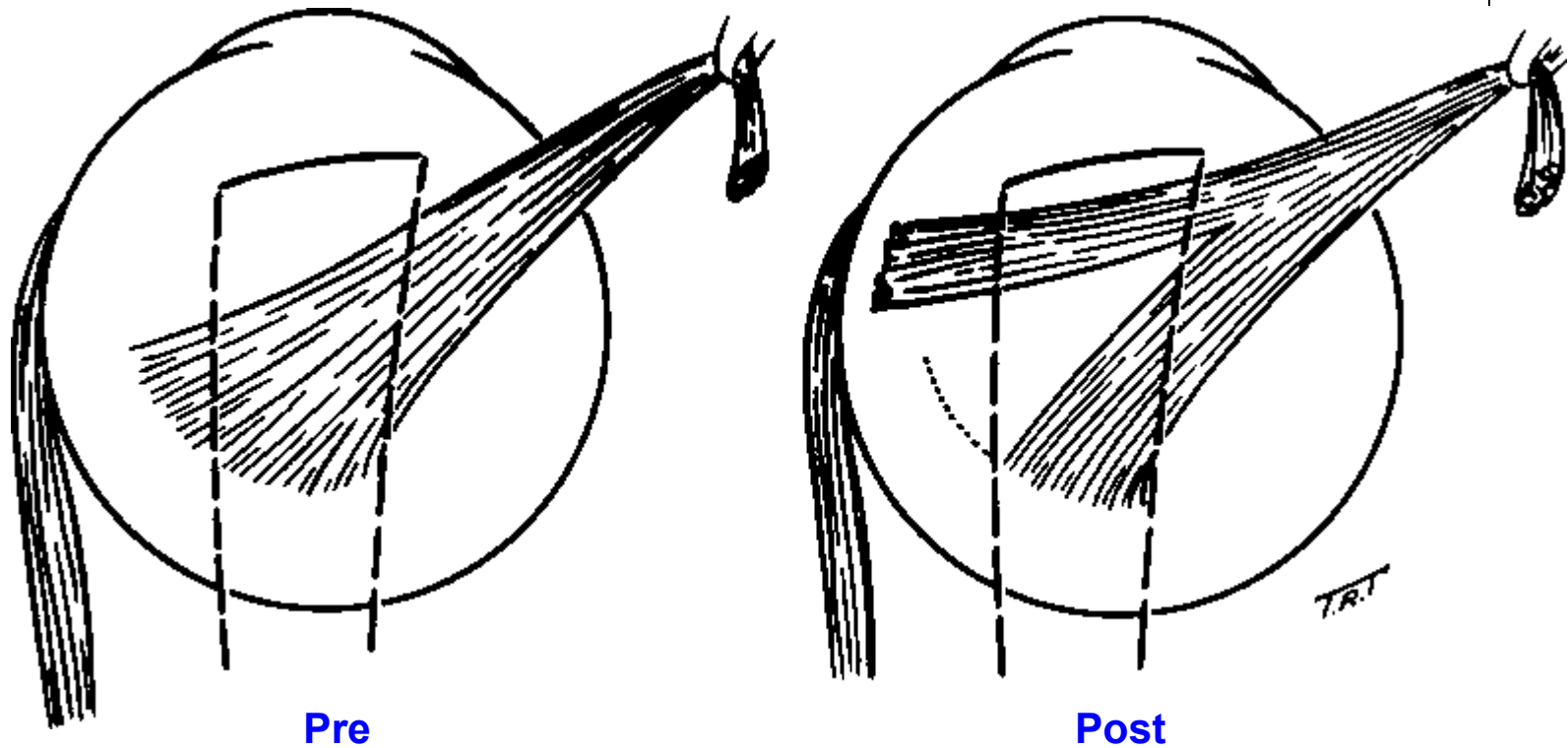
Both SO tendons are split, and the anterior portion of each is repositioned anteriorly and temporally

Management of bilateral SO palsy:

–If main c/o is torsional diplopia: **Harada-Ito procedure**

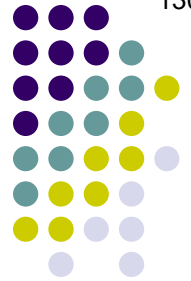


Vertical Deviations



Harada-Ito procedure

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

2° to

Superior
Oblique (SO)

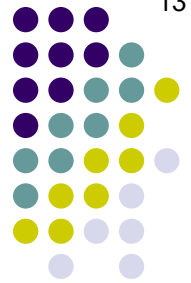
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the two-words system

2° to

Superior
Oblique (SO)

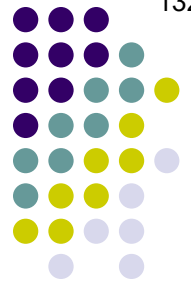
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system

2° to

Superior
Oblique (SO)

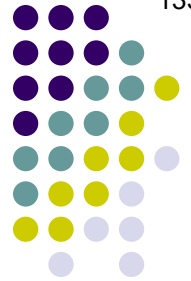
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system
(aka the vestibular-ocular one word)

2° to

Superior
Oblique (SO)

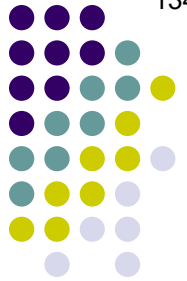
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system
(aka the vestibular-ocular reflex, VOR)

2° to

Superior
Oblique (SO)

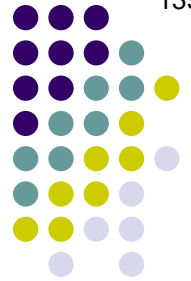
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the
(aka the vestibulo-ocular reflex, VOR)

vestibular-ocular system

What is the vestibular-ocular system?

2

Superior
Oblique (SO)

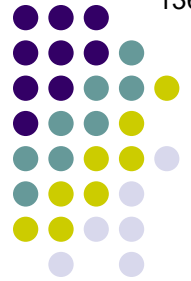
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibulo-ocular reflex, VOR)

vestibular-ocular system

What is the vestibular-ocular system?

It is one of the # ocular motor systems that 1) facilitate bifixation of an object of regard, as well as 2) smoothly and rapidly reorient gaze when a new object of regard is detected in the visual periphery

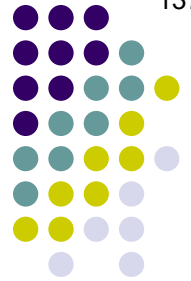
Superior Oblique (SO) Inferior Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibulo-ocular reflex, VOR)

vestibular-ocular system

What is the vestibular-ocular system?

It is one of the six ocular motor systems that 1) facilitate bifixation of an object of regard, as well as 2) smoothly and rapidly reorient gaze when a new object of regard is detected in the visual periphery

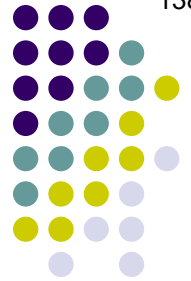
Superior Oblique (SO) Inferior Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibulo-ocular reflex, VOR).

vestibular-ocular system

What is the vestibular-ocular system?

2 It is one of the six ocular motor systems that 1) facilitate bifixation of an object of regard, as well as 2) smoothly and rapidly reorient gaze when a new object of regard is detected in the visual periphery

What general term is used to refer to these six control systems?

Superior
Oblique (SO)

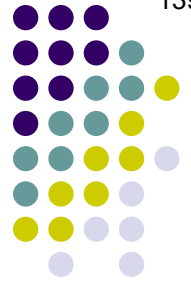
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibulo-ocular reflex, VOR).

vestibular-ocular system

What is the vestibular-ocular system?

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What general term is used to refer to these six control systems?

Because they innervate the nuclei of the peripheral nerves that control eye movements, these systems are referred to as **extraocular** pathways

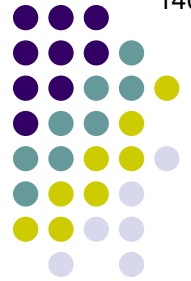
Superior Oblique (SO) Inferior Oblique (IO)

— Overaction

— **Palsy**

— Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibulo-ocular reflex, VOR).

vestibular-ocular system

What is the vestibular-ocular system?

2 It is one of the six ocular motor systems that 1) facilitate bifixation of an object of regard, as well as 2) smoothly and rapidly reorient gaze when a new object of regard is detected in the visual periphery

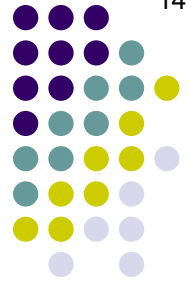
What general term is used to refer to these six control systems?

Because they innervate the nuclei of the peripheral nerves that control eye movements, these systems are referred to as **supranuclear** pathways

Superior Oblique (SO) Inferior Oblique (IO)

- Overaction
- **Palsy**
- Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system
(aka the vestibular-ocular reflex, VOR)

Why is skew deviation being mentioned here?

Superior
Oblique (SO)

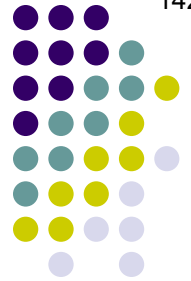
Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

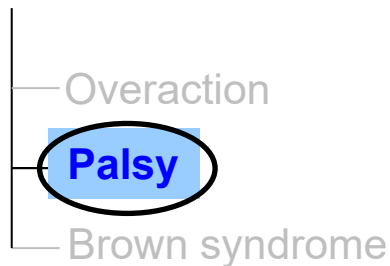
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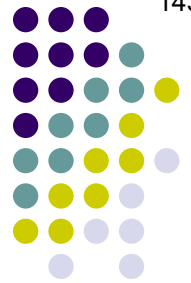
2^o to *Why is skew deviation being mentioned here?*
Because it can easily be mistaken for a SO palsy

Superior
Oblique (SO)

Inferior
Oblique (IO)



Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibular-ocular reflex, VOR)

2° to *Why is skew deviation being mentioned here?*
Because it can easily be mistaken for a SO palsy

Can't they be distinguished via the 3-step test?

Superior
Oblique (SO)

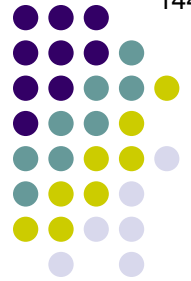
Interior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibular-ocular reflex, VOR)

2° to *Why is skew deviation being mentioned here?*

Because it can easily be mistaken for a SO palsy

Can't they be distinguished via the 3-step test?

Unfortunately no—skew deviation may 'pass' the test as a SO palsy

Superior
Oblique (SO)

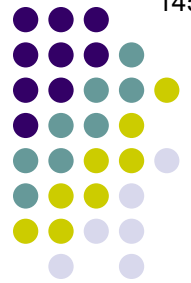
Interior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system
(aka the vestibular-ocular reflex, VOR)

2^o to *Why is skew deviation being mentioned here?*
Because it can easily be mistaken for a SO palsy

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

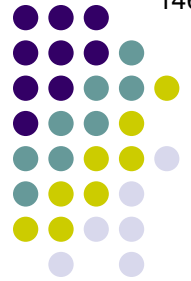
Palsy

Brown syndrome

?

?

Vertical Deviations



Vertical Deviations

In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibular-ocular reflex, VOR)

2° to *Why is skew deviation being mentioned here?*
Because it can easily be mistaken for a SO palsy

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

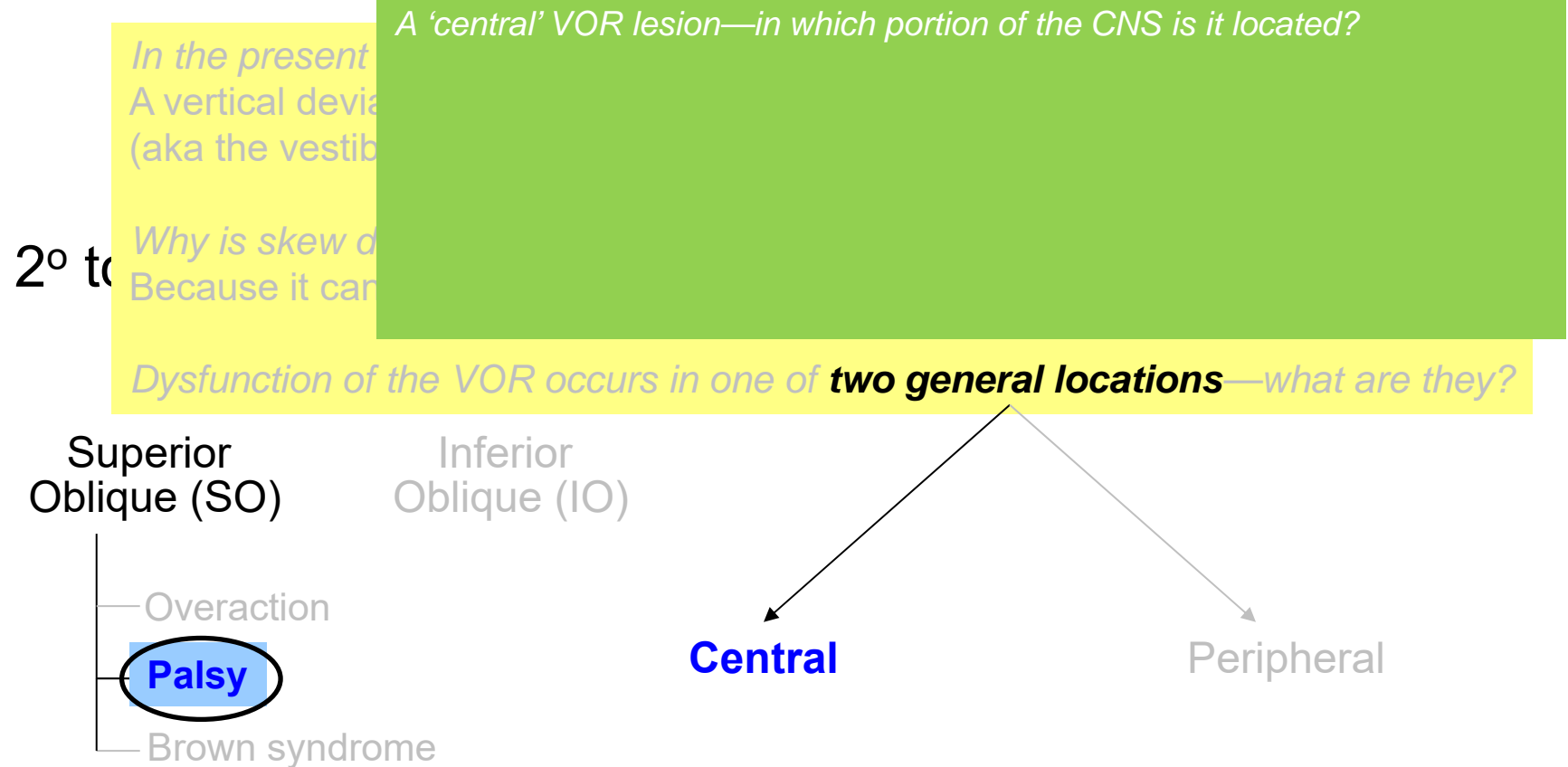
Palsy

Brown syndrome

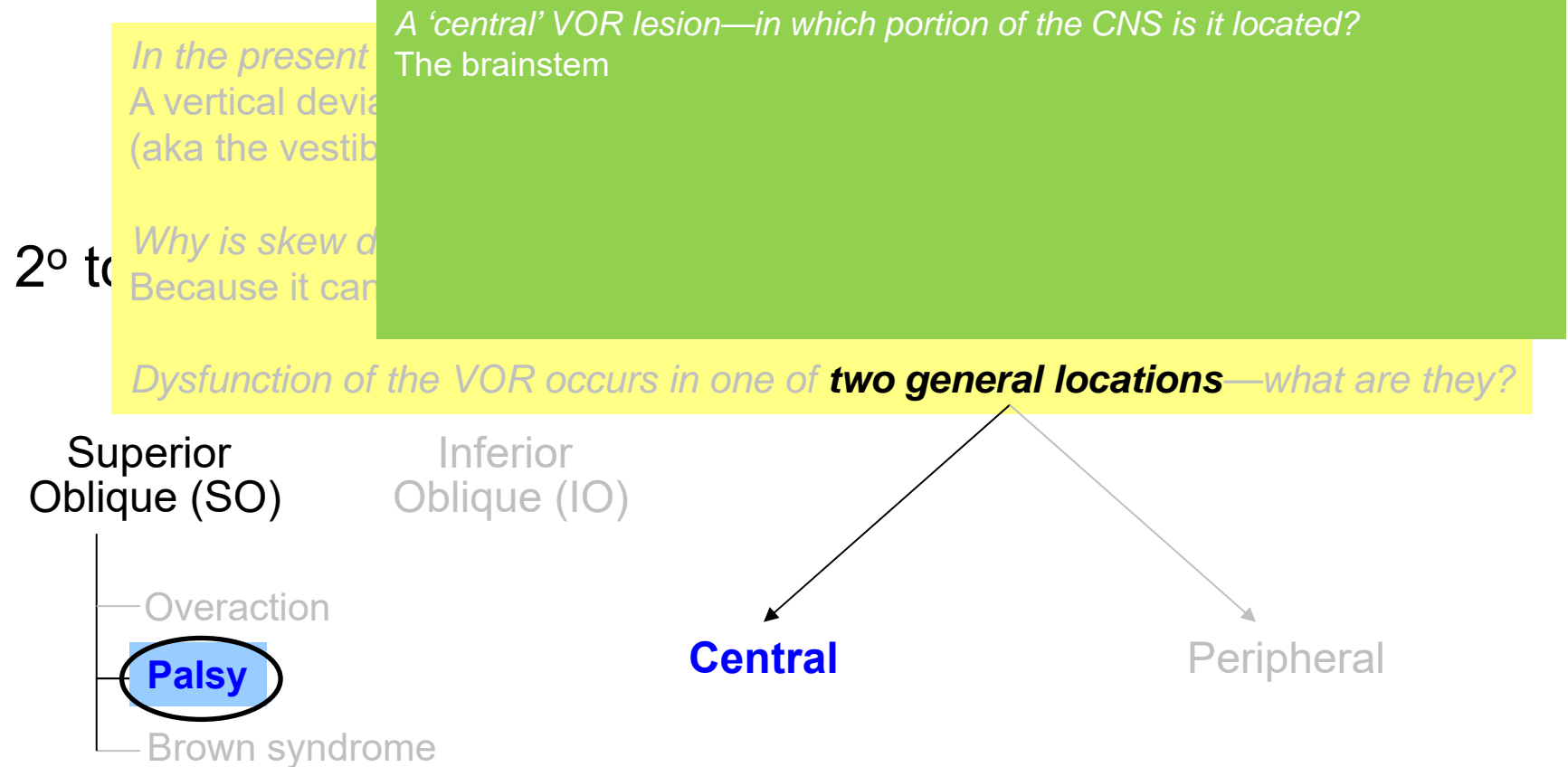
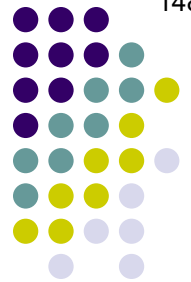
Central

Peripheral

Vertical Deviations



Vertical Deviations



Vertical Deviations



In the present
A vertical deviation
(aka the vestibulo-ocular reflex)
Why is skew deviation?
Because it can be

A 'central' VOR lesion—in which portion of the CNS is it located?
 The brainstem

Likewise, a 'peripheral' VOR lesion—to what structure/area does this locate?

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

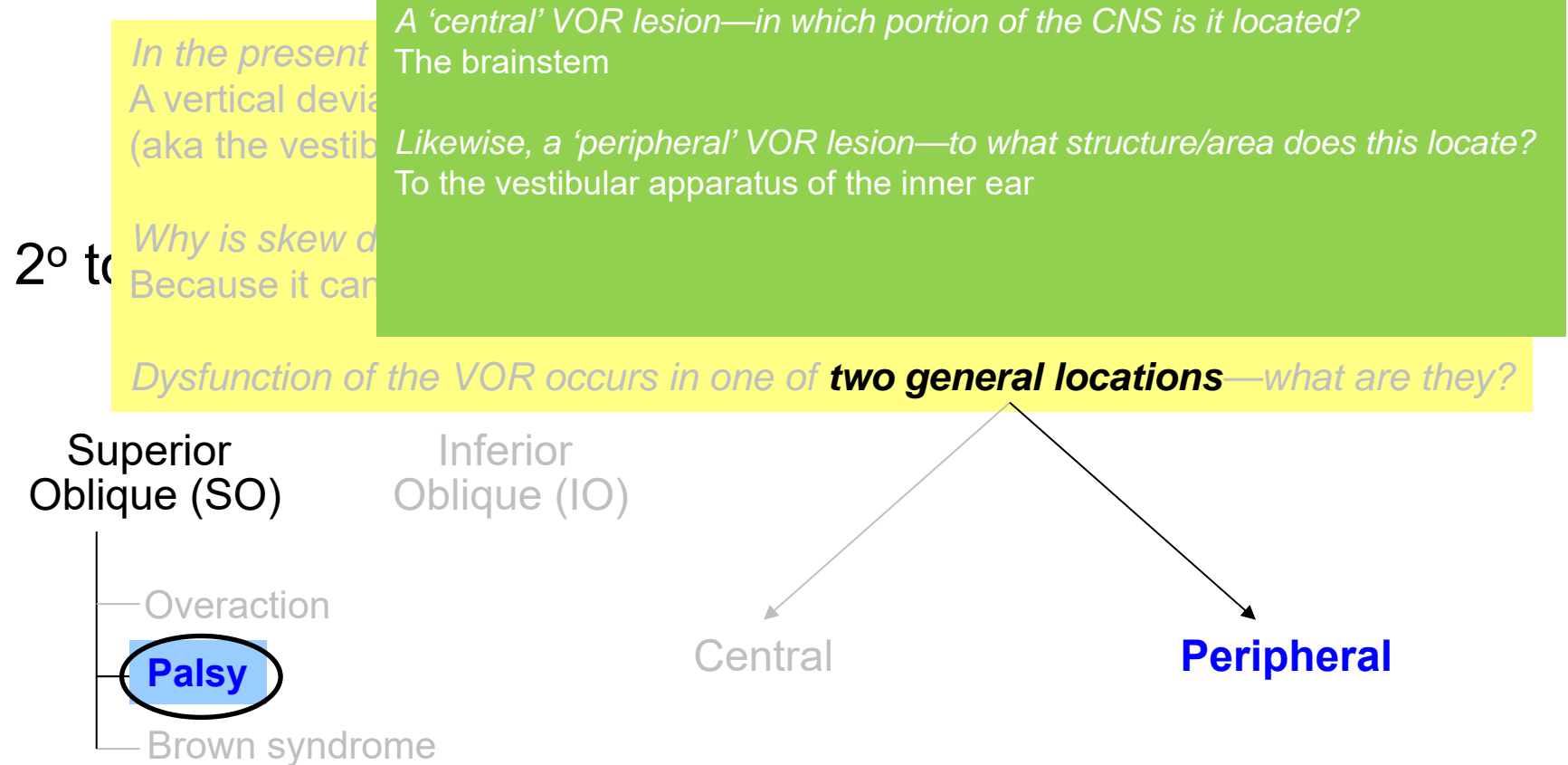
Palsy

Brown syndrome

Central

Peripheral

Vertical Deviations



Vertical Deviations



In the present
A vertical deviation
(aka the vestibulo-ocular reflex)

Why is skew deviation?
Because it can be caused by a dysfunction of the VOR

A 'central' VOR lesion—in which portion of the CNS is it located?
The brainstem

Likewise, a 'peripheral' VOR lesion—to what structure/area does this locate?
To the vestibular apparatus of the inner ear

What are the two major components of the vestibular apparatus?

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Central

Peripheral

?

?

Vertical Deviations



In the present
A vertical deviation
(aka the vestibulo-ocular reflex)

Why is skew deviation?
Because it can be caused by a lesion in the brainstem or the vestibular apparatus of the inner ear

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

A 'central' VOR lesion—in which portion of the CNS is it located?
The brainstem

Likewise, a 'peripheral' VOR lesion—to what structure/area does this locate?
To the vestibular apparatus of the inner ear

What are the two major components of the vestibular apparatus?
The semicircular canals and the otoliths

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

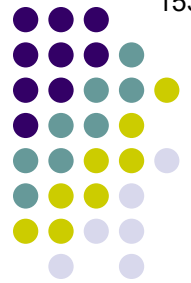
Central

Peripheral

Semicircular
canals

Otoliths

Vertical Deviations



In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibular-ocular reflex, VOR)

2° to *Why is skew deviation being mentioned here?*
Because it can easily be mistaken for a SO palsy

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Central?

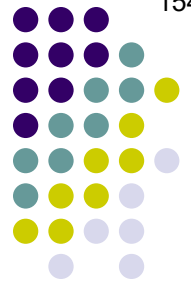
Peripheral

*Semicircular
canals?*

Otoliths?

Of the three locations, damage to which is most likely to result in a skew deviation?

Vertical Deviations



In the present context, what is a skew deviation?

A vertical deviation secondary to dysfunction of the vestibular-ocular system (aka the vestibular-ocular reflex, VOR)

2° to *Why is skew deviation being mentioned here?*
Because it can easily be mistaken for a SO palsy

*Dysfunction of the VOR occurs in one of **two general locations**—what are they?*

Superior
Oblique (SO)

Inferior
Oblique (IO)

Overaction

Palsy

Brown syndrome

Central

Peripheral

Semicircular
canals

Otoliths!

Of the three locations, damage to which is most likely to result in a skew deviation?

The otoliths

Vertical Deviations

They can't reliably be differentiated via the 3-step test...

(No question yet—keep going)

	Positive 3-step test?		
SO palsy	Yes		
Skew	Yes		

Overaction
Palsy
 Brown syndrome

Central

Peripheral

Semicircular
canals

Otoliths!

Of the three locations, damage to which is most likely to result in a skew deviation?
The otoliths

Vertical Deviations

*They can't reliably be differentiated via the 3-step test...But they **can** be differentiated based on a simple clinical observation, as well as a simple maneuver.*

(No question yet—keep going)

	Positive 3-step test?		
SO palsy	Yes		
Skew	Yes		

Overaction

Palsy

Brown syndrome

Central

Peripheral

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canals

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Vertical Deviations

They can't reliably be differentiated via the 3-step test...But they **can** be differentiated based on a simple clinical observation, as well as a simple maneuver.
What is the observation?

	Positive 3-step test?	?	
SO palsy	Yes		
Skew	Yes		

Overaction

Palsy

Brown syndrome

Central

Peripheral

Semicircular
canals

Otoliths!

Of the three locations, damage to which is most likely to result in a skew deviation?
The otoliths

Vertical Deviations

They can't reliably be differentiated via the 3-step test...But they **can** be differentiated based on a simple clinical observation, as well as a simple maneuver.
What is the observation? Is the eye intorted, or extorted?

	Positive 3-step test?	Eye intorted, or extorted?	
SO palsy	Yes		
Skew	Yes		

Overaction
Palsy
 Brown syndrome

Central

Peripheral

Semicircular
canals

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Of the three locations, damage to which is most likely to result in a skew deviation?
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	Positive 3-step test?	Eye intorted, or extorted?	
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Overaction
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What is the observation? Is the eye intorted, or extorted?

	Positive 3-step test?	Eye intorted, or extorted?	
SO palsy	Yes	Extorted	
Skew	Yes	Intorted	

Overaction
Palsy
 Brown syndrome

Central

Peripheral

Semicircular
canals

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Of the three locations, damage to which is most likely to result in a skew deviation?
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	Positive 3-step test?	Eye intorted, or extorted?	
SO palsy	Yes	Extorted	
Skew	Yes	Intorted	

Overaction

Palsy

Brown syndrome

Recall that the SO is an intorter of the eye, so it follows that an SO palsy results in extorsion.

ral

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The otoliths

Semicircular canals

Otoliths!

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Overaction

Palsy

Brown syndrome

Recall that the SO is an intorter of the eye, so it follows that an SO palsy results in extorsion. In contrast, the hyper eye in skew deviation is usually **intorted**.

Of the three locations, damage to which is most likely to result in a skew deviation?
The otoliths

Semicircular canals

Otoliths!

Vertical Deviations

They can't reliably be differentiated via the 3-step test...But they **can** be differentiated based on a simple clinical observation, as well as a simple maneuver. What is the observation? Is the eye intorted, or extorted?

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Overaction

Palsy

Brown

Recall that the SO is an intorter of the eye, so it follows that an SO palsy results in extorsion. In contrast, the hyper eye in skew deviation is usually **intorted**.

How does one go about determining whether an eye is intorted or extorted?

Of the most likely to result in a skew deviation:
The otoliths

Semicircular canals

Otoliths!

Vertical Deviations

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Overaction

Palsy

Brown

Recall that the SO is an intorter of the eye, so it follows that an SO palsy results in **extorsion**. In contrast, the hyper eye in skew deviation is usually **intorted**.

How does one go about determining whether an eye is intorted or extorted? Probably the best method is via DFE, by taking note of the relative positions of the ONH and macula

Of the most likely to result in a skew deviation:
The otoliths

Semicircular canals

Otoliths!

Vertical Deviations

They can't reliably be differentiated via the 3-step test...But they **can** be differentiated based on a simple clinical observation, as well as a simple maneuver.

What is the observation? Is the eye intorted, or extorted?

What is the maneuver?

		Positive 3-step test?	Eye intorted, or extorted?	?
Next	SCN	Yes	Extorted	
	SN	Yes	Intorted	

Overaction

Palsy

Brown syndrome

Central

Peripheral

Semicircular
canals

Otoliths!

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Vertical Deviations

They can't reliably be differentiated via the 3-step test...But they **can** be differentiated based on a simple clinical observation, as well as a simple maneuver.

What is the observation? Is the eye intorted, or extorted?

What is the maneuver? Does the hyper resolve if the pt lies supine?

		Positive 3-step test?	Eye intorted, or extorted?	Resolves when supine?
Next	SCN	Yes	Extorted	
	SN	Yes	Intorted	

Palsy

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Central

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Vertical Deviations

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What is the observation? Is the eye intorted, or extorted?

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	Positive 3-step test?	Eye intorted, or extorted?	Resolves when supine?
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Vertical Deviations

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	Positive 3-step test?	Eye intorted, or extorted?	Resolves when supine?
SO palsy	Yes	Extorted	No
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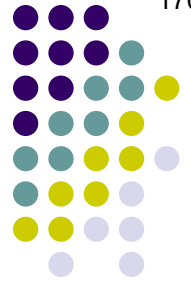
Overaction
Palsy
 Brown syndrome

Take note—these are the traits that differentiate skew from SO palsy!

Of the three locations, damage to which is most likely to result in a skew deviation?
The otoliths

Semicircular canals

Otoliths!



Vertical Deviations

Vertical Deviations

*Define **Brown syndrome**:*

2° to oblique dysfunction

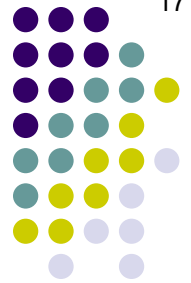
Superior
Oblique (SO)

Inferior
Oblique

Overaction

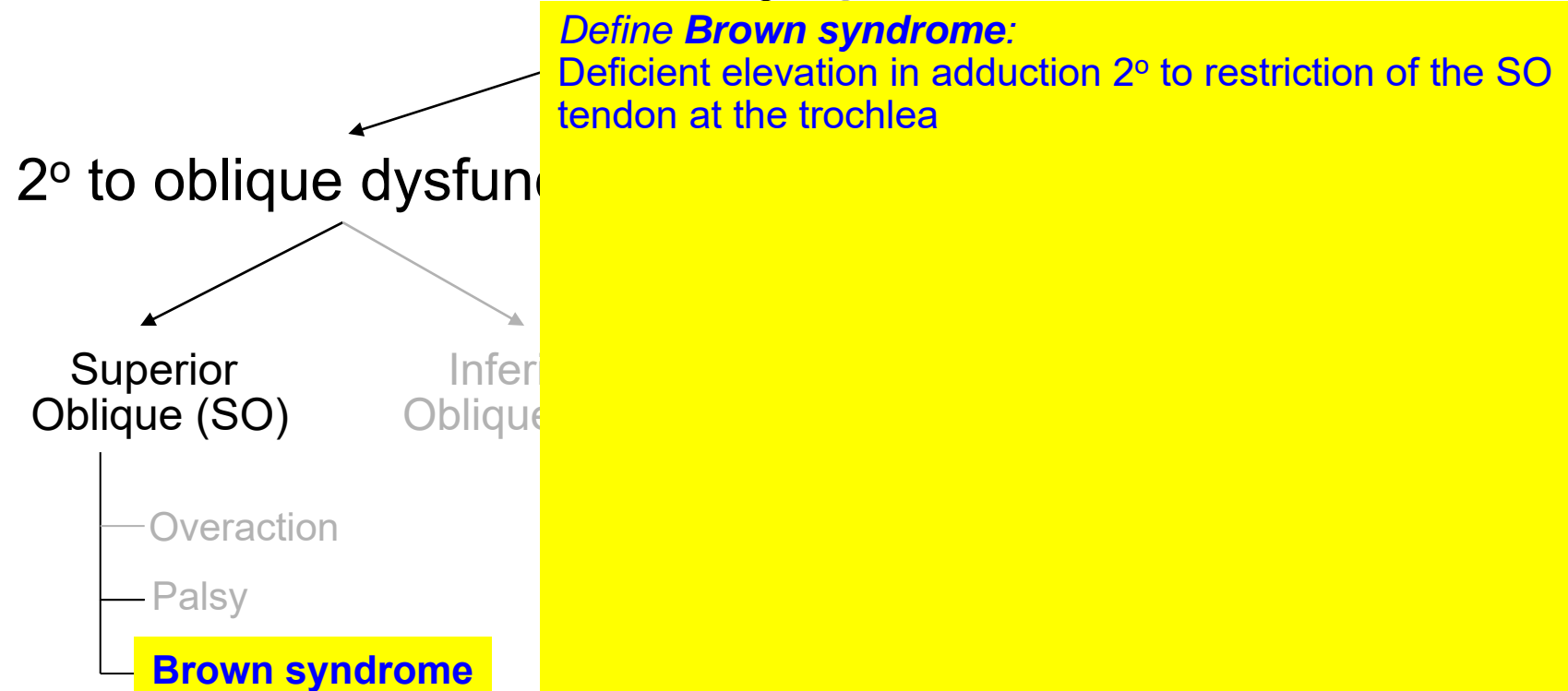
Palsy

Brown syndrome

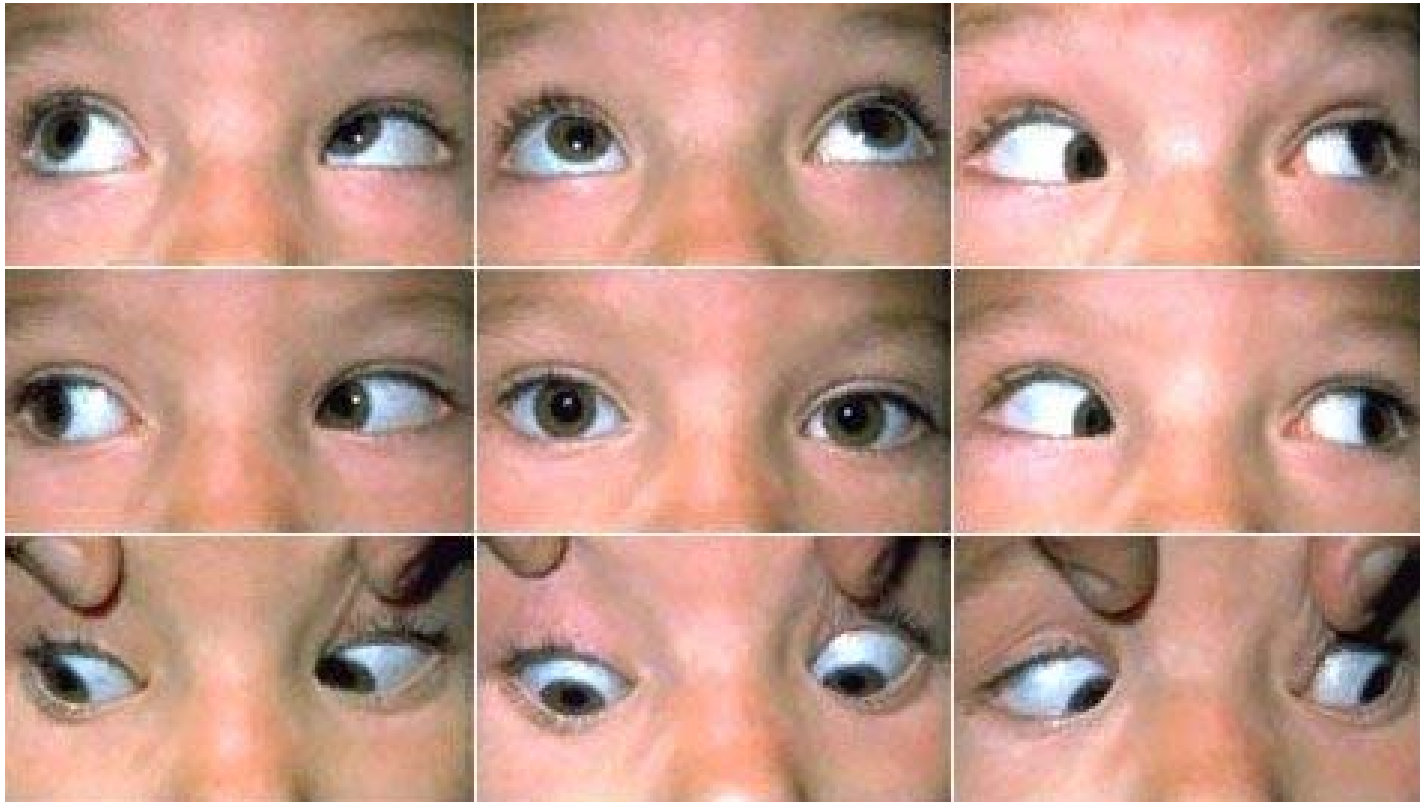


Vertical Deviations

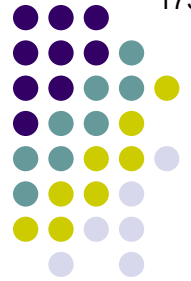
Vertical Deviations



Vertical Deviations



Right Brown syndrome



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Overaction

Palsy

Brown syndrome

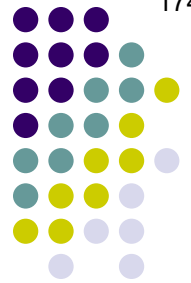
*Define **Brown syndrome**:*

Deficient elevation in adduction 2° to restriction of the SO tendon at the trochlea

Is Brown syndrome more common in...

...males or females?

...OD or OS?



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
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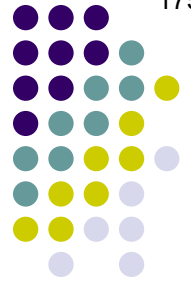
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Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

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Oblique (SO)

Overaction

Palsy

Brown syndrome

Inferior
Oblique

*Define **Brown syndrome**:*

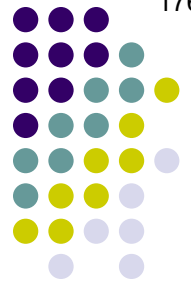
Deficient elevation in adduction 2° to restriction of the SO tendon at the trochlea

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*...OD or OS? **OD***

*What common strabismus syndrome has the opposite pattern (i.e., is more common in **females** and **left eyes**)?*



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

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Oblique (SO)

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Duane syndrome



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Vertical Deviations

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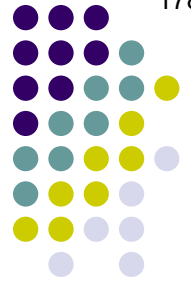
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*What common strabismus syndrome has the opposite pattern (i.e., is more common in **females** and **left eyes**)?*

Duane syndrome

Name three causes of SO restriction at the trochlea:

--
--
--



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Overaction

Palsy

Brown syndrome

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Oblique

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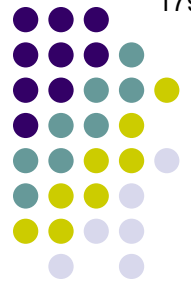
Duane syndrome

Name three causes of SO restriction at the trochlea:

--**Idiopathic/congenital** (ie, born with a short tendon)

--**Traumatic**

--**Inflammatory**



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Overaction

Palsy

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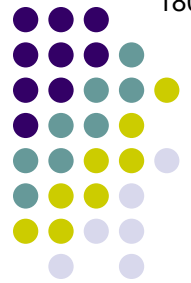
--**Traumatic**

--**Inflammatory**

In addition to restricted elevation, what else occurs during adduction in Brown syndrome?

--

--



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

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Palsy

Brown syndrome

Inferior
Oblique

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Duane syndrome

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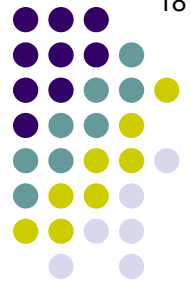
--**Traumatic**

--**Inflammatory**

In addition to restricted elevation, what else occurs during adduction in Brown syndrome?

--The palpebral fissure widens

--The eye may involuntarily depress (called *downshoot*)



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique

Define **Brown syndrome**:

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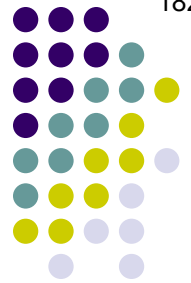
Duane syndrome

Briefly, what is Duane syndrome?

restriction at the trochlea:
(born with a short tendon)

on, what else occurs during

the eye may involuntarily depress (called *downshoot*)



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
Oblique (IO)

Define Brown syndrome:

Deficient elevation in adduction 2° to restriction of the SO tendon at the trochlea

Is Brown syndrome more common in...

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What common strabismus syndrome has the opposite pattern (i.e., is more common in females and left eyes)?

Duane syndrome

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

--At least some limitation of **direction** movement

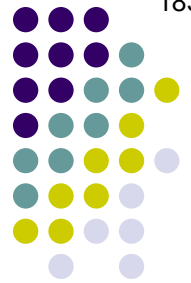
restriction at the trochlea:

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Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

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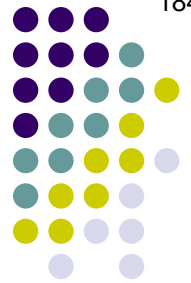
--At least some limitation of horizontal movement

restriction at the trochlea:

(born with a short tendon)

on, what else occurs during

the eye may involuntarily depress (called downshoot)



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

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Oblique (SO)

Inferior
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Duane syndrome

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

--At least some limitation of horizontal movement

-- Attempted **movement** causes the globe to **one word**, and may cause it to

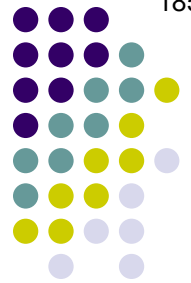
this or that movement

restriction at the trochlea:

born with a short tendon)

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Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

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Duane syndrome

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

--At least some limitation of horizontal movement

-- Attempted adduction causes the globe to retract, and may cause it to up- or downshoot

restriction at the trochlea:

born with a short tendon)

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Vertical Deviations

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2° to oblique dysfunction

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Oblique (SO)

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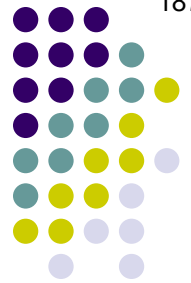
What is the cause?

restriction at the trochlea:

born with a short tendon)

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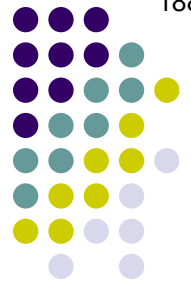
The nucleus for cranial nerve # is missing, and the [] rectus is innervated by cranial nerve #

restriction at the trochlea:

born with a short tendon)

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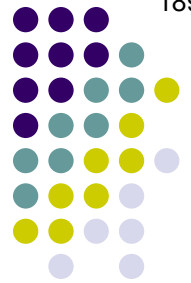
The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

restriction at the trochlea:

(born with a short tendon)

on, what else occurs during

the eye may involuntarily depress (called downshoot)



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

Inferior
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No question yet, keep going

What is the cause?

The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

restriction at the trochlea:

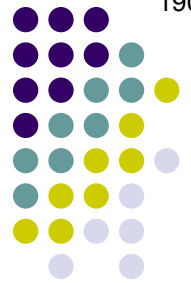
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on, what else occurs during

How does this...

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Vertical Deviations



Vertical Deviations

2° to oblique dysfunction

Superior
Oblique (SO)

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...OD or OS? **OD**

What common strabismus syndrome has the opposite pattern (i.e., is more common in females and left eyes)?

Duane syndrome

Briefly, what is Duane syndrome?

A motility disorder with the following key findings:

- At least some limitation of horizontal movement
- Attempted adduction causes the globe to retract, and may cause it to up- or downshoot

What is the cause?

The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

*No question yet, keep going
(this one is rhetorical)*

*restriction at the trochlea:
(born with a short tendon)*

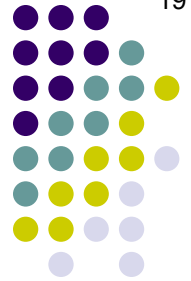
...cause this?

on, what else occurs during

How does this...

the eye may involuntarily depress (called downshoot)

Vertical Deviations



Vertical Deviations

When someone with an intact oculomotor system adducts their eye, innervation is increased to the medial rectus (as it should be) and decreased to the lateral rectus (also as it should be).

(No question—continue when ready)

Superior
Oblique (SO)

Inferior
Oblique

What common strabismus syndrome has the opposite pattern (i.e., is more common in females than males)?

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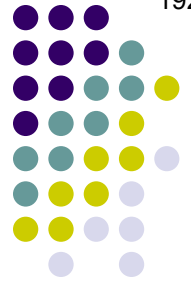
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Vertical Deviations

When someone with an intact oculomotor system adducts their eye, innervation is increased to the medial rectus (as it should be) and decreased to the lateral rectus (also as it should be). However, in a Duane's pt CN3 innervates the LR, so when she attempts to adduct **her** eye, innervation is increased to both the medial rectus **and** the aberrantly-innervated lateral rectus, **so the eye doesn't adduct.**

(No question—continue when ready)

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Oblique (SO)

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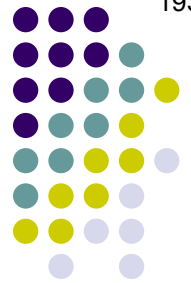
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(No question—continue when ready)

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Oblique (SO)

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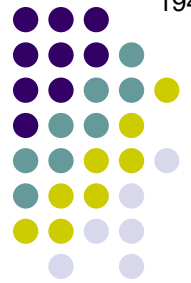
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Oblique (SO)

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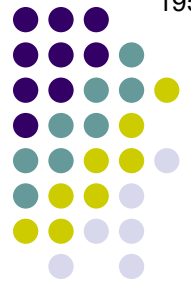
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Vertical Deviations

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This finding—that increased innervation to an agonist muscles is accompanied by a simultaneous decrease in innervation to its antagonist—is ubiquitous to have been ratified into law. What is the eponymous name of the law of ‘reciprocal innervation’?

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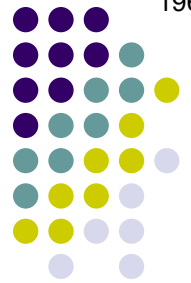
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This finding—that increased innervation to an agonist muscles is accompanied by a simultaneous decrease in innervation to its antagonist—is ubiquitous to have been ratified into law. What is the eponymous name of the law of ‘reciprocal innervation’?

Sherrington's law. You should note that Duane syndrome is an exception to Sherrington's law (this is noteworthy because it would make a good OKAP question)

Superior
Oblique (SO)

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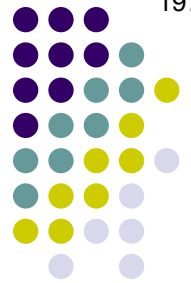
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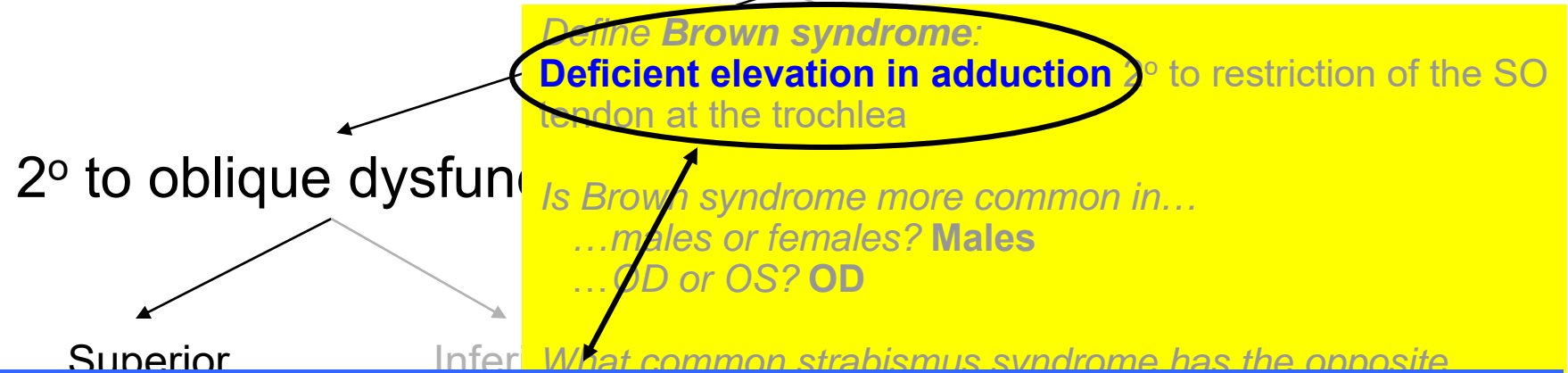
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Vertical Deviations



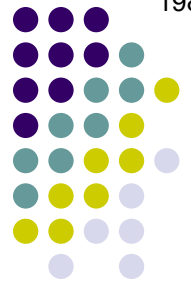
Vertical Deviations



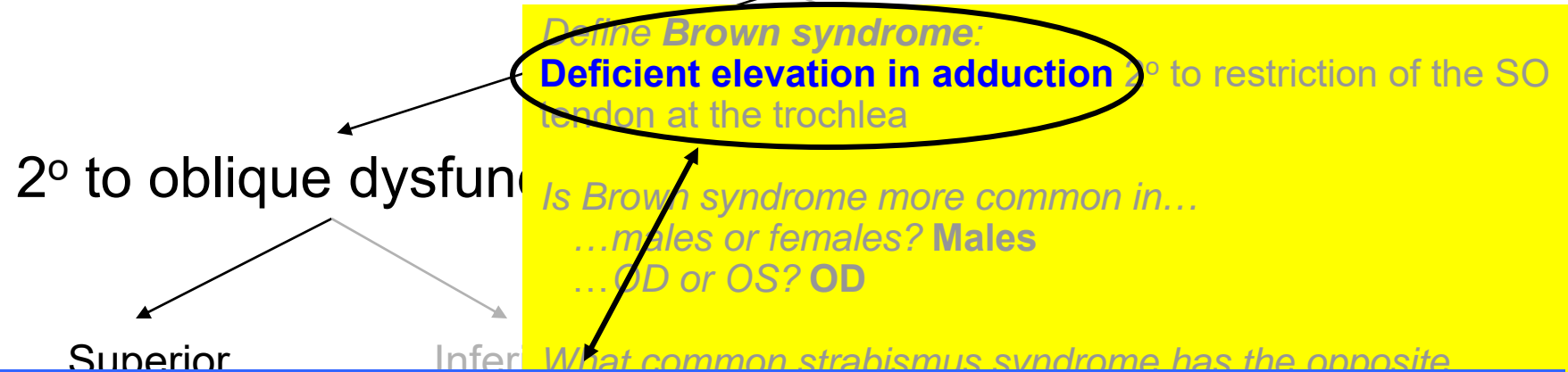
What other two entities could produce restriction of elevation in adduction?

- 1)
- 2)

Vertical Deviations



Vertical Deviations



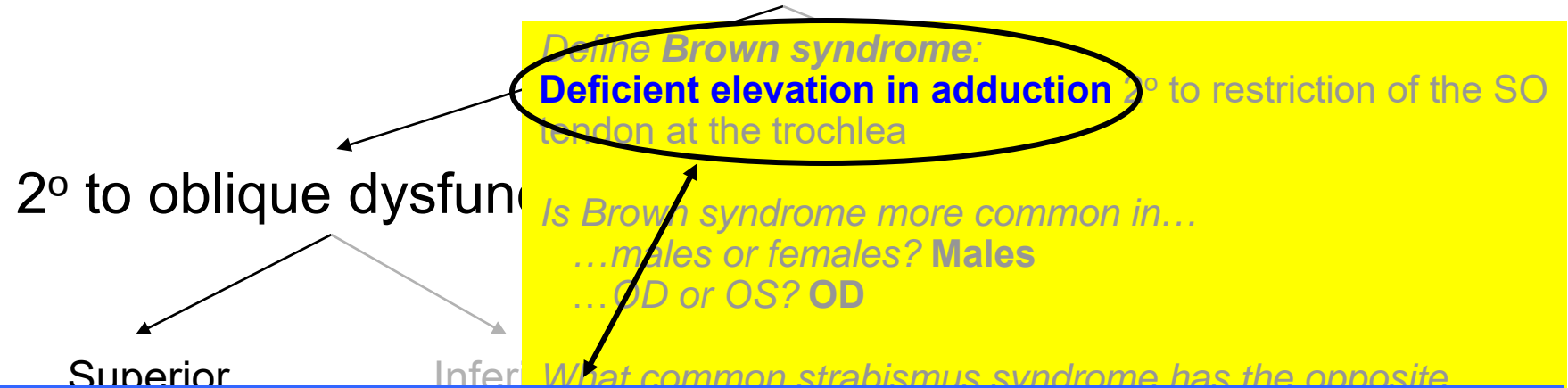
What other two entities could produce restriction of elevation in adduction?

- 1) IR restriction
- 2) IO palsy



Vertical Deviations

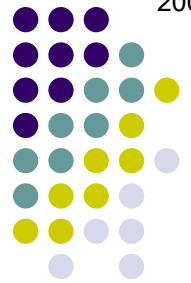
Vertical Deviations



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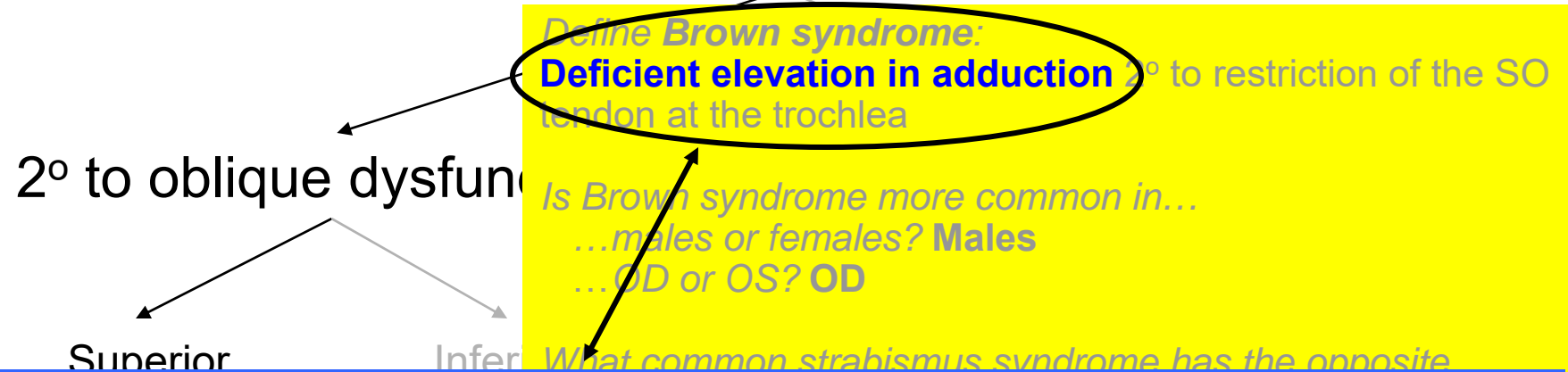
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What clinical exam finding **must** be present if one is to make the diagnosis of Brown syndrome?



Vertical Deviations

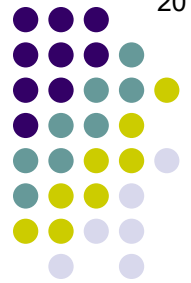
Vertical Deviations



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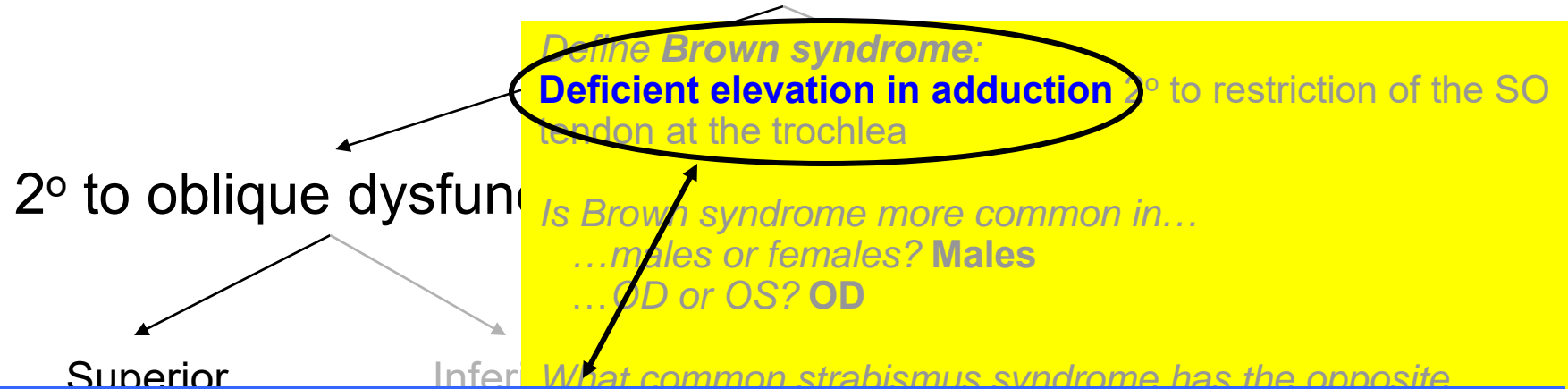
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What clinical exam finding **must** be present if one is to make the diagnosis of Brown syndrome?
 Forced ductions testing must be positive (i.e., indicate restriction)



Vertical Deviations

Vertical Deviations



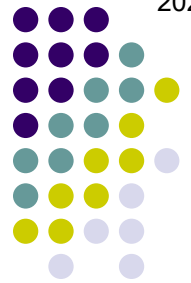
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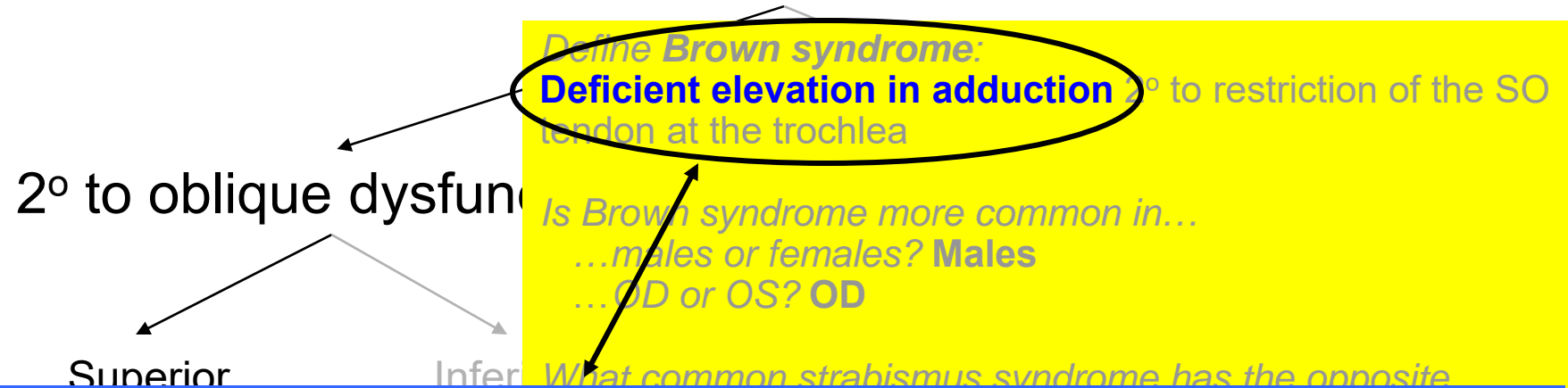
Forced ductions testing must be positive (i.e., indicate restriction)

But forced ductions are positive in IR restriction as well—how can the two conditions be differentiated?



Vertical Deviations

Vertical Deviations



What other two entities could produce restriction of elevation in adduction?

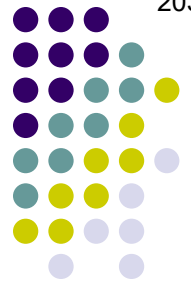
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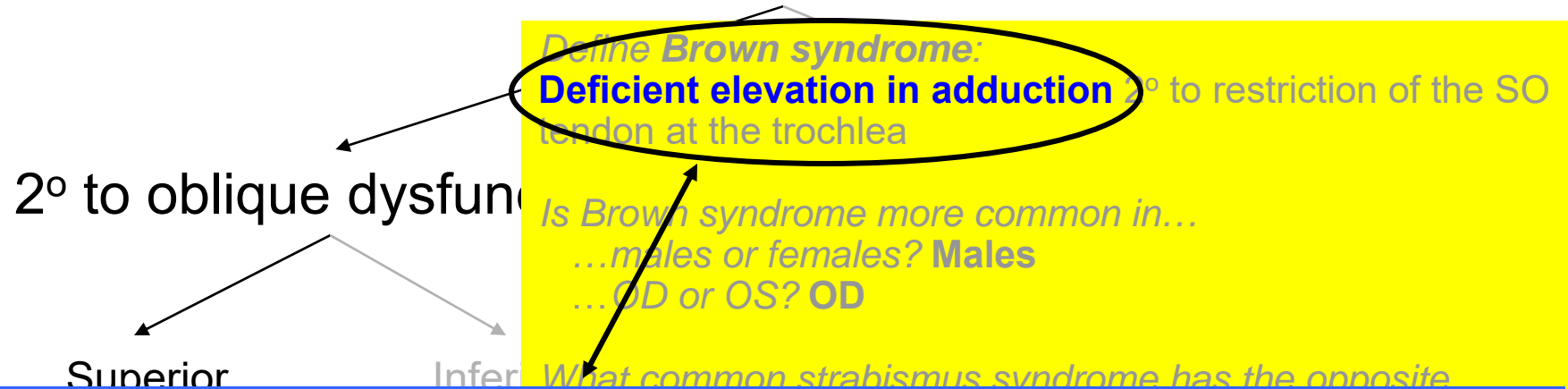
But forced ductions are positive in IR restriction as well—how can the two conditions be differentiated?

By the globe while performing forced ductions.



Vertical Deviations

Vertical Deviations



What other two entities could produce restriction of elevation in adduction?

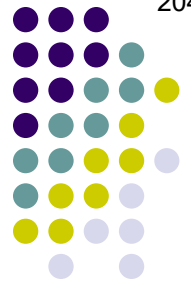
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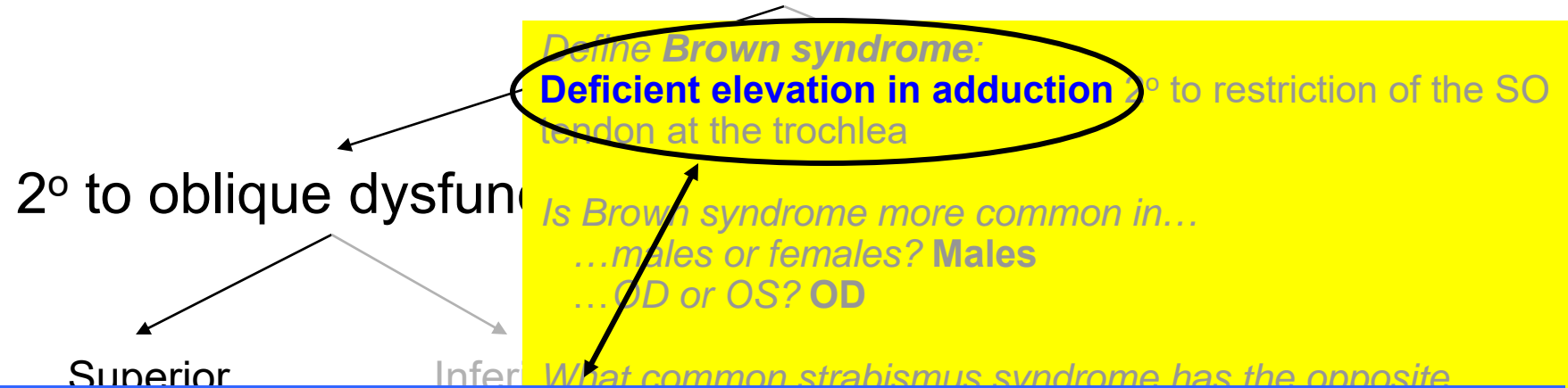
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Vertical Deviations

Vertical Deviations



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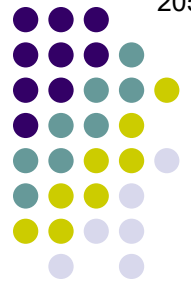
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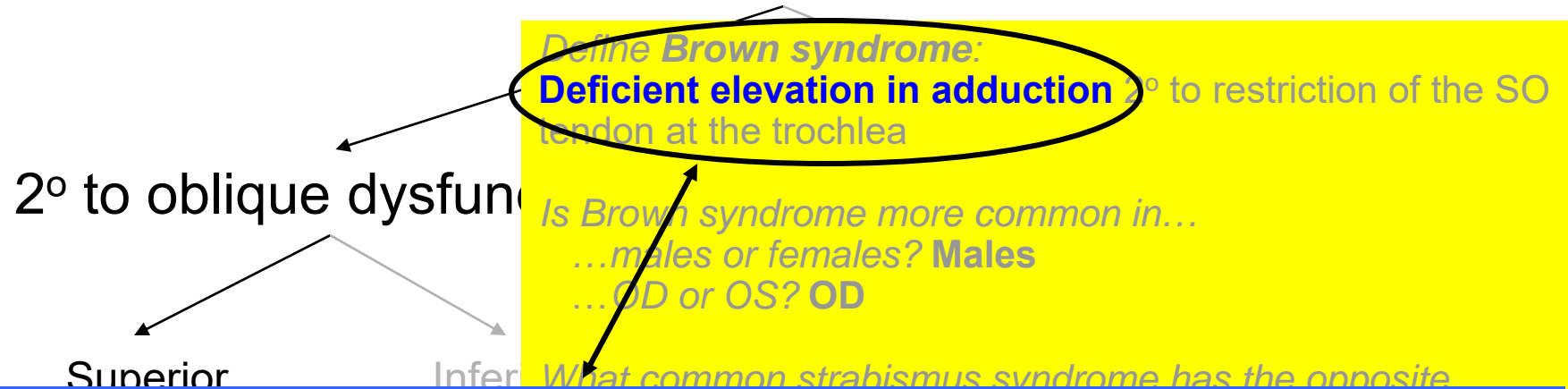
But forced ductions are positive in IR restriction as well—how can the two conditions be differentiated?

By retropulsing the globe while performing forced ductions. In IR restriction, retropulsion takes the muscle **off** stretch, thereby rendering forced ductions 'less positive.' In contrast, retropulsion places the SO tendon **on** stretch, and thus retropulsion will render the forced ductions 'more positive' in Brown syndrome.



Vertical Deviations

Vertical Deviations



What other two entities could produce restriction of elevation in adduction?

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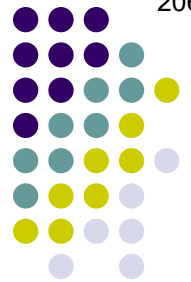
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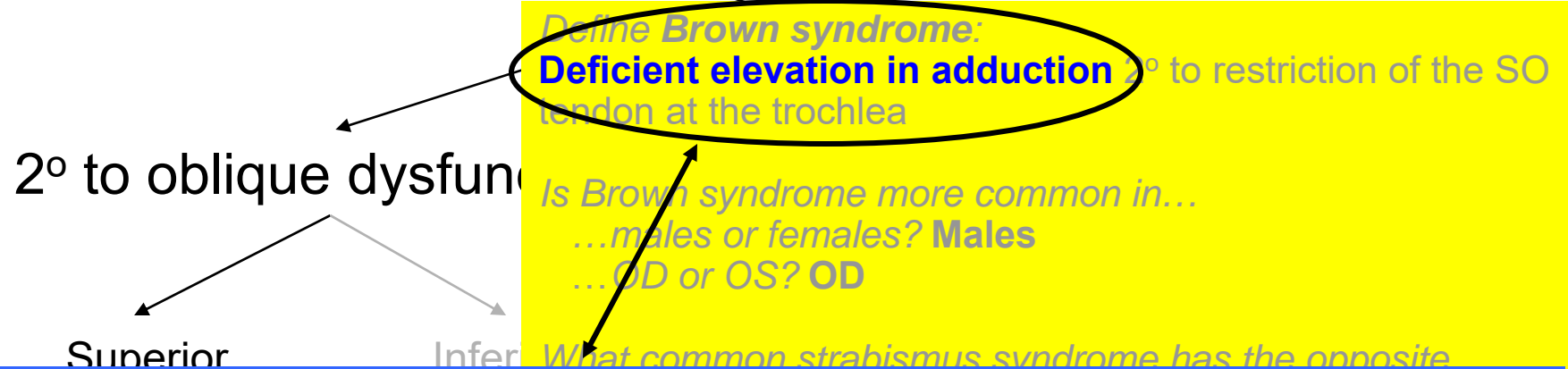
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Vertical Deviations



Vertical Deviations



Differentiating Brown syndrome from IO palsy

	Forced ductions?		
IO Palsy			
Brown Syndrome			

What other two
 1) IR restriction
 2) IO palsy

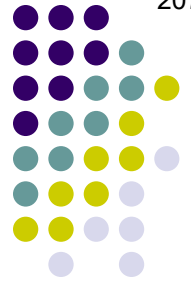
What clinical e
 Forced duction

But forced duc
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 forced duction

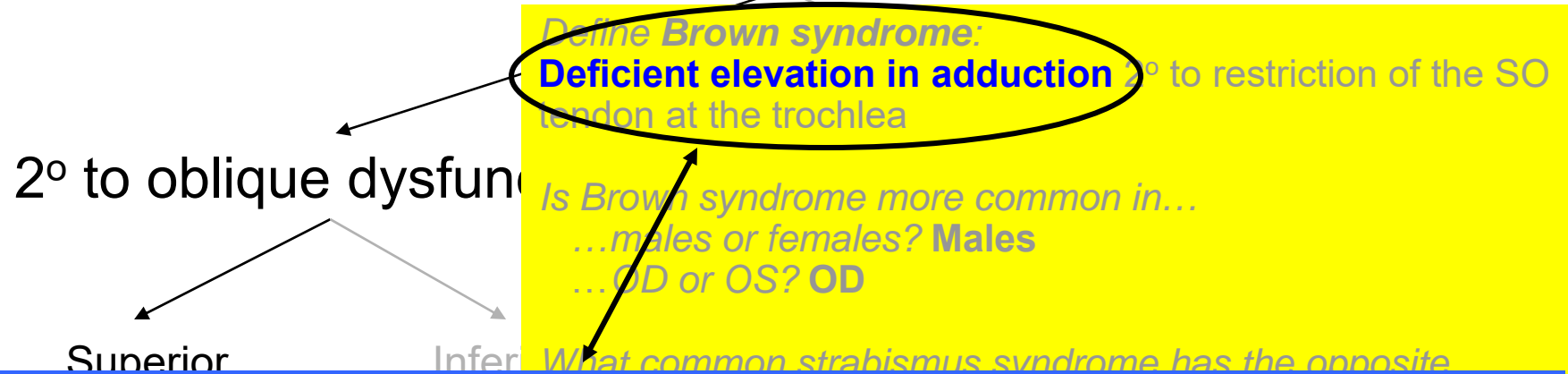
own syndrome?

ons be differentiated?
 pulsion takes the
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 prior to performing

Vertical Deviations



Vertical Deviations



Differentiating Brown syndrome from IO palsy

	Forced ductions?		
IO Palsy	Negative		
Brown Syndrome	Positive		

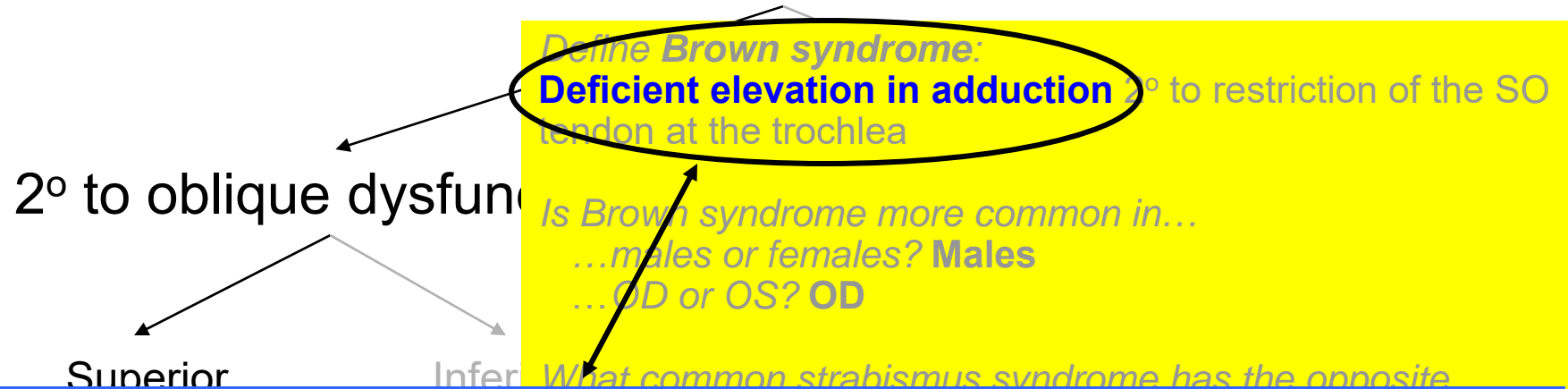
...Brown syndrome?

...How can they be differentiated?
 ...By retropulsing the SO tendon. In Brown syndrome, retropulsion places the SO tendon 'more positive' in the trochlea prior to performing forced duction.

Vertical Deviations



Vertical Deviations



Differentiating Brown syndrome from IO palsy

	Forced ductions?	Strabismus pattern?	
IO Palsy	Negative		
Brown Syndrome	Positive		

What other two
 1) IR restriction
 2) IO palsy

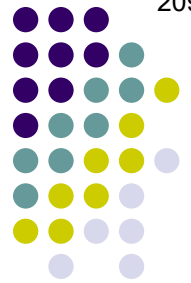
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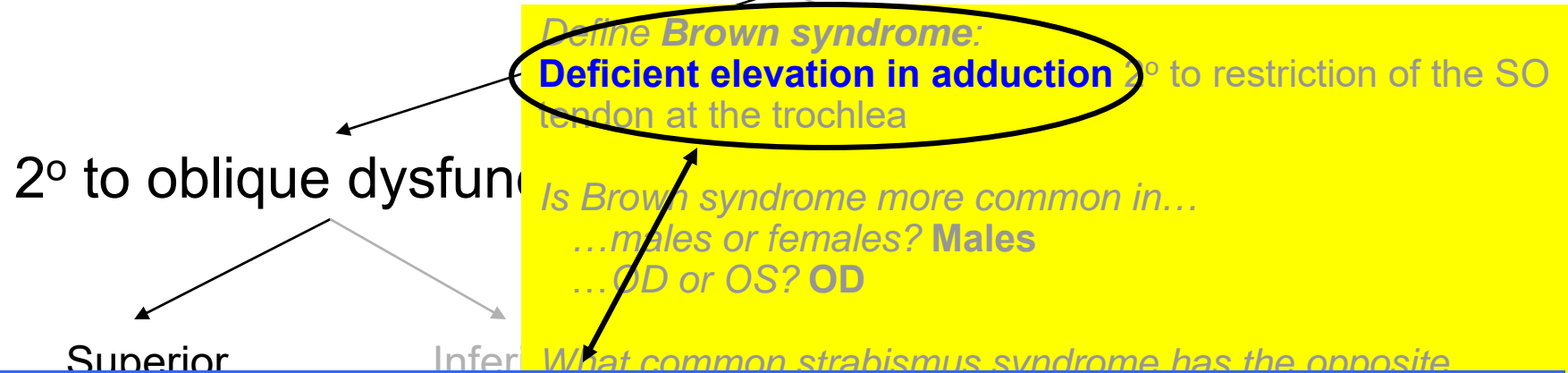
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 prior to performing

Vertical Deviations



Vertical Deviations



Differentiating Brown syndrome from IO palsy

	Forced ductions?	Strabismus pattern?	
IO Palsy	Negative	A pattern	
Brown Syndrome	Positive	V pattern	

What other two
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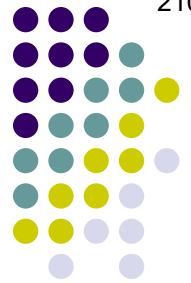
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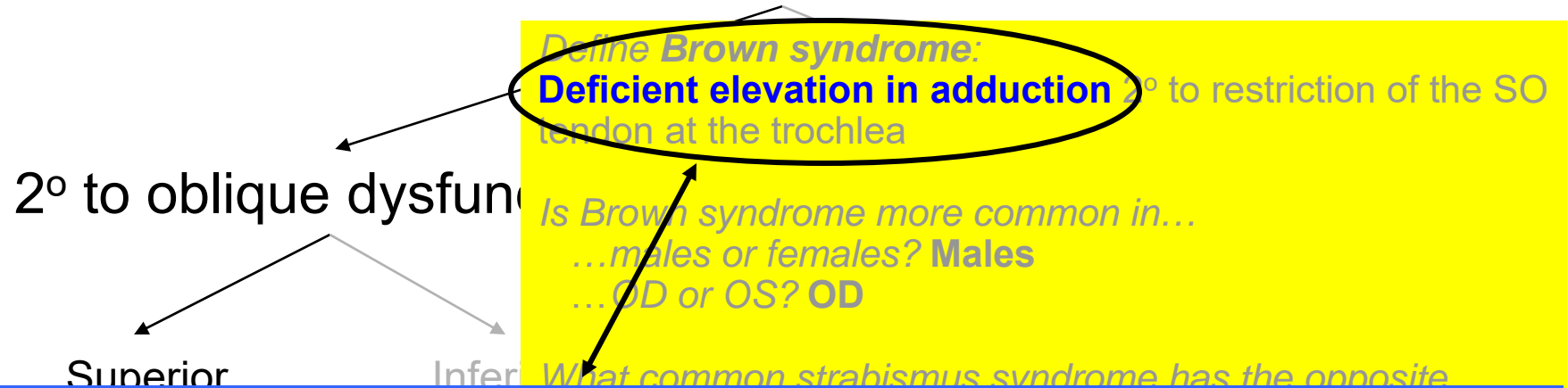
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Vertical Deviations



Vertical Deviations



Differentiating Brown syndrome from IO palsy

	Forced ductions?	Strabismus pattern?	SO overaction?
IO Palsy	Negative	A pattern	
Brown Syndrome	Positive	V pattern	

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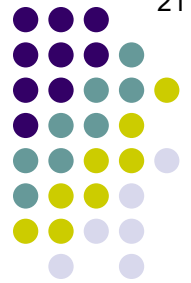
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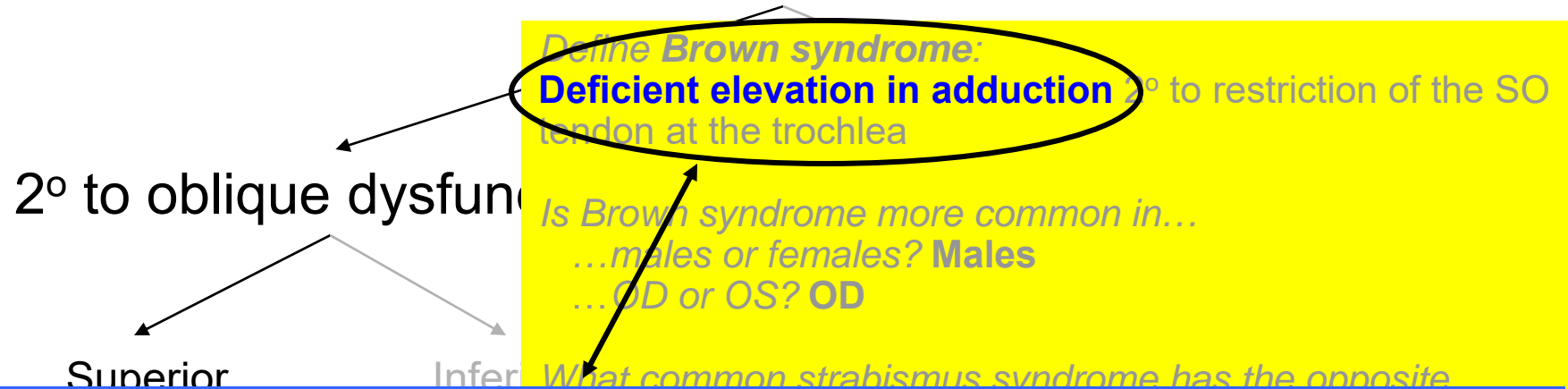
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Vertical Deviations



Vertical Deviations



Differentiating Brown syndrome from IO palsy

	Forced ductions?	Strabismus pattern?	SO overaction?
IO Palsy	Negative	A pattern	Present
Brown Syndrome	Positive	V pattern	Absent

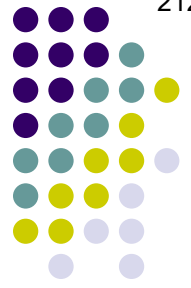
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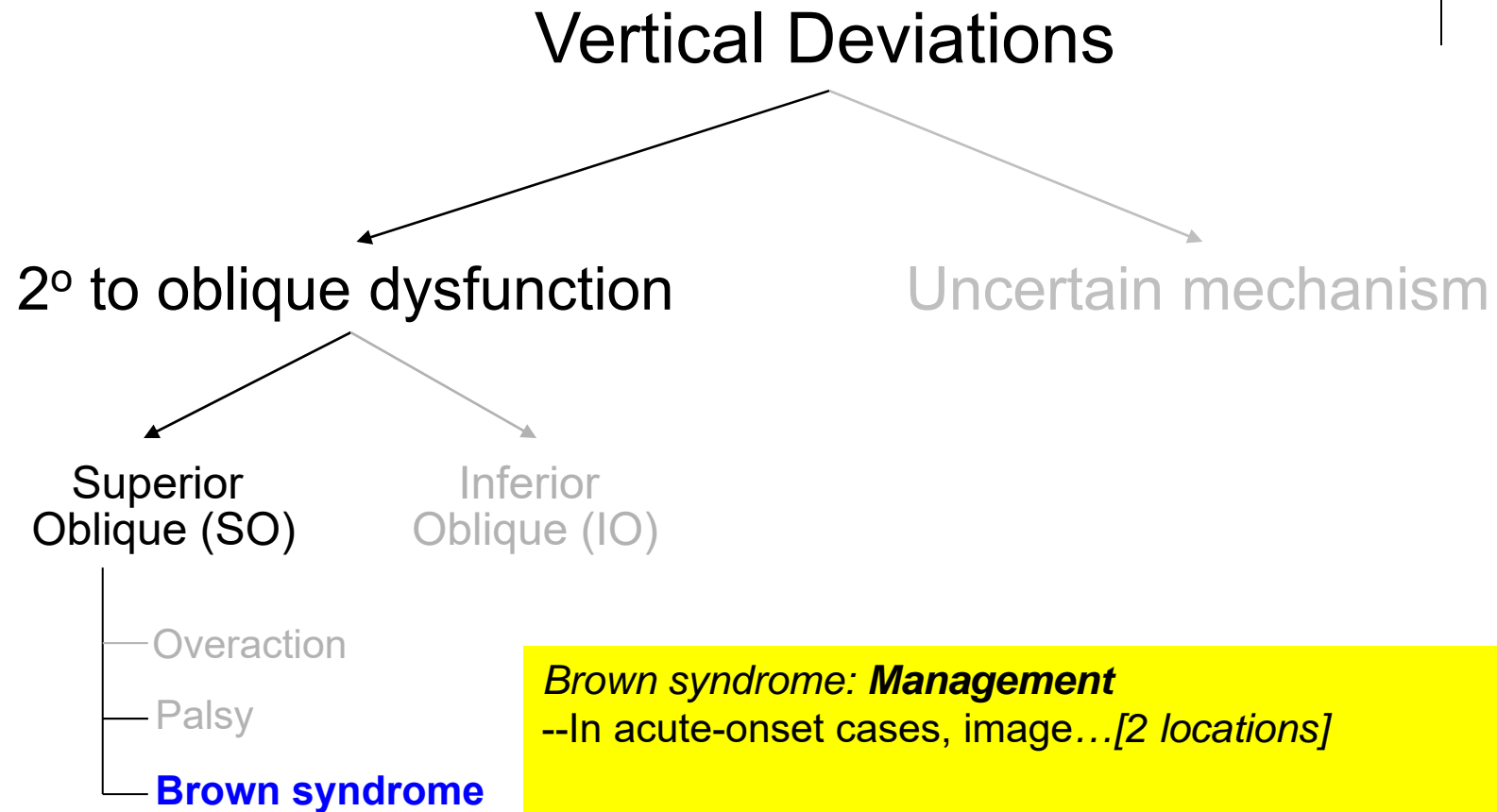
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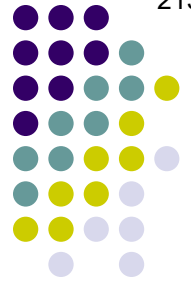


Vertical Deviations

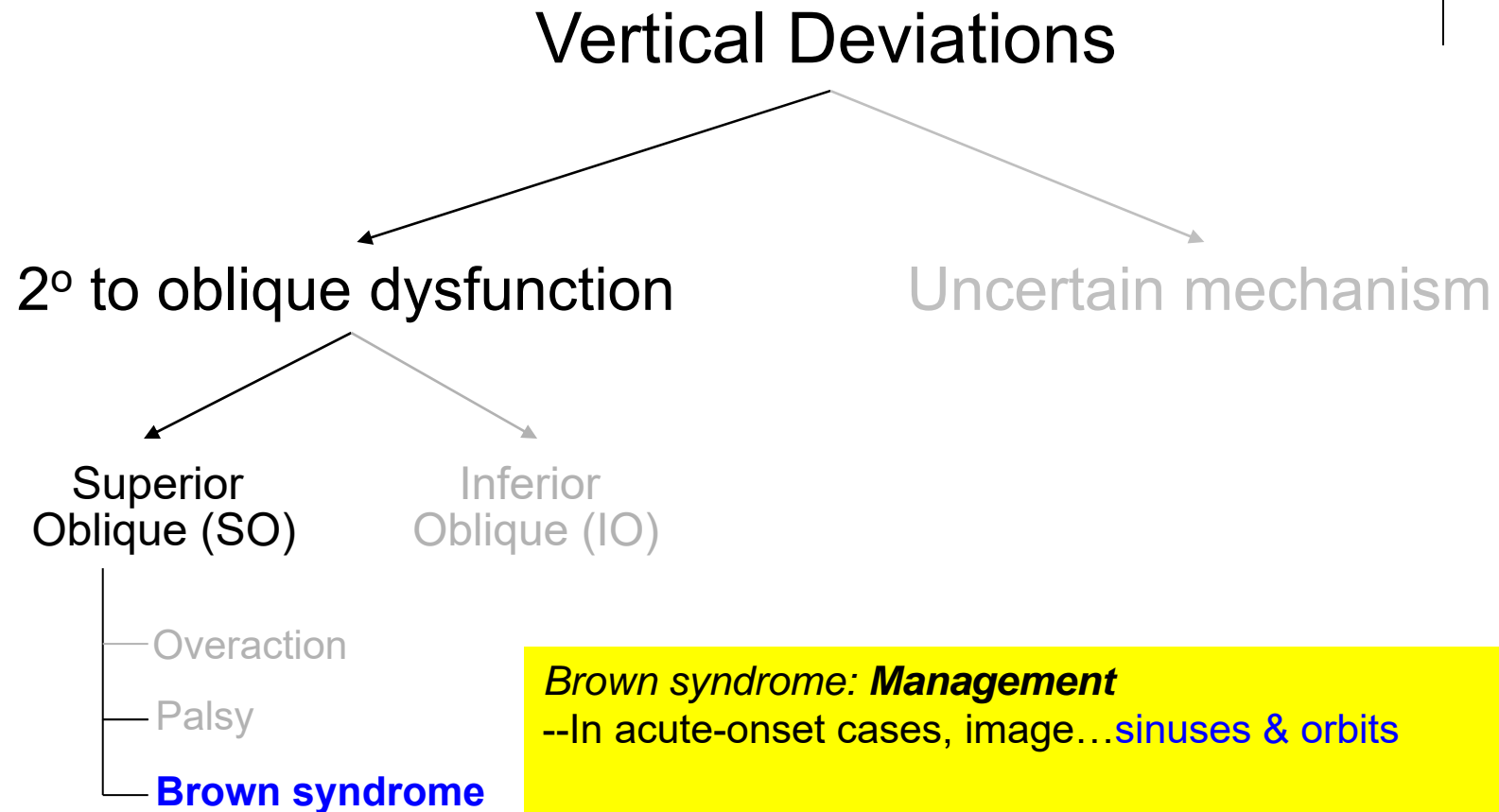


*Brown syndrome: **Management***

--In acute-onset cases, image...[2 locations]



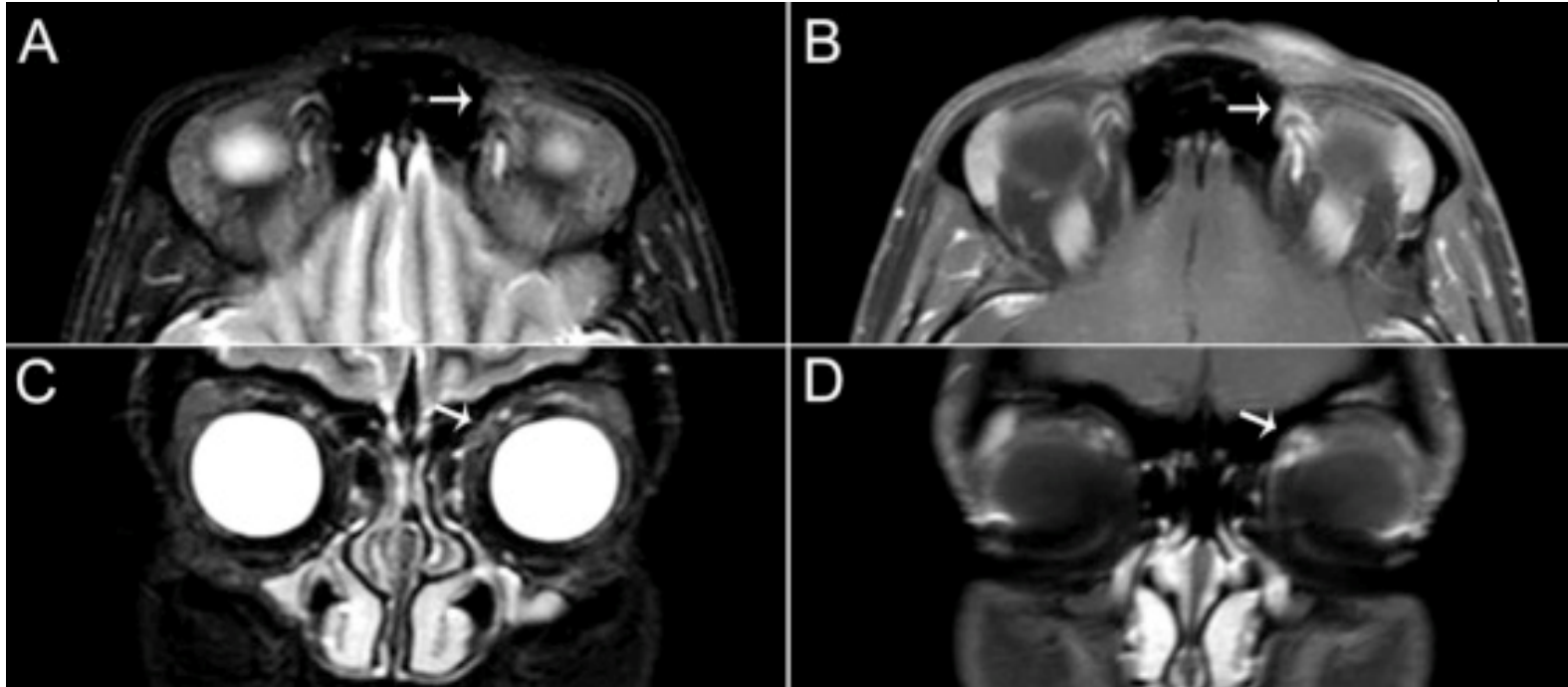
Vertical Deviations



*Brown syndrome: **Management***

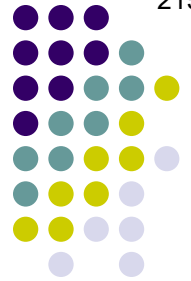
--In acute-onset cases, image...sinuses & orbits

Vertical Deviations

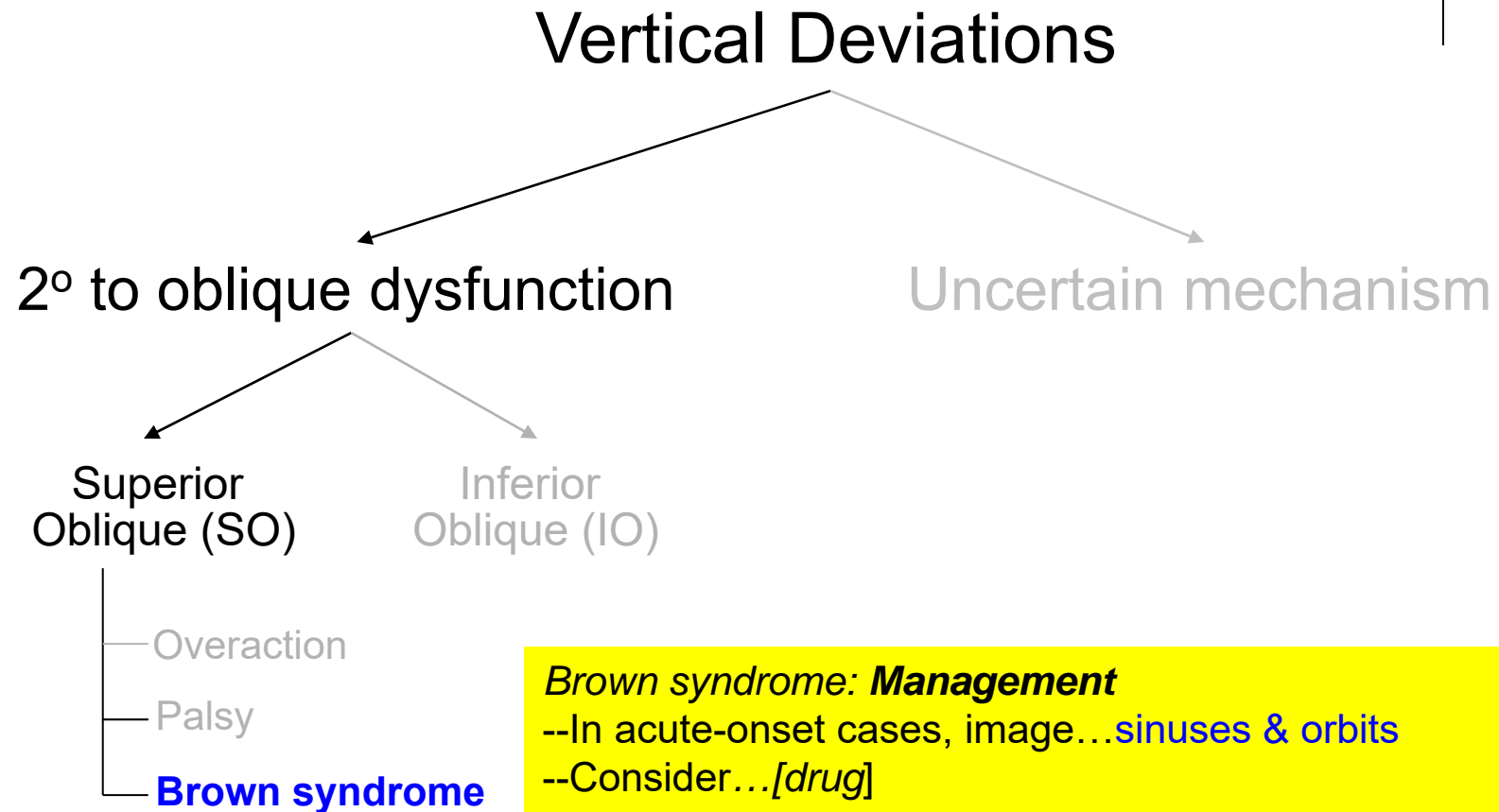


Axial STIR (A) and postcontrast [fat-saturated](#) T1 (B) images; coronal STIR (C) and postcontrast fat-saturated T1 (D) images. There is subtle increased STIR signal and mild asymmetric thickening in anterior portion of the left superior oblique tendon. On postcontrast imaging, there is prominent enhancement around the trochlea region (B and D, indicated by the arrows).

Acute Brown syndrome

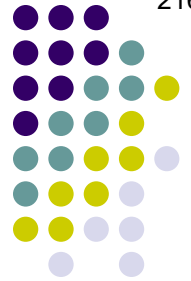


Vertical Deviations

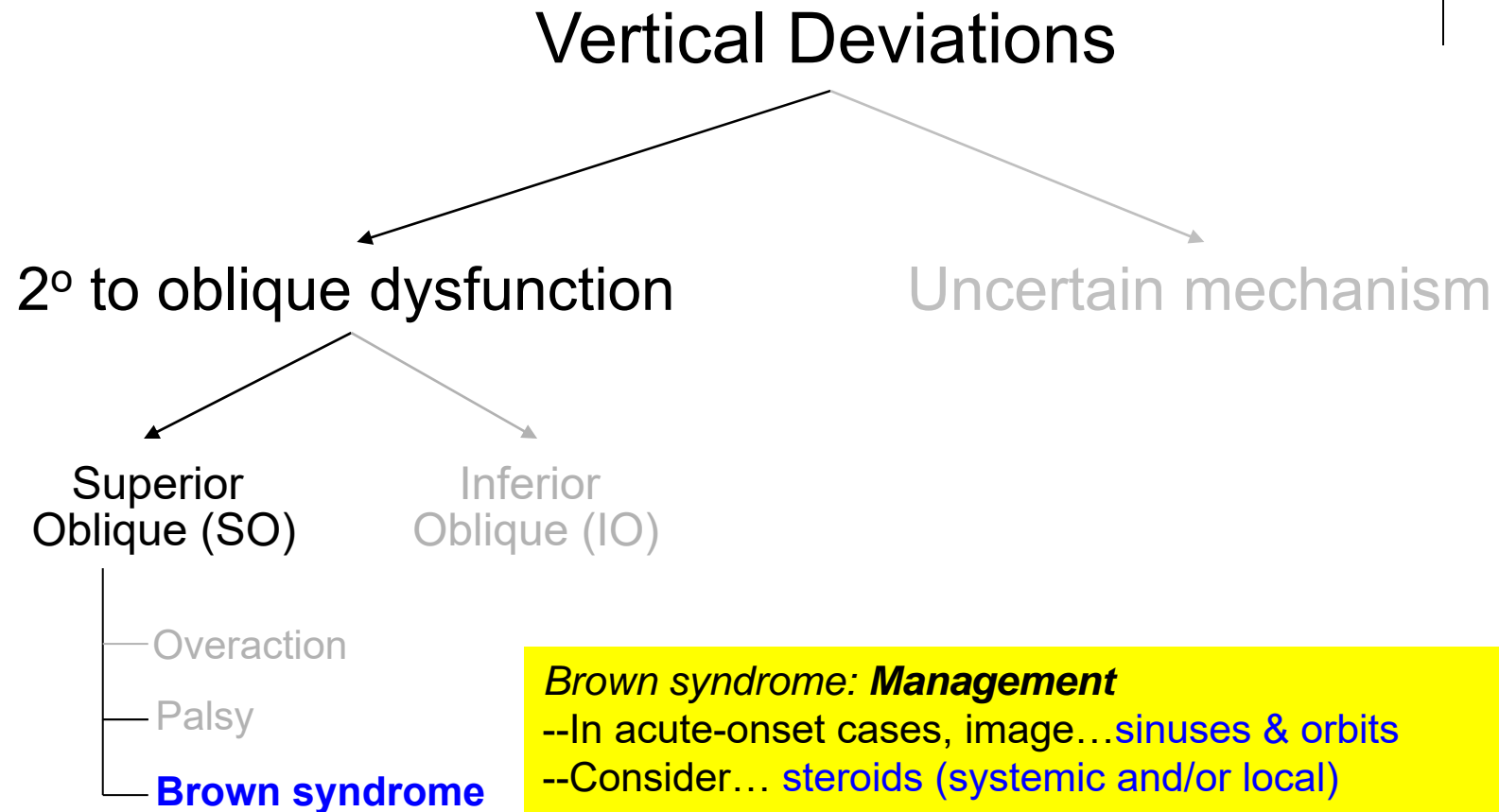


*Brown syndrome: **Management***

- In acute-onset cases, image...sinuses & orbits
- Consider...[drug]

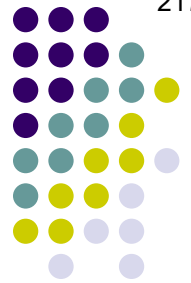


Vertical Deviations

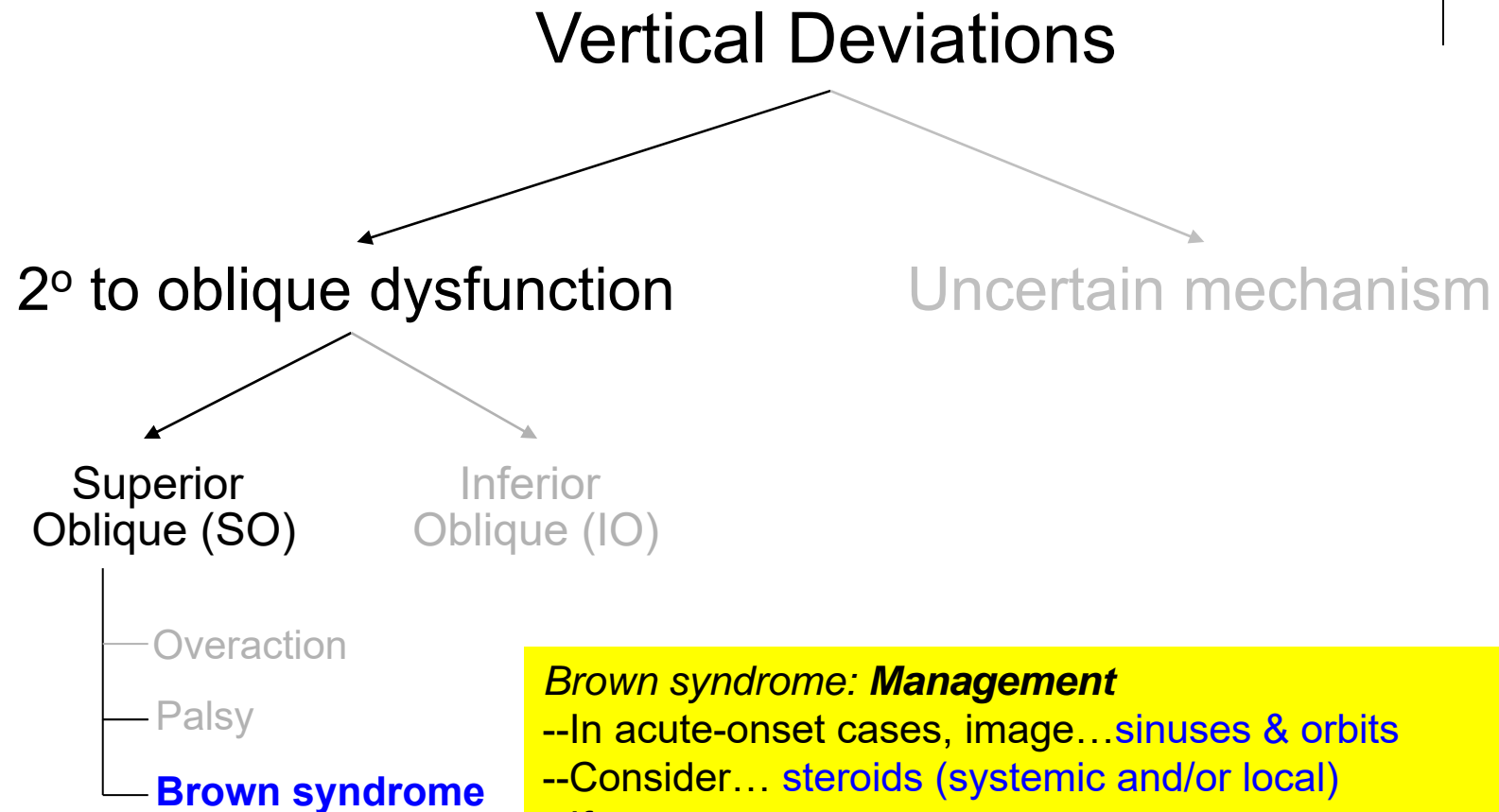


*Brown syndrome: **Management***

- In acute-onset cases, image...sinuses & orbits
- Consider... steroids (systemic and/or local)

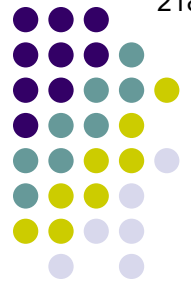


Vertical Deviations

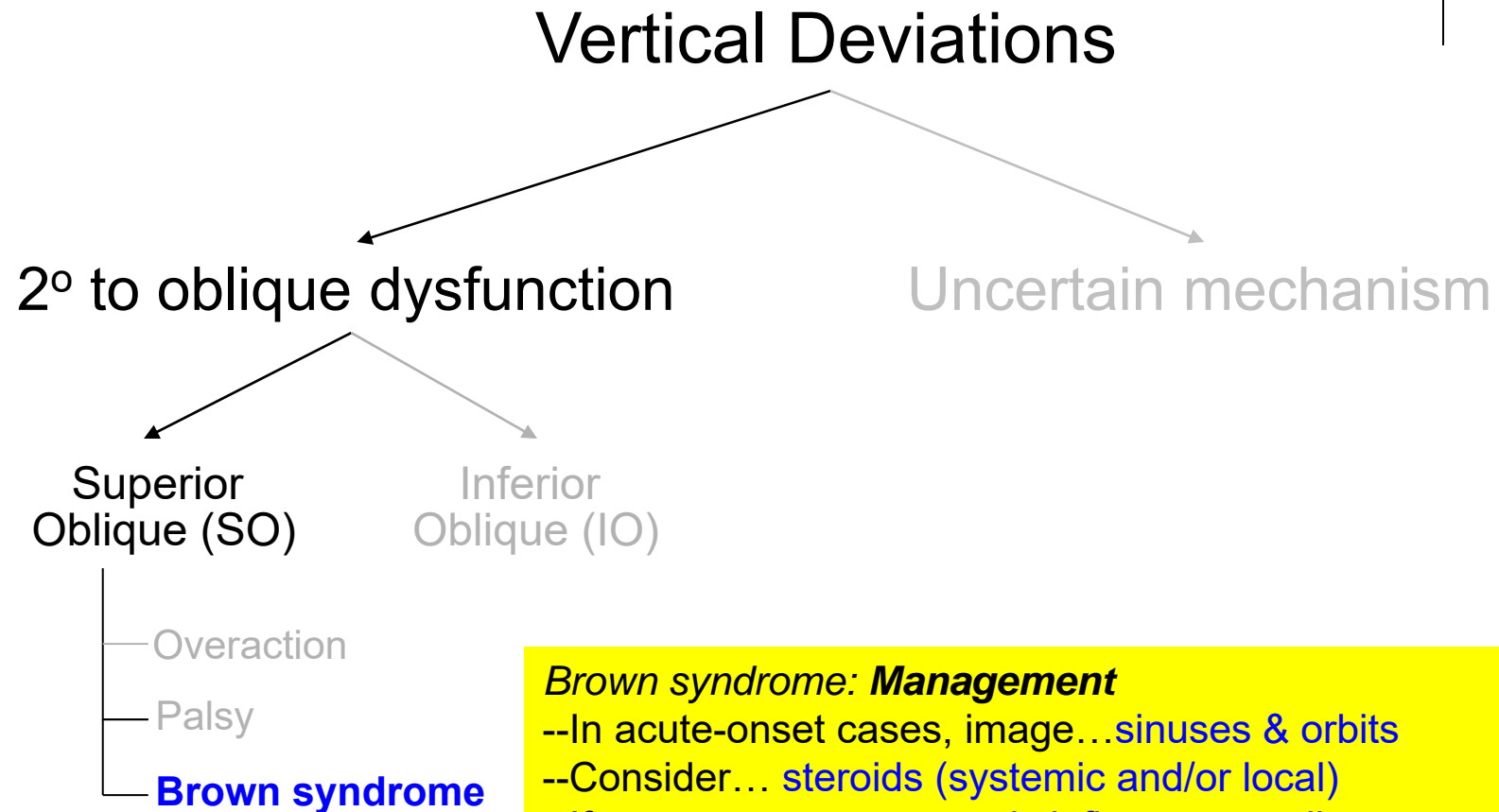


*Brown syndrome: **Management***

- In acute-onset cases, image...sinuses & orbits
- Consider... **steroids** (systemic and/or local)
- If present, treat...

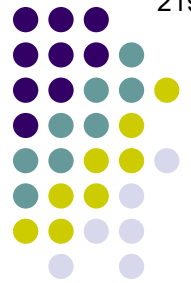


Vertical Deviations

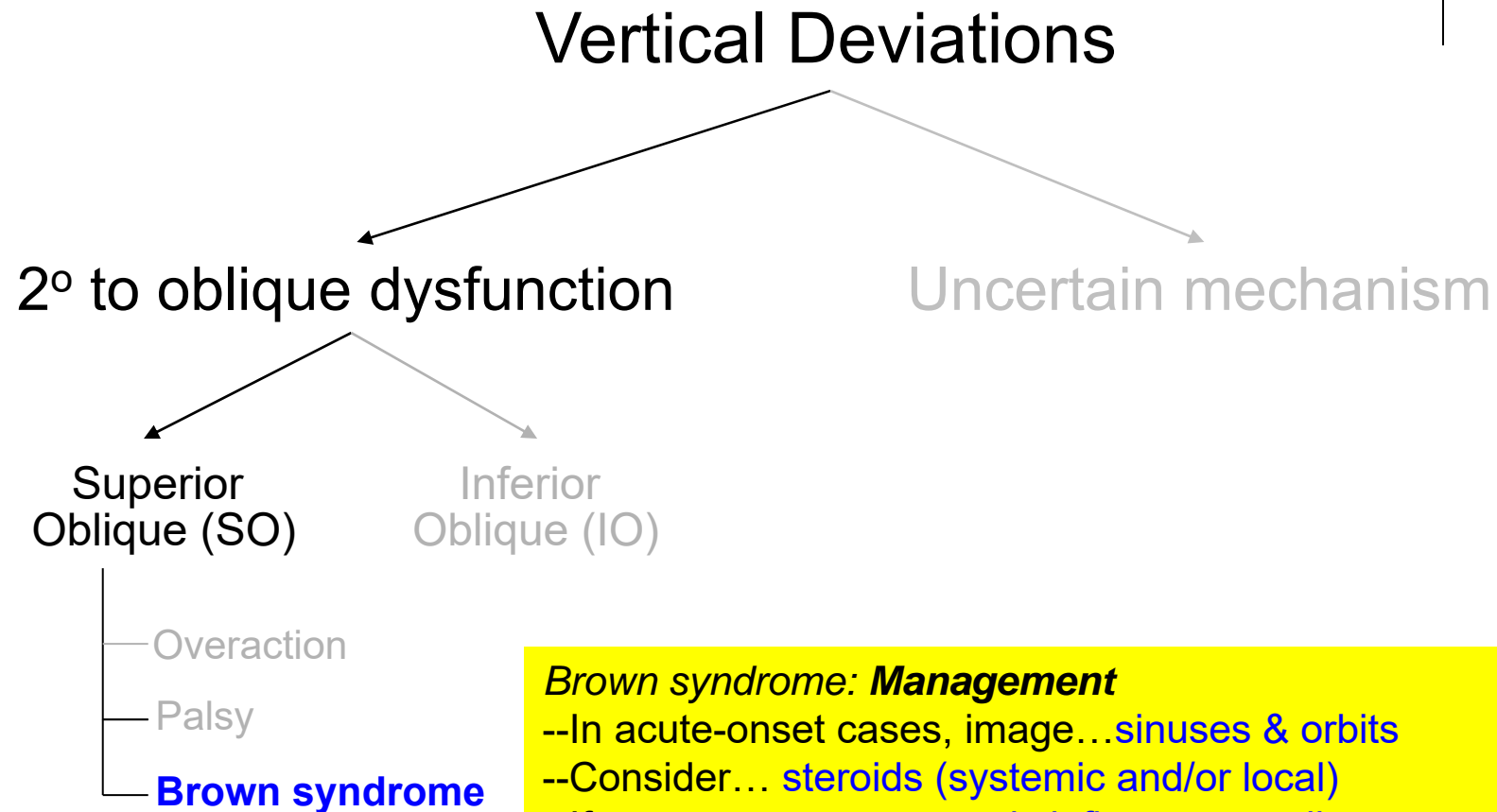


*Brown syndrome: **Management***

- In acute-onset cases, image...sinuses & orbits
- Consider... **steroids** (systemic and/or local)
- If present, treat...systemic inflammatory disease

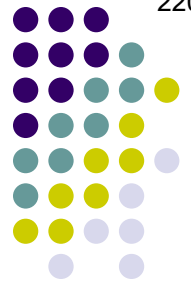


Vertical Deviations

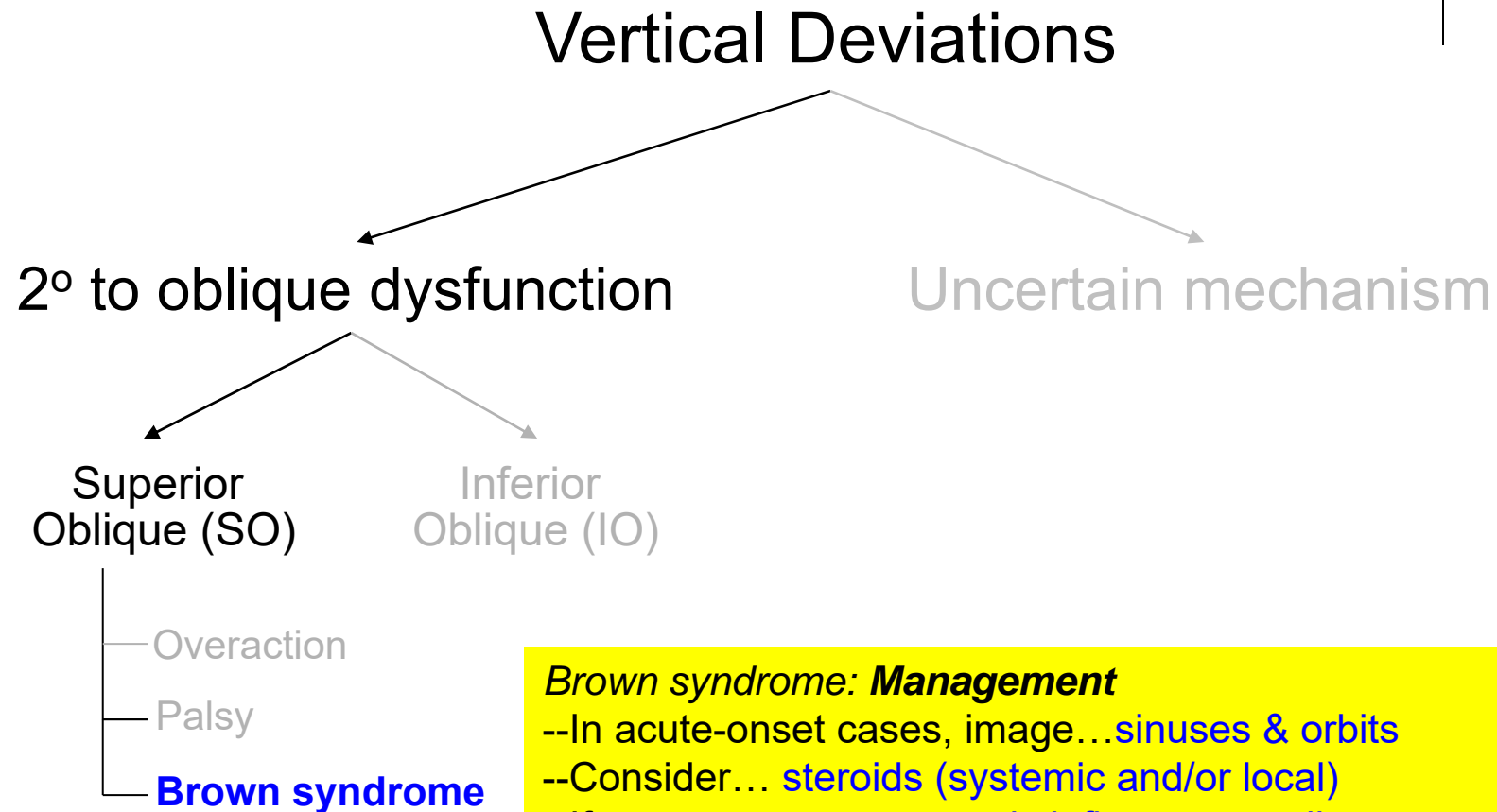


*Brown syndrome: **Management***

- In acute-onset cases, image...sinuses & orbits
- Consider... **steroids** (systemic and/or local)
- If present, treat...**systemic inflammatory disease**
- Consider surgery only if...[specific strabismic problem]

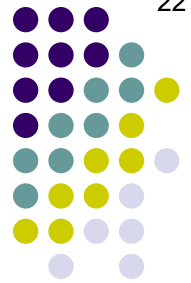


Vertical Deviations

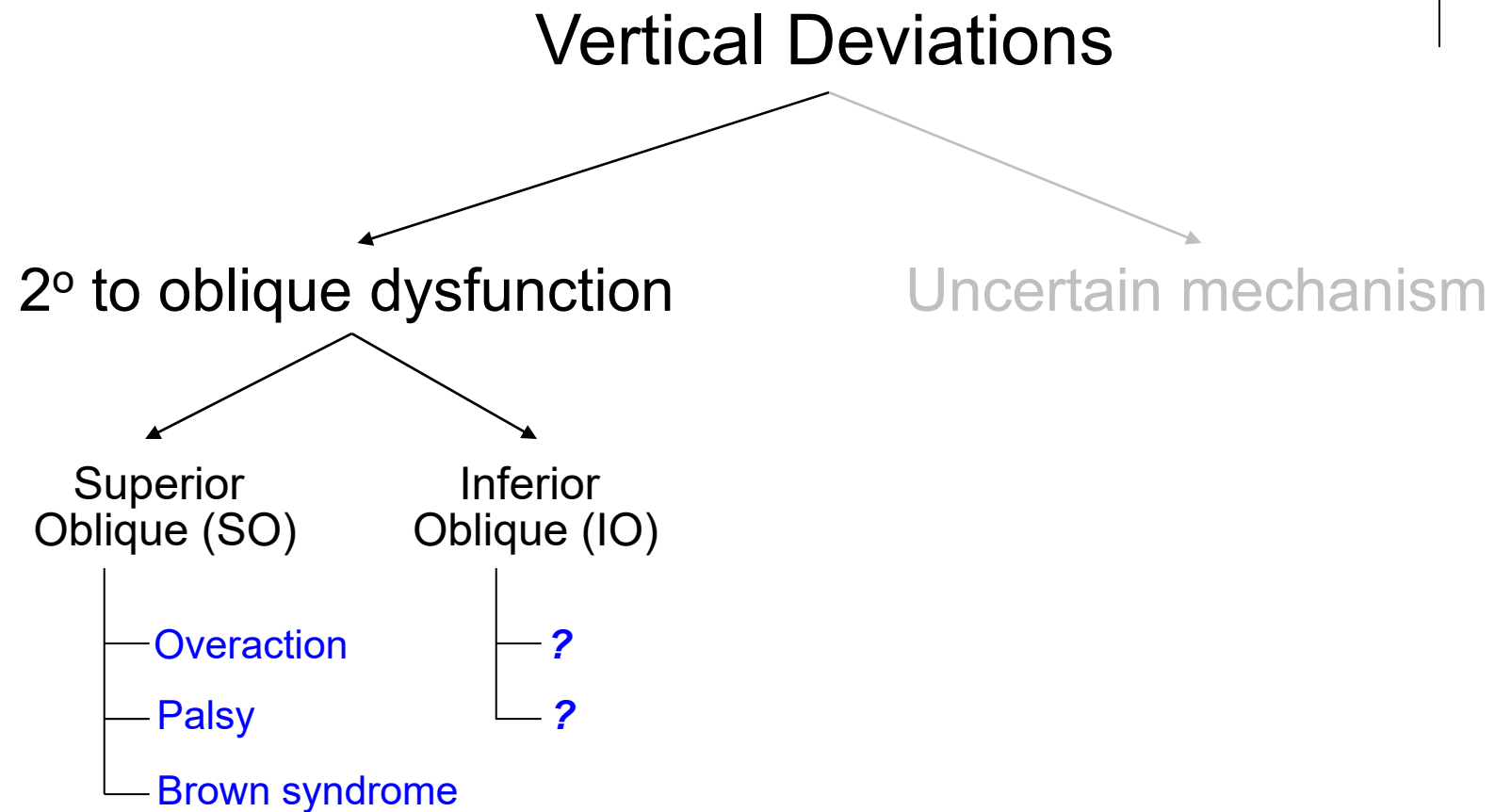


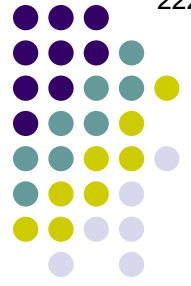
*Brown syndrome: **Management***

- In acute-onset cases, image...sinuses & orbits
- Consider... **steroids** (systemic and/or local)
- If present, treat...systemic inflammatory disease
- Consider surgery only if...hypotropic in primary gaze

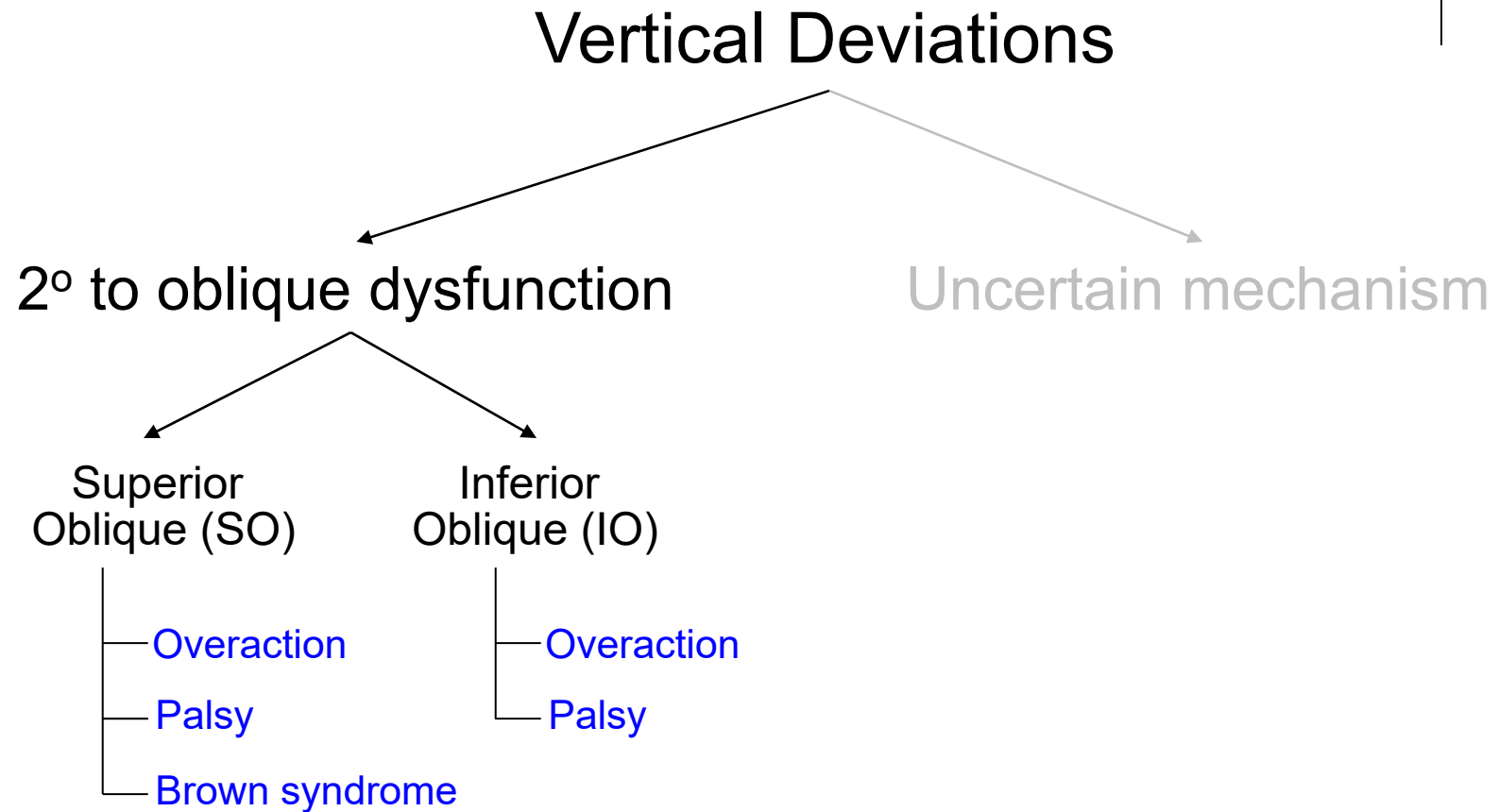


Vertical Deviations



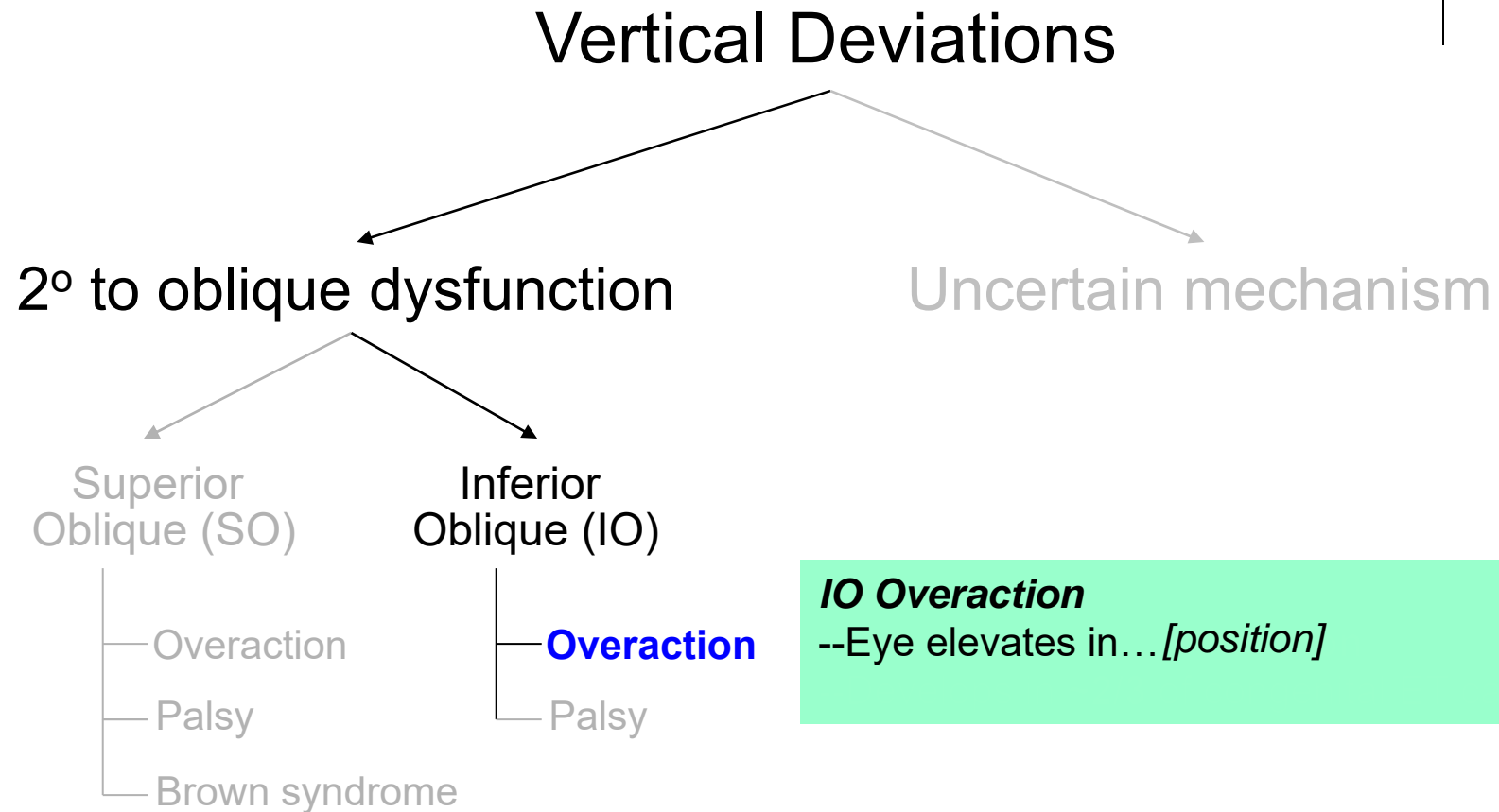


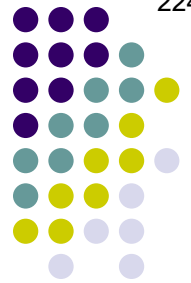
Vertical Deviations



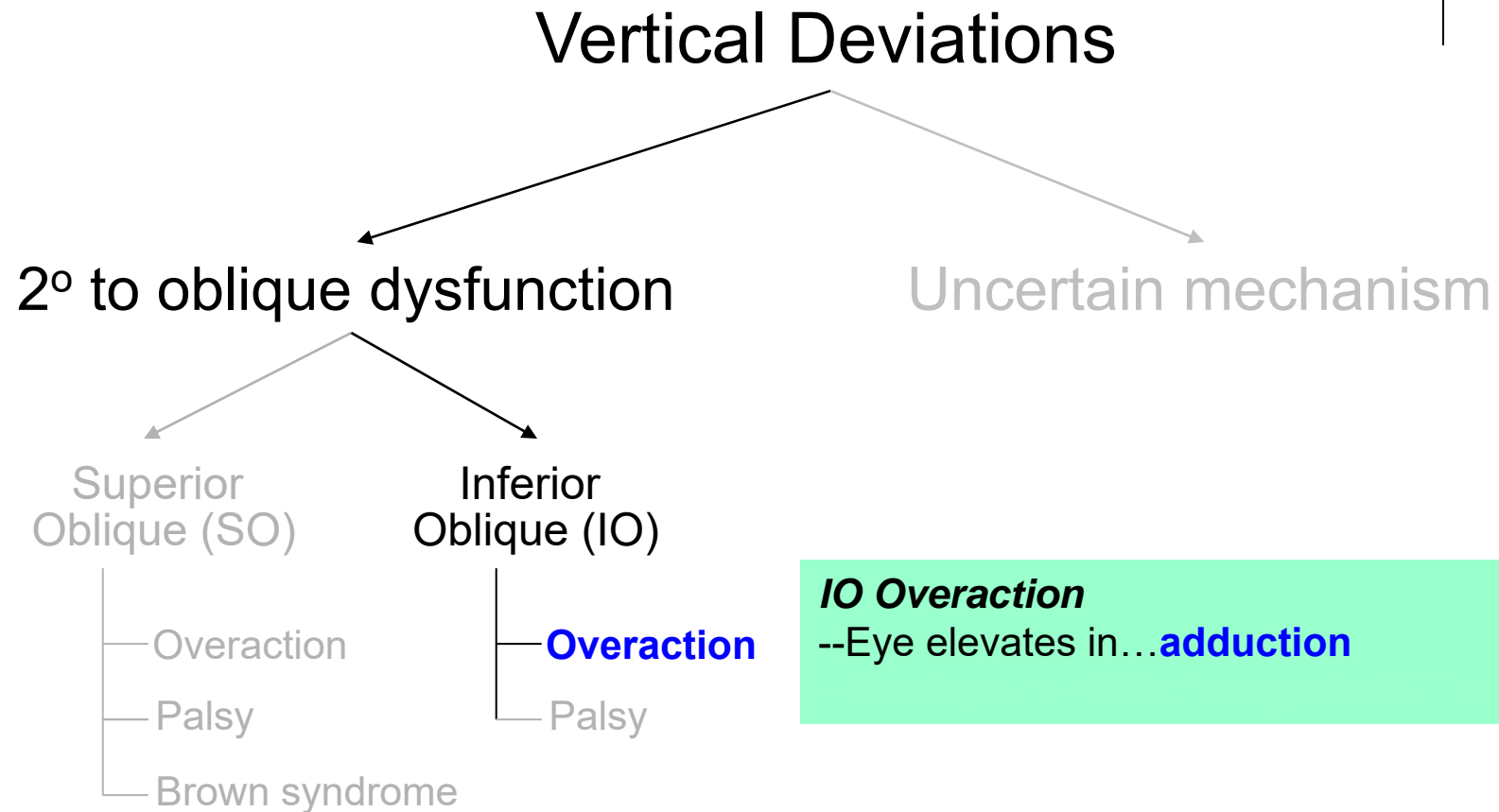


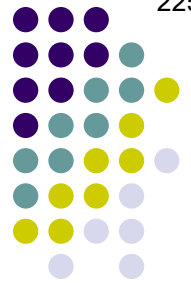
Vertical Deviations



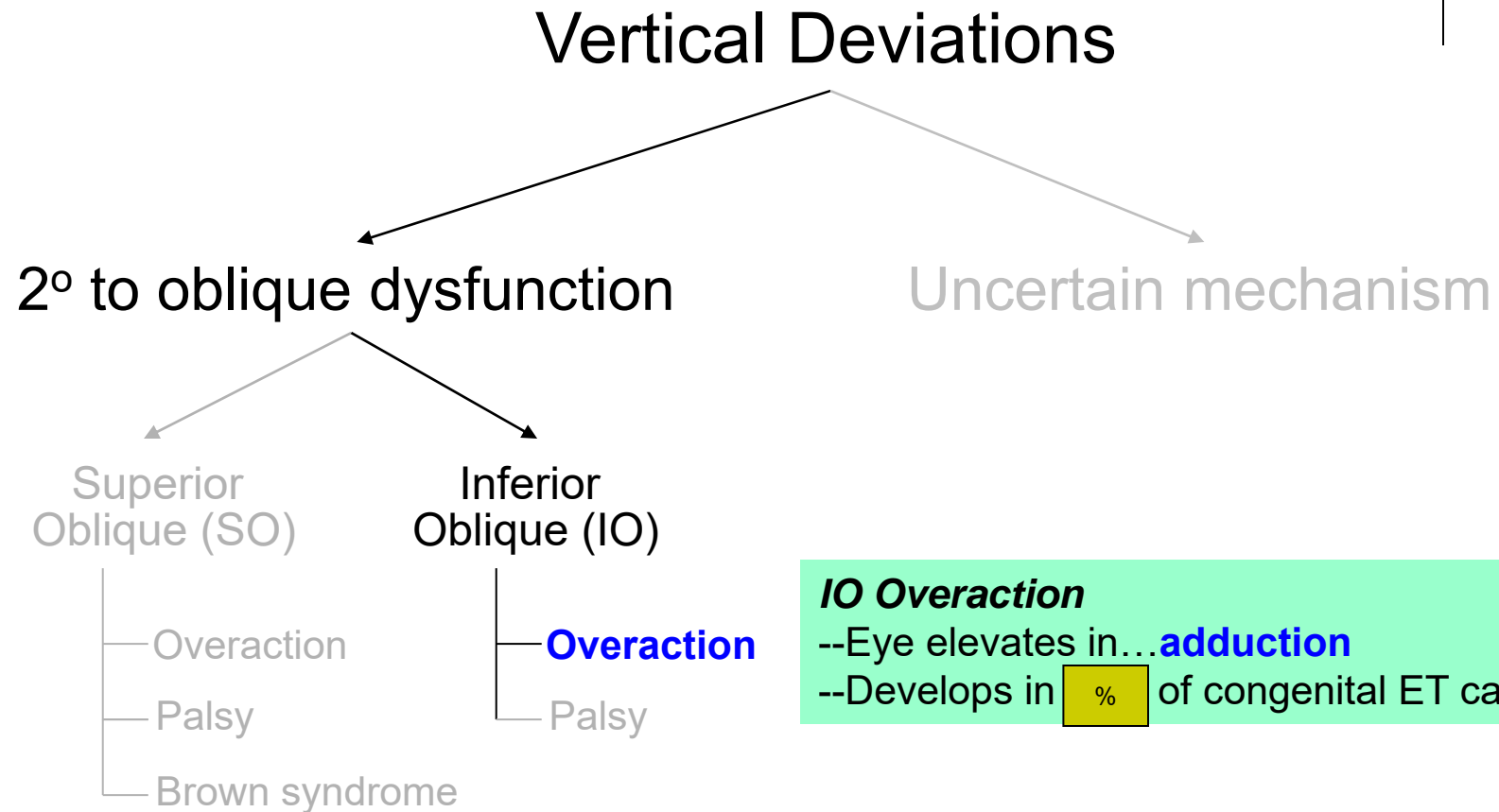


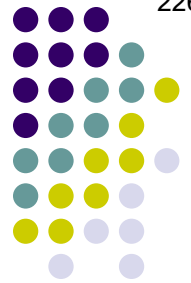
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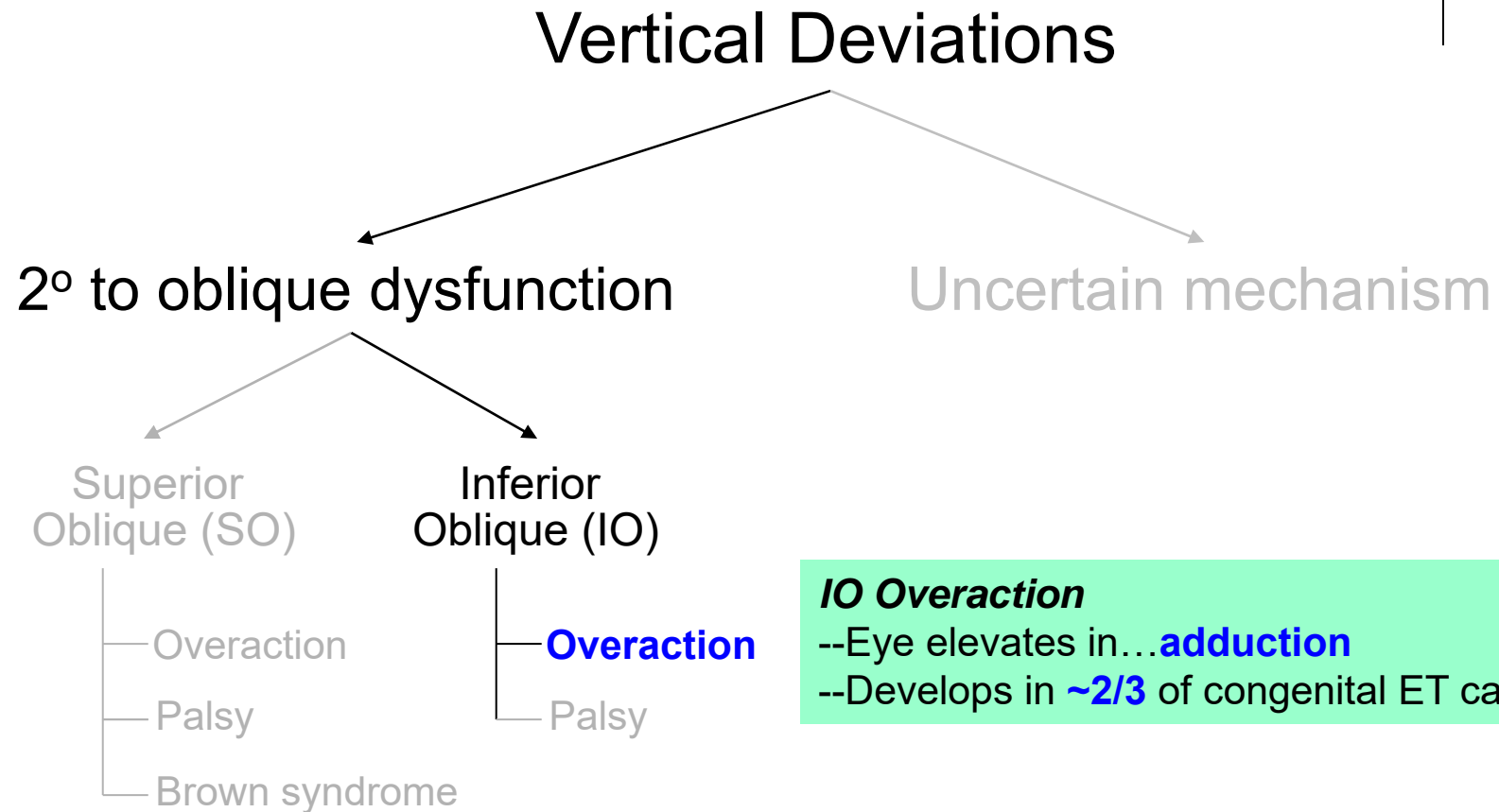


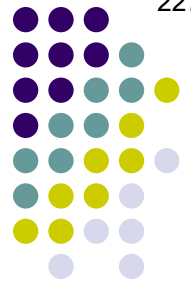
Vertical Deviations



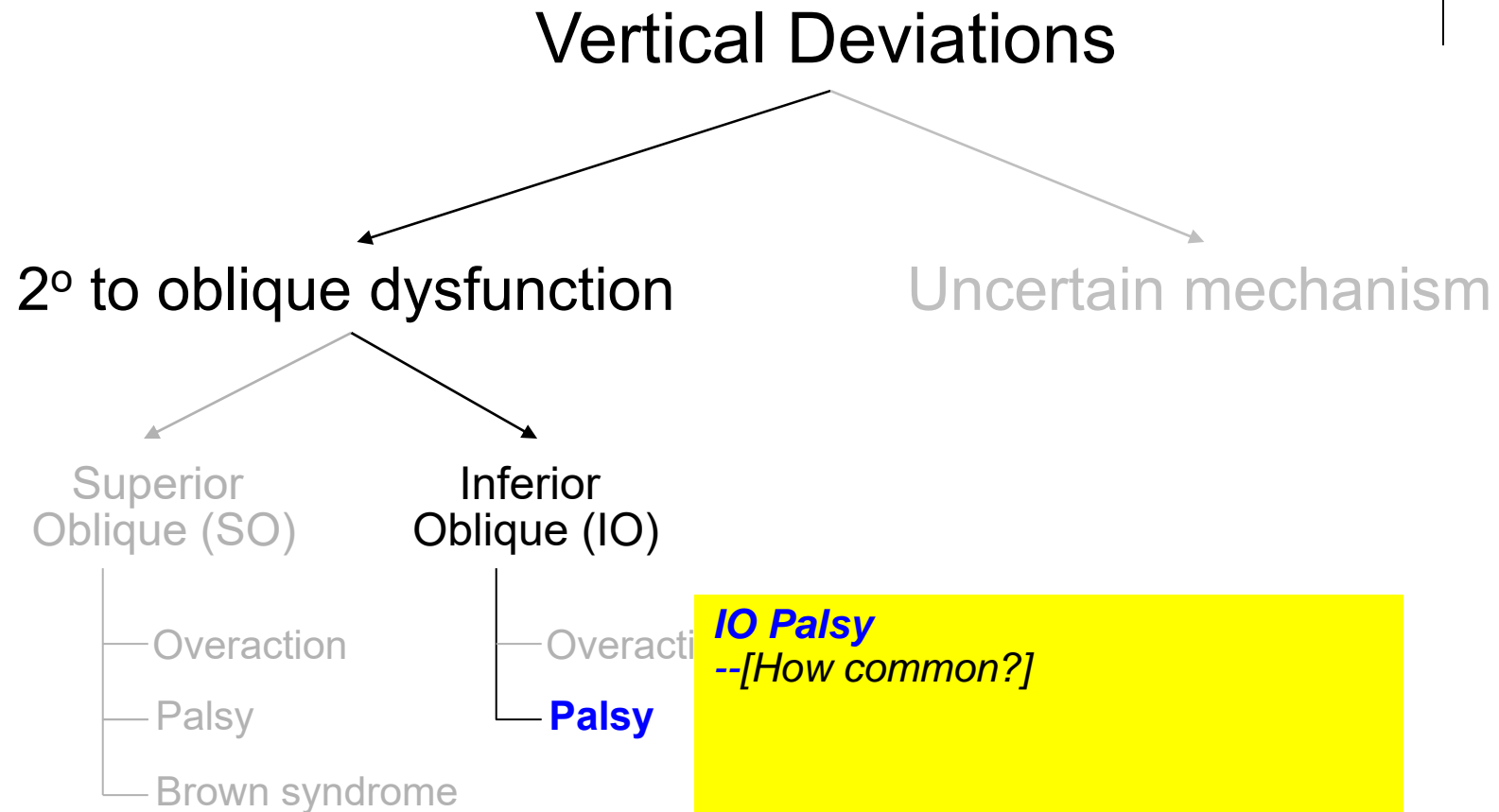


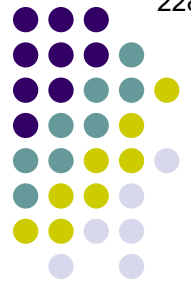
Vertical Deviations



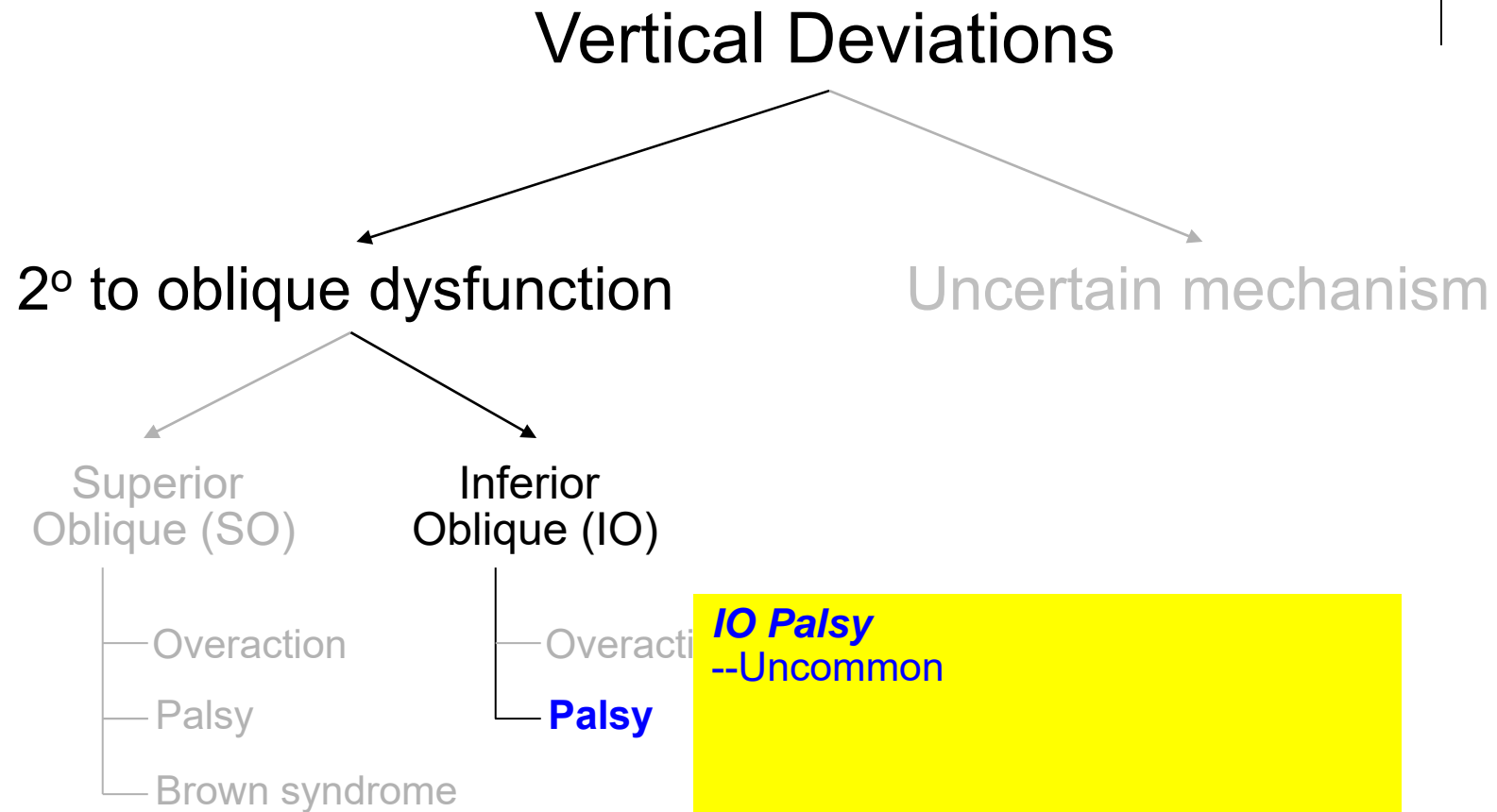


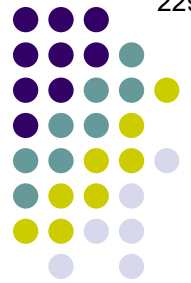
Vertical Deviations



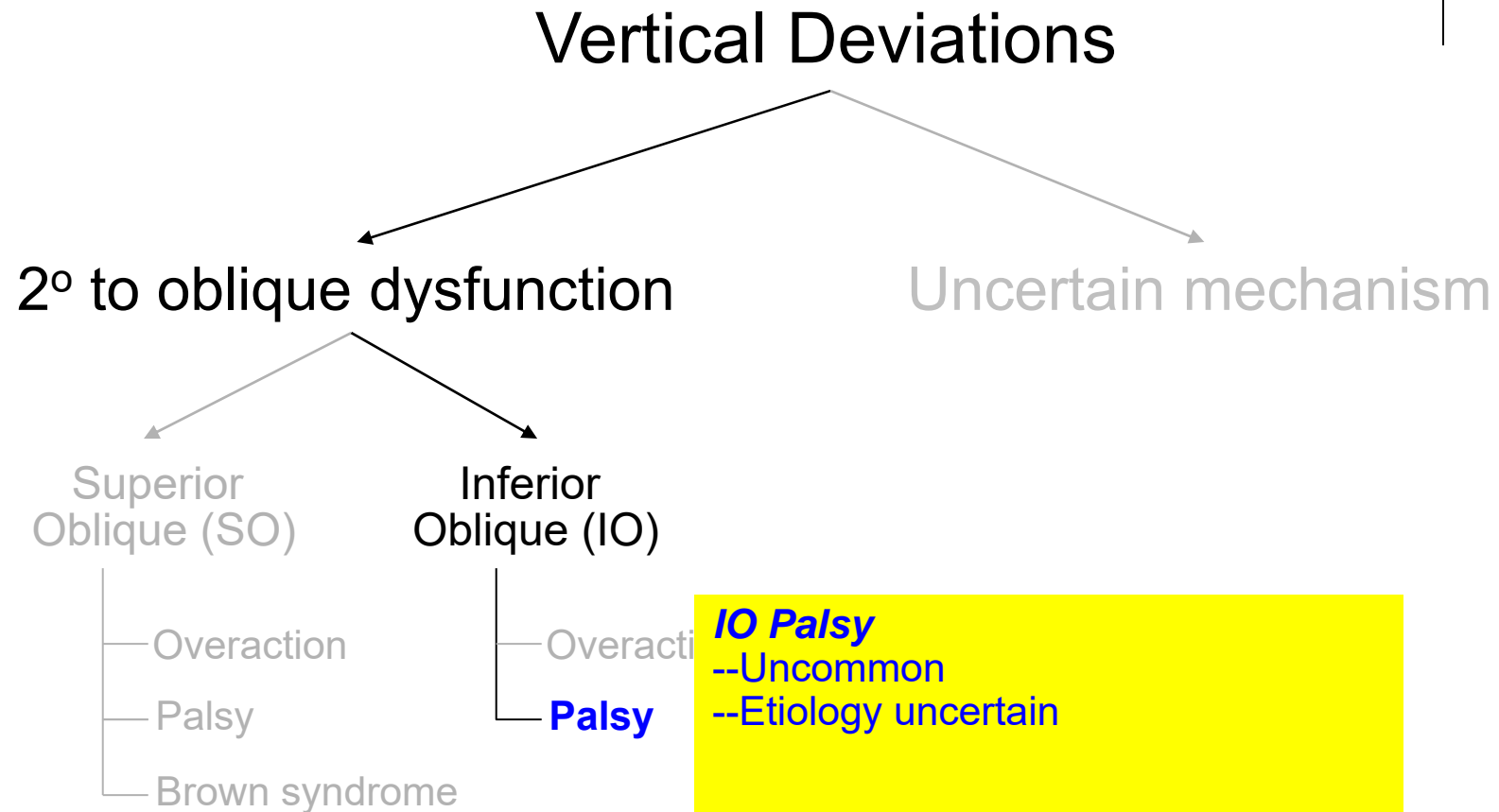


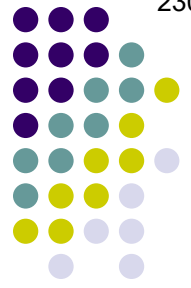
Vertical Deviations



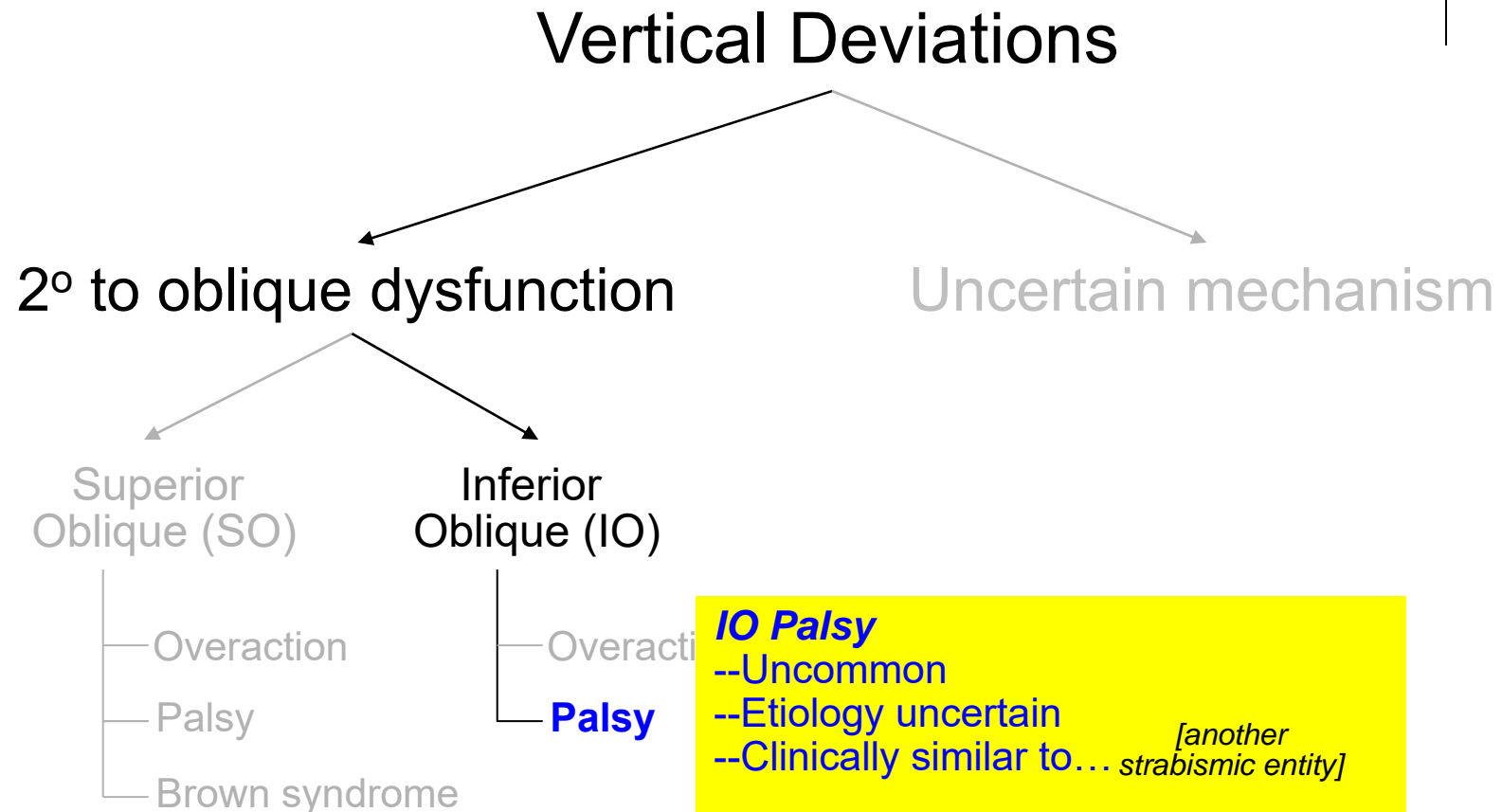


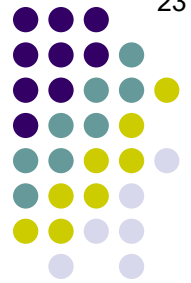
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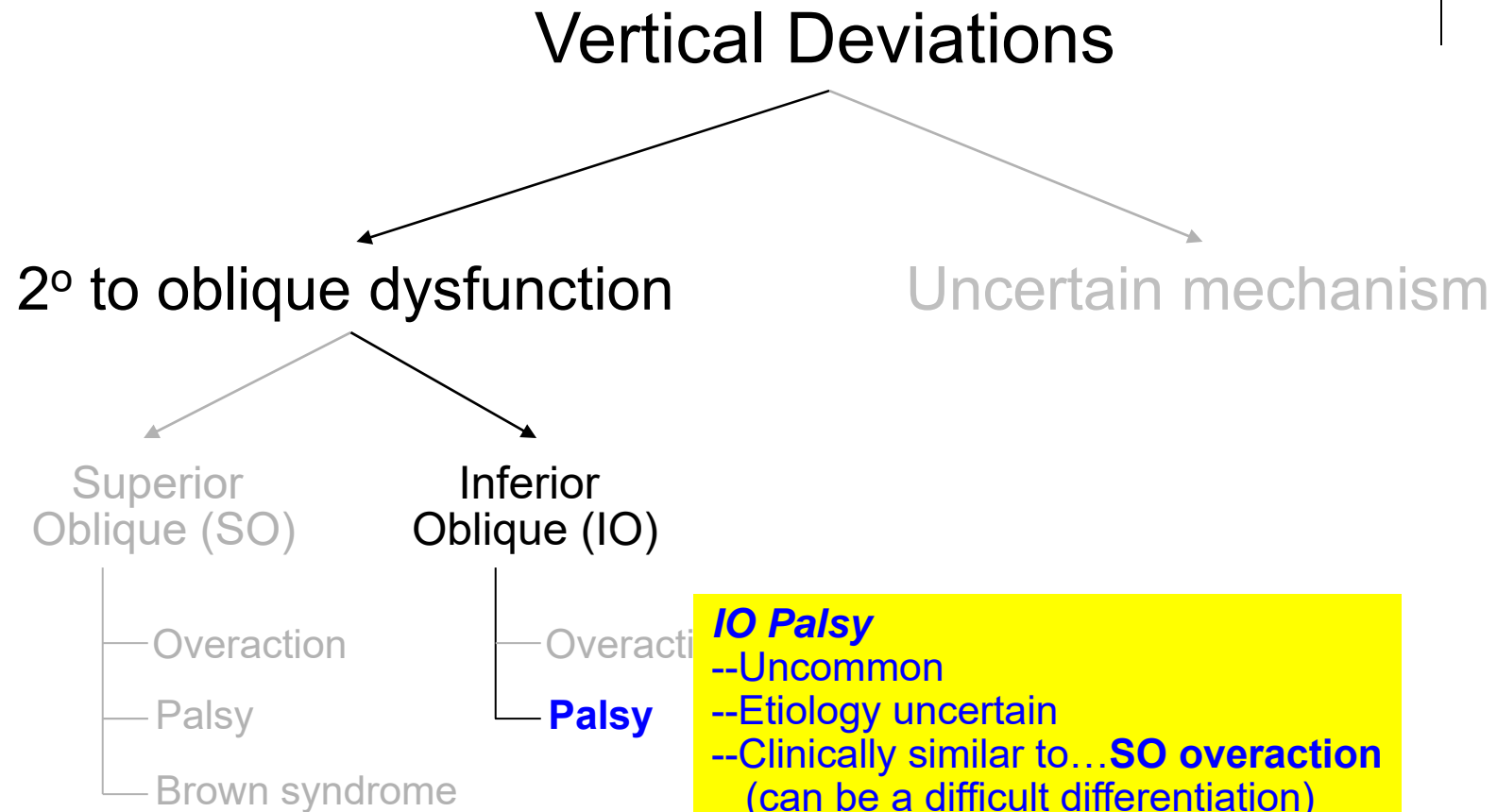


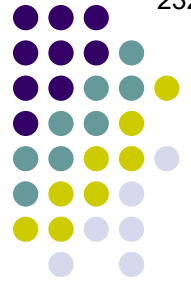
Vertical Deviations



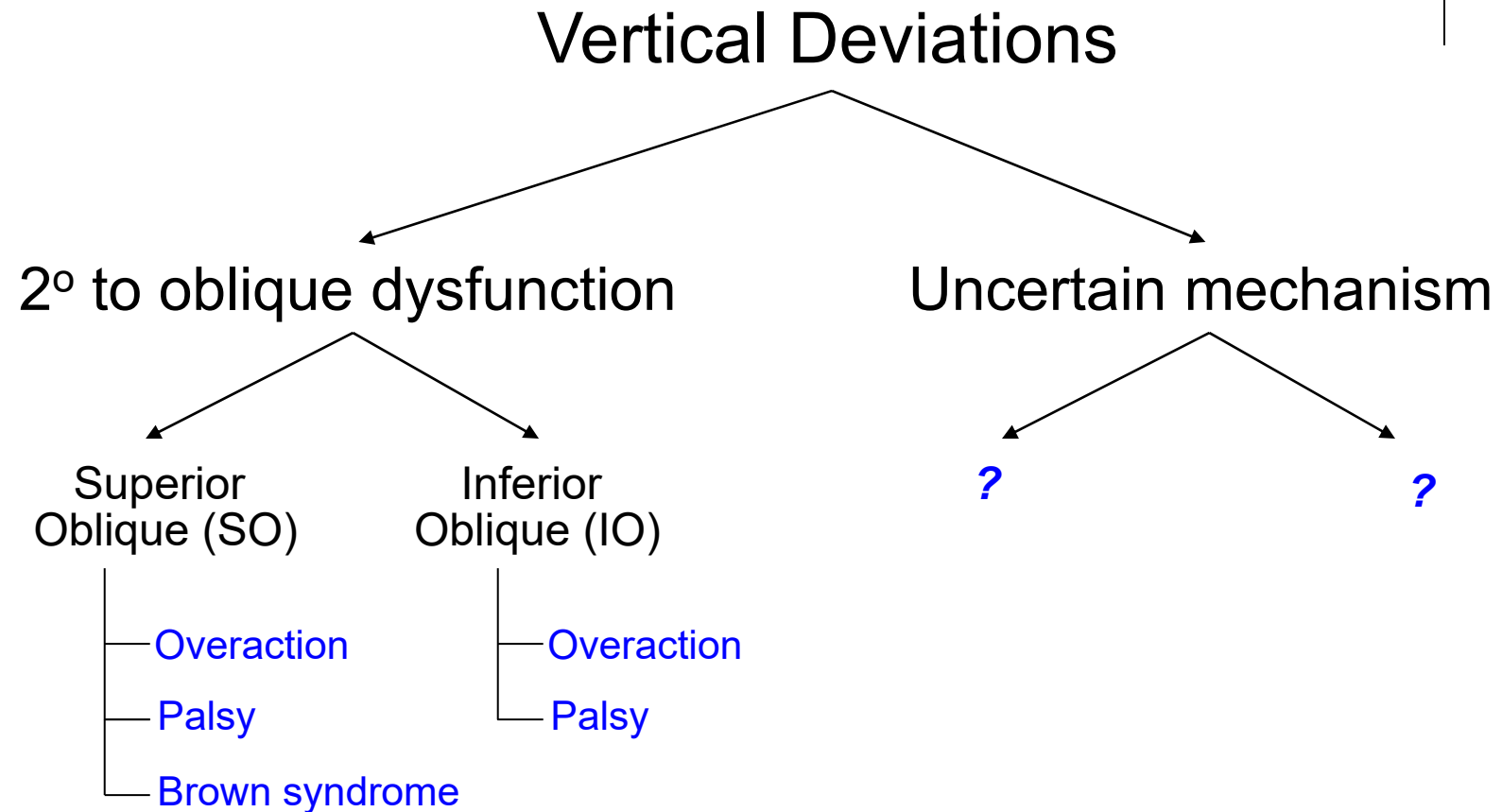


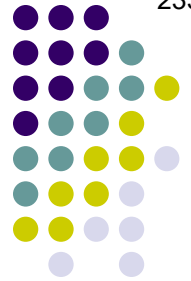
Vertical Deviations



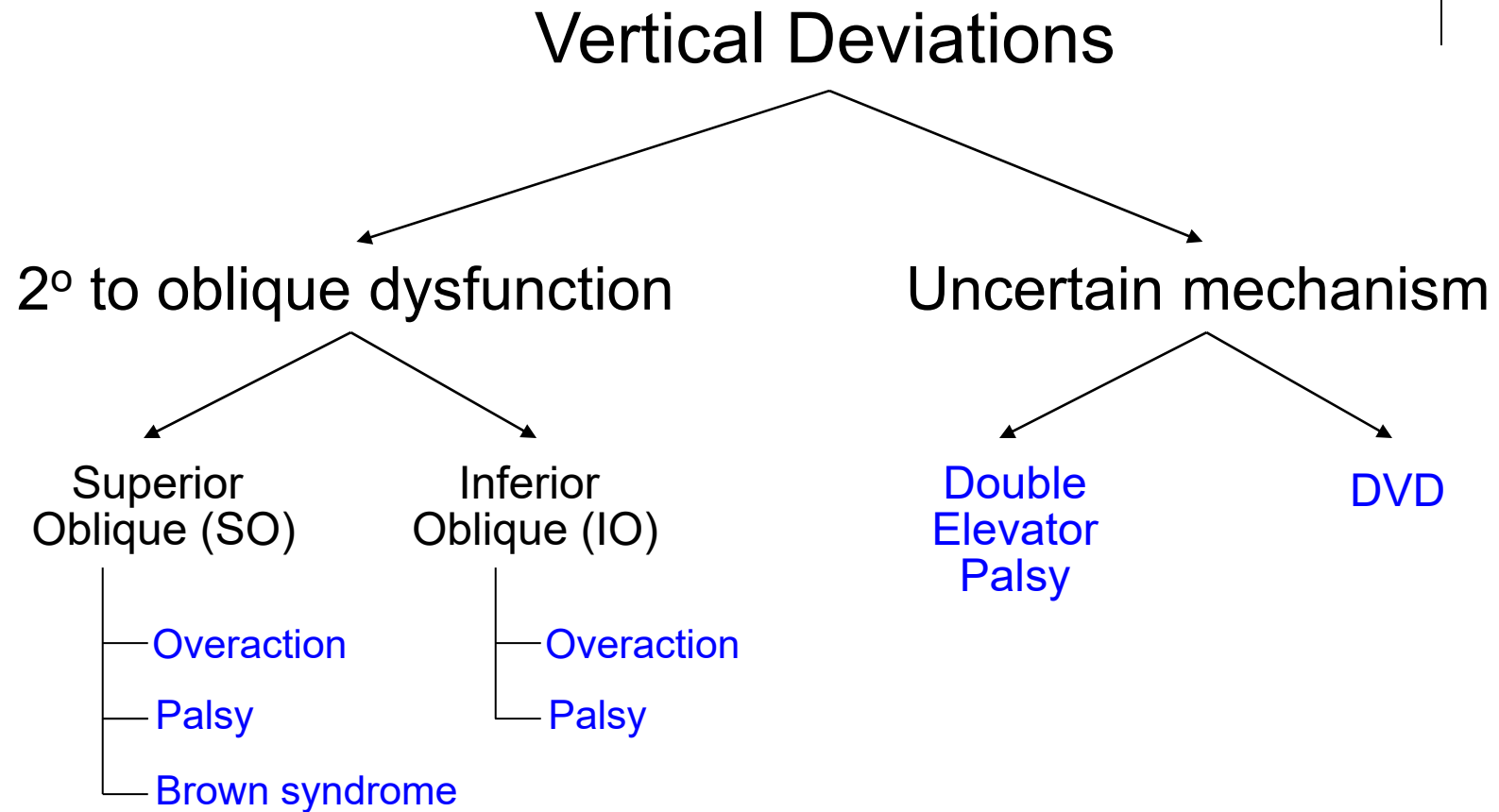


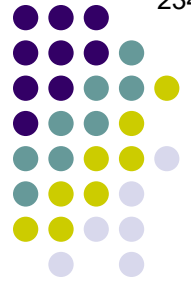
Vertical Deviations



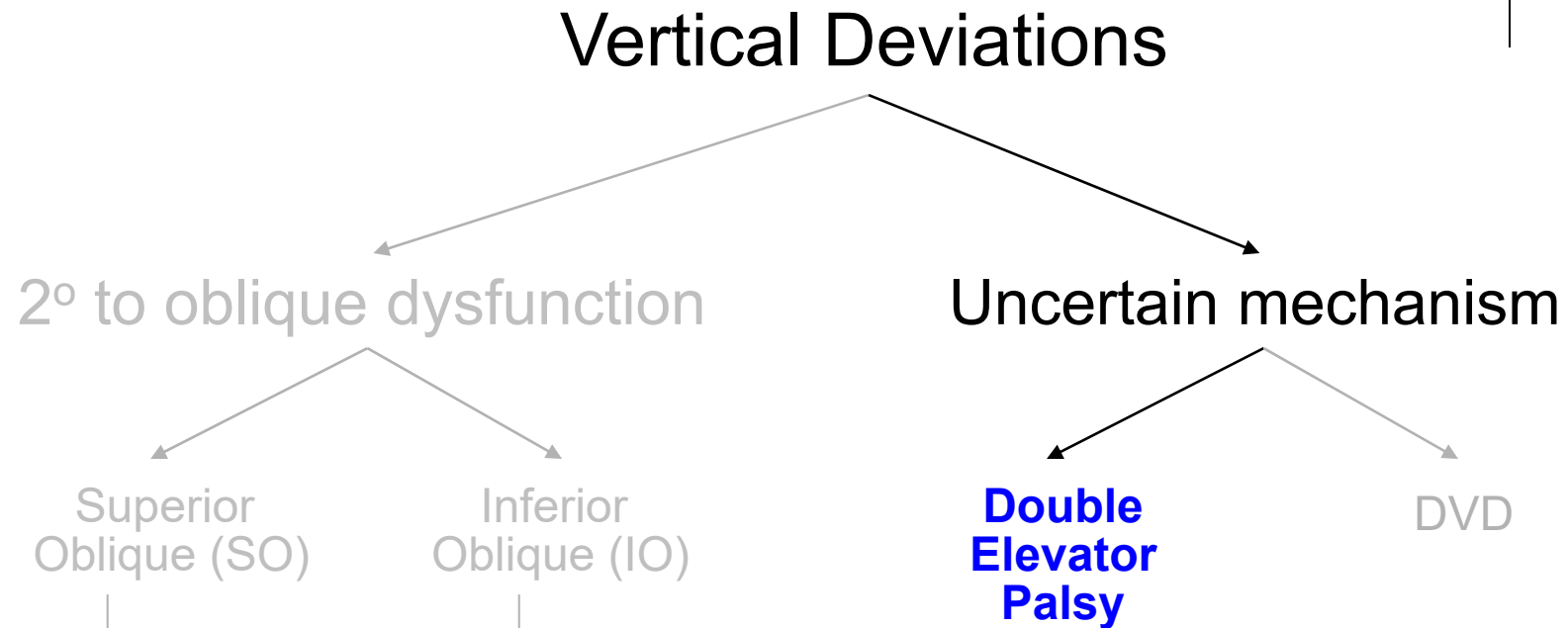


Vertical Deviations

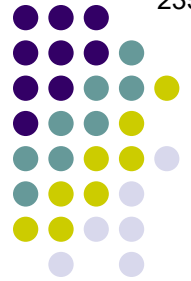




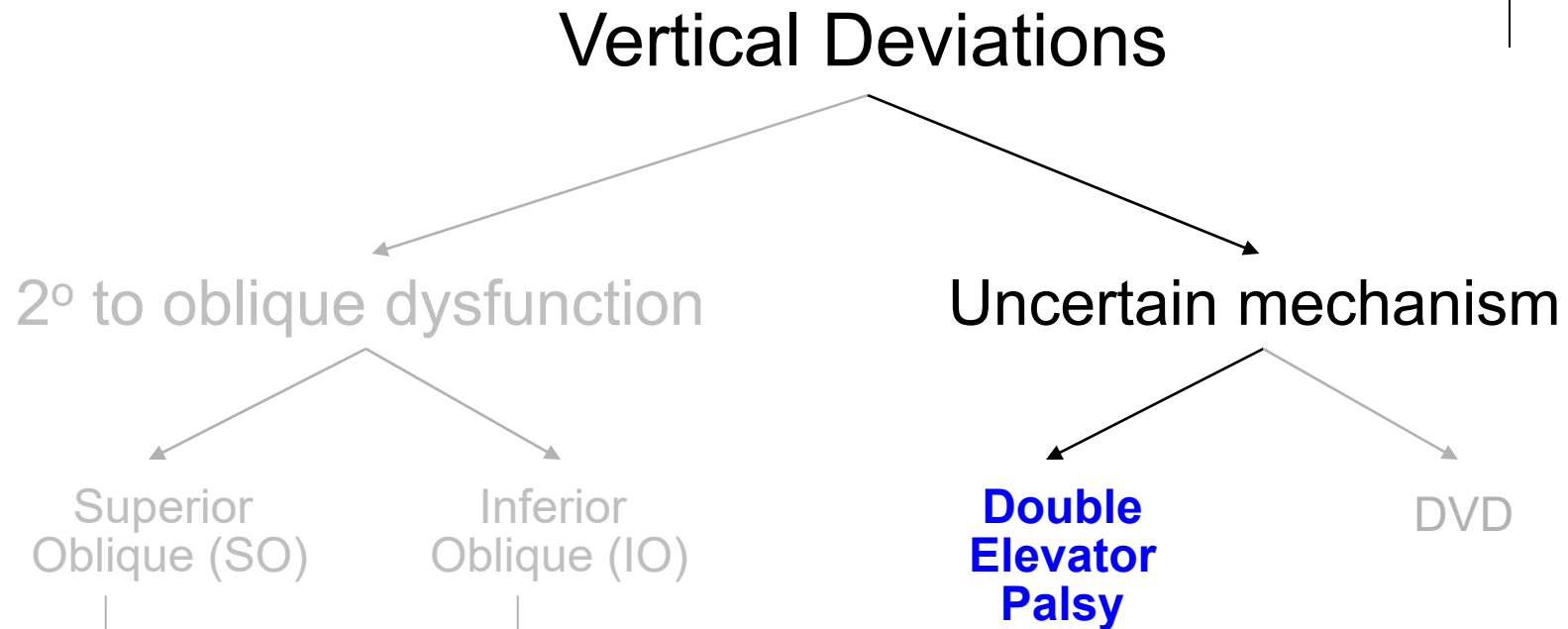
Vertical Deviations



Double Elevator Palsy
--aka...

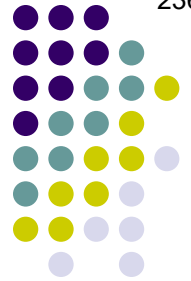


Vertical Deviations

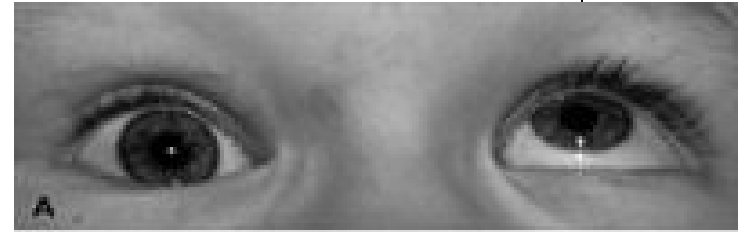


Double Elevator Palsy

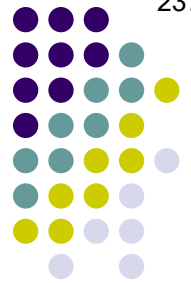
--aka...**Monocular Elevation Deficiency**



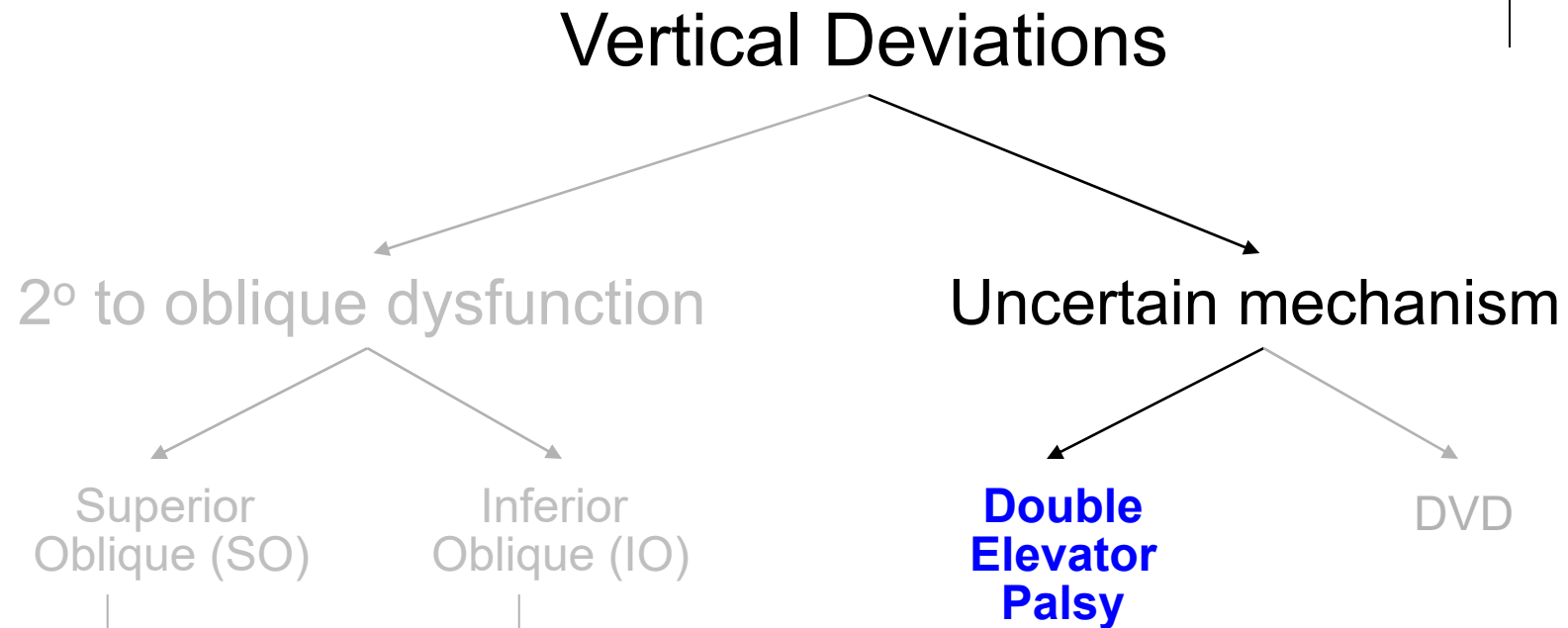
Vertical Deviations



Double elevator palsy



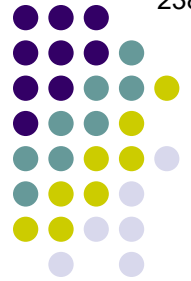
Vertical Deviations



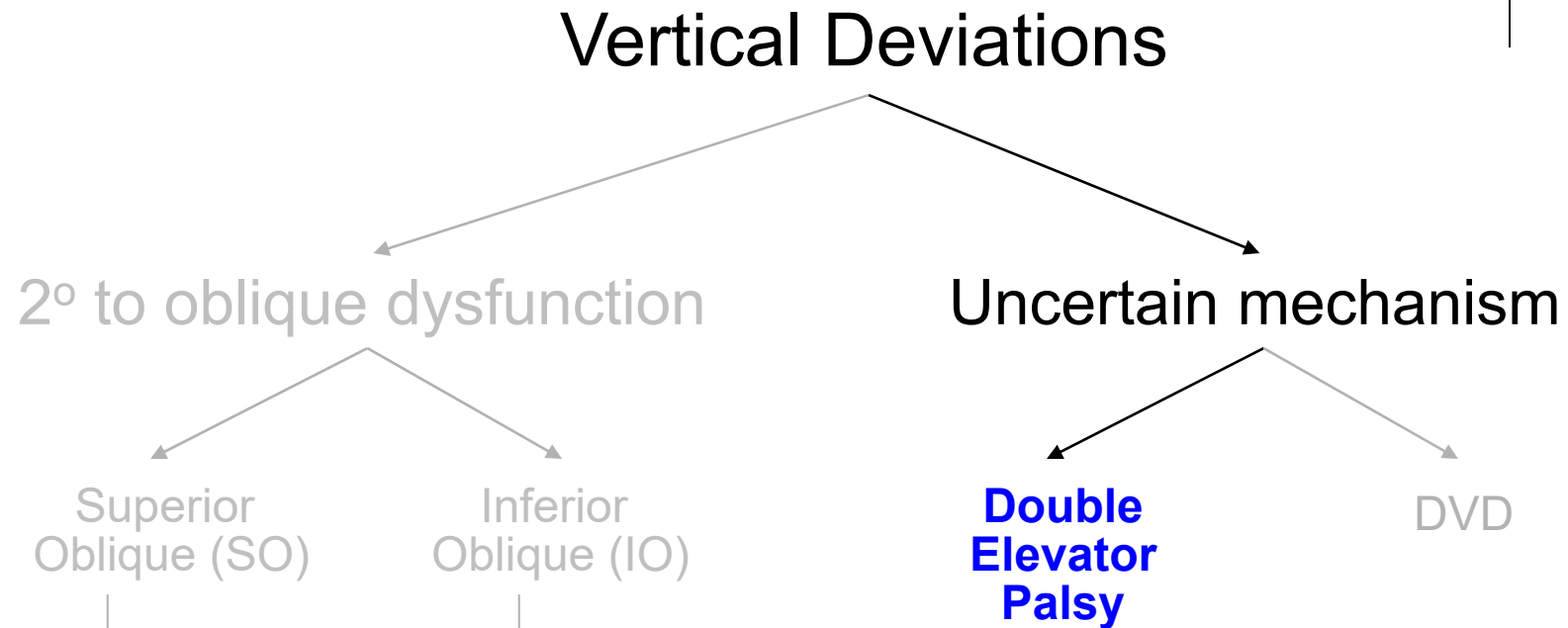
Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...*[basic problem]*



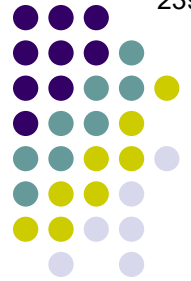
Vertical Deviations



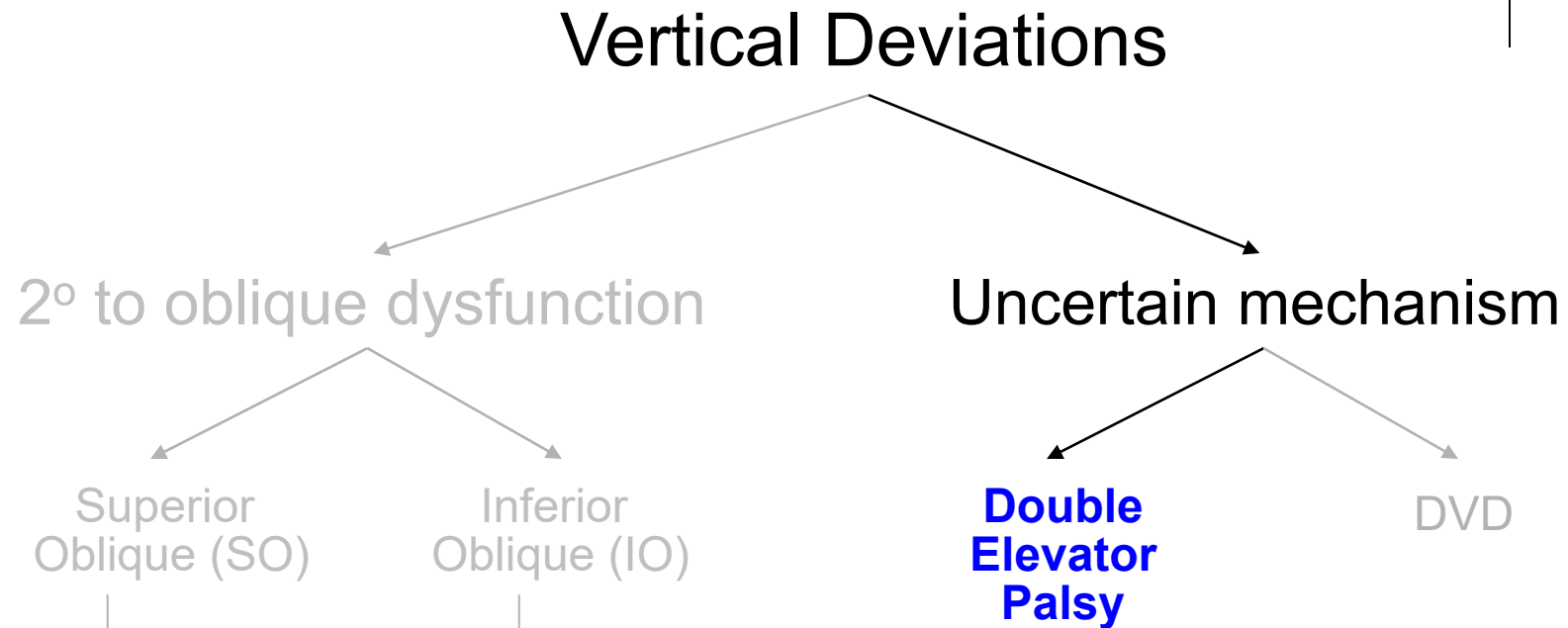
Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze



Vertical Deviations

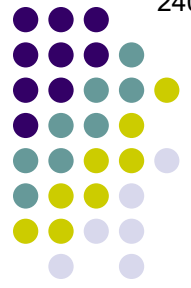


Double Elevator Palsy

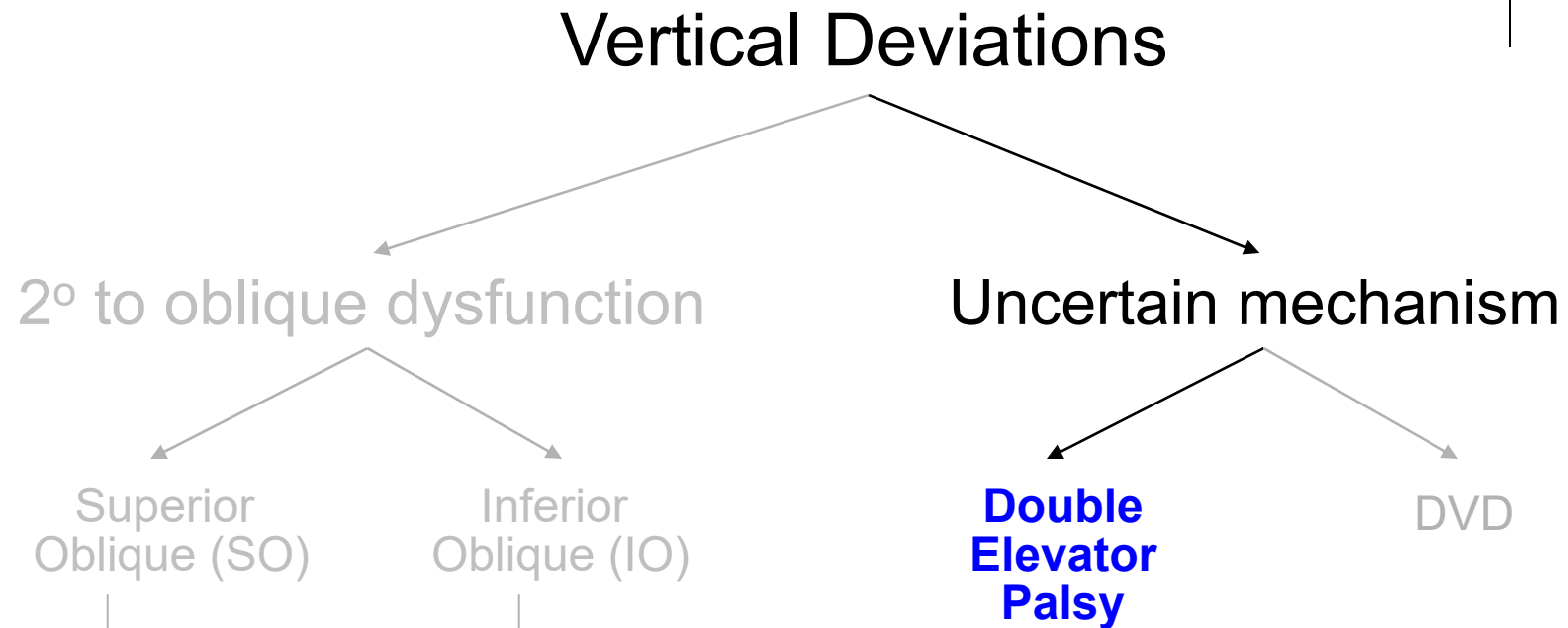
--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

--Due to...[two explanations]



Vertical Deviations

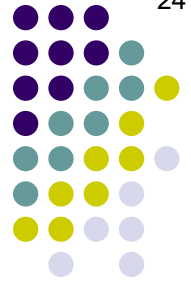


Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

--Due to...restriction or elevation insufficiency (or both)



Vertical Deviations

Vertical Deviations

Differentiating between IR restriction and elevator insufficiency as the cause of a double elevator palsy

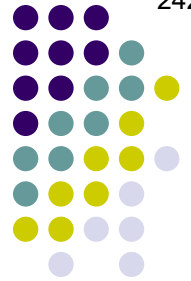
Uncertain mechanism

	Forced ductions?		
Inferior Restriction			
Elevator Insufficiency			

Double
Elevator
Palsy

DVD

--Due to...restriction or elevator insufficiency (or both)



Vertical Deviations

Vertical Deviations

Differentiating between IR restriction and elevator insufficiency as the cause of a double elevator palsy

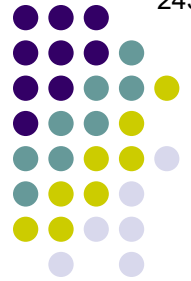
	Forced ductions?		
Inferior Restriction	Positive		
Elevator Insufficiency	Negative		

Uncertain mechanism

Double Elevator Palsy

DVD

--Due to...restriction or elevator insufficiency (or both)



Vertical Deviations

Vertical Deviations

Differentiating between IR restriction and elevator insufficiency as the cause of a double elevator palsy

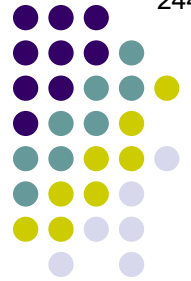
	Forced ductions?	Force generation?	
Inferior Restriction	Positive		
Elevator Insufficiency	Negative		

Uncertain mechanism

Double Elevator Palsy

DVD

--Due to...restriction or elevator insufficiency (or both)



Vertical Deviations

Vertical Deviations

Differentiating between IR restriction and elevator insufficiency as the cause of a double elevator palsy

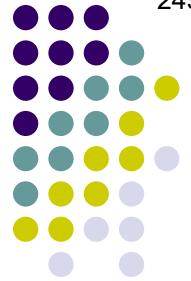
	Forced ductions?	Force generation?	
Inferior Restriction	Positive	Normal	
Elevator Insufficiency	Negative	Reduced	

Uncertain mechanism

Double Elevator Palsy

DVD

--Due to...restriction or elevator insufficiency (or both)



Vertical Deviations

Vertical Deviations

Differentiating between IR restriction and elevator insufficiency as the cause of a double elevator palsy

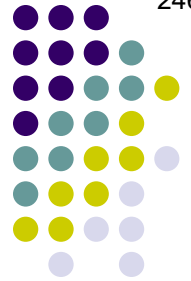
Uncertain mechanism

	Forced ductions?	Force generation?	Elevation saccades?
Inferior Restriction	Positive	Normal	
Elevator Insufficiency	Negative	Reduced	

Double Elevator Palsy

DVD

--Due to...restriction or elevator insufficiency (or both)



Vertical Deviations

Vertical Deviations

Differentiating between IR restriction and elevator insufficiency as the cause of a double elevator palsy

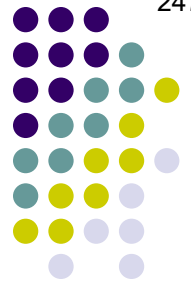
	Forced ductions?	Force generation?	Elevation saccades?
Inferior Restriction	Positive	Normal	Normal
Elevator Insufficiency	Negative	Reduced	Reduced

Uncertain mechanism

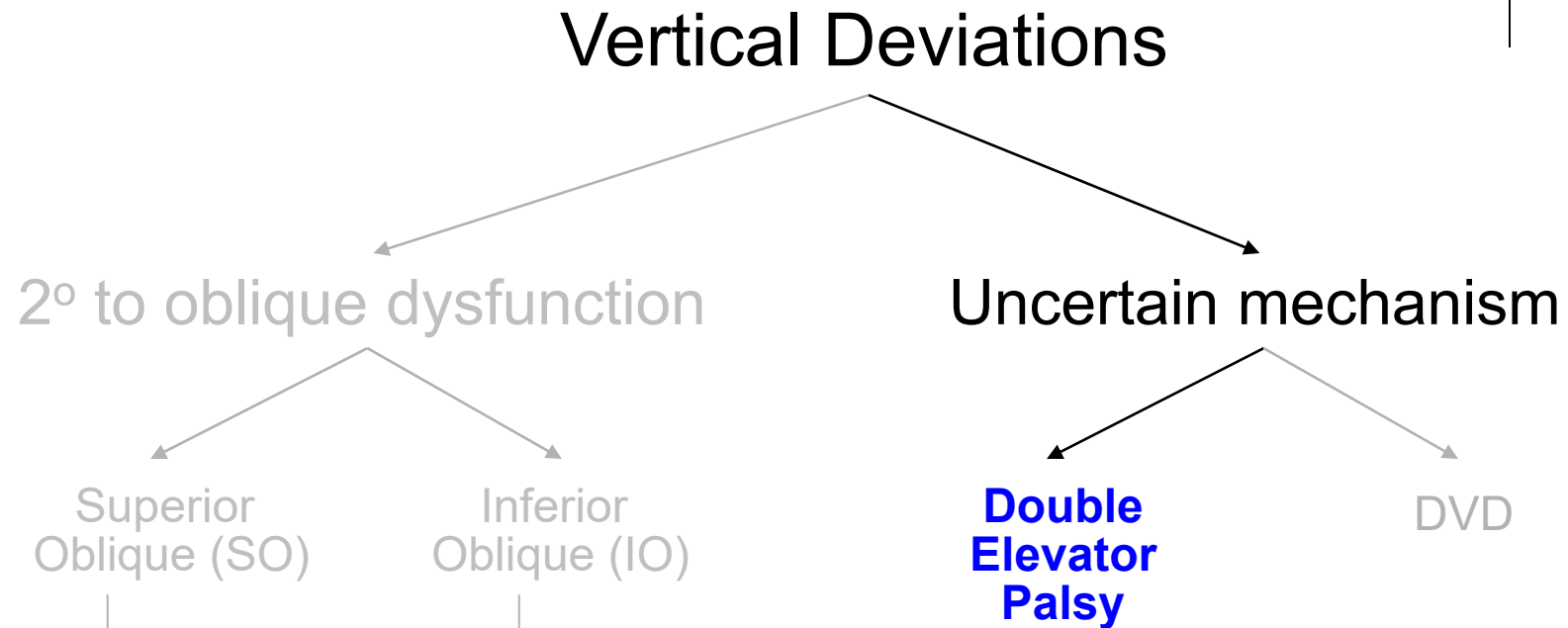
Double Elevator Palsy

DVD

--Due to...restriction or elevator insufficiency (or both)



Vertical Deviations



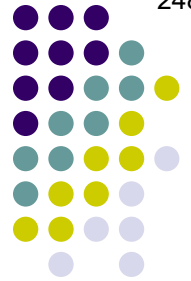
Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

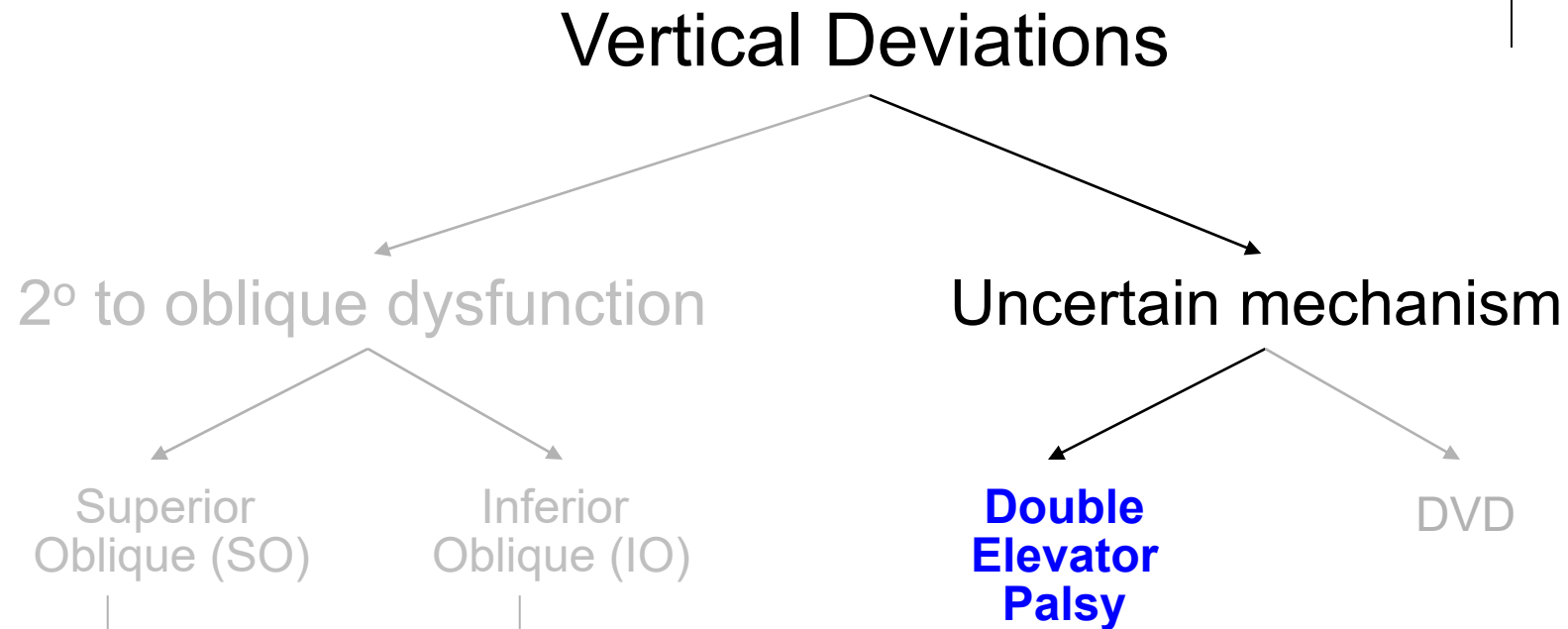
--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

--Due to...restriction or elevation insufficiency (or both)

--Presents with...



Vertical Deviations



Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

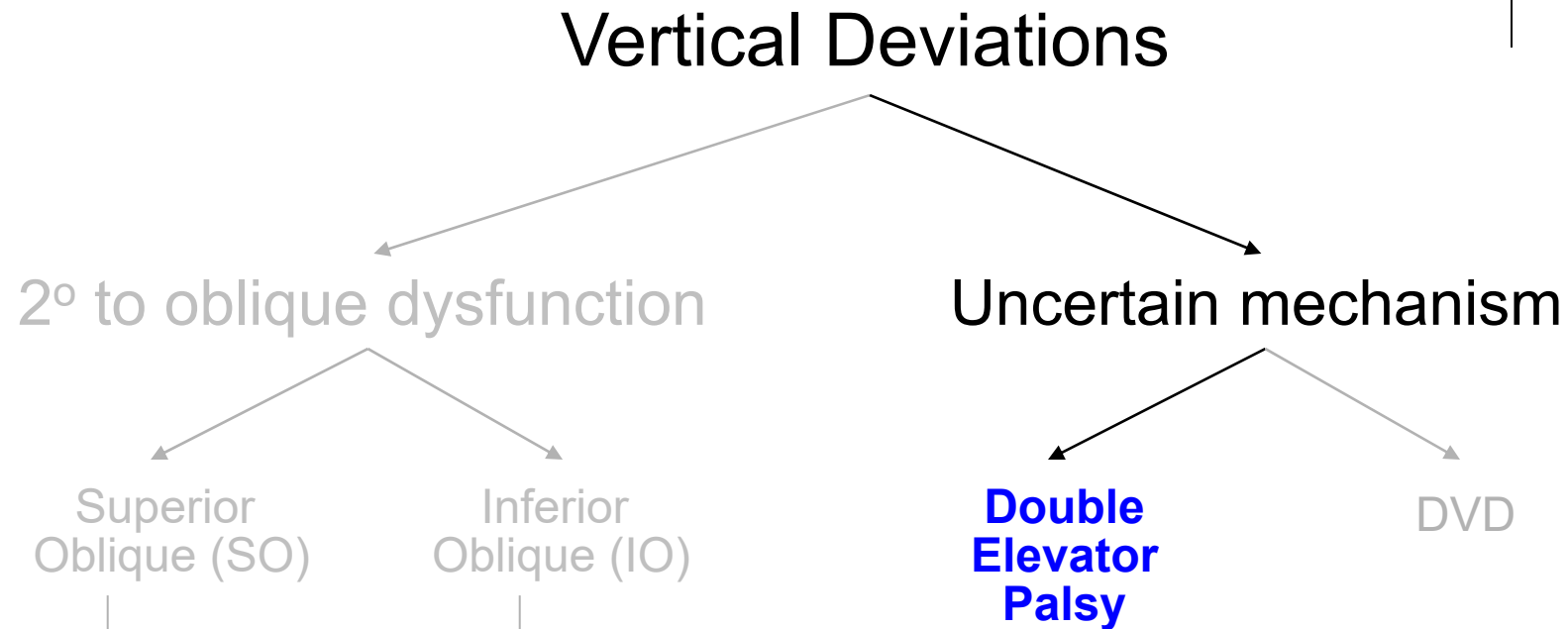
--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

--Due to...restriction or elevation insufficiency (or both)

--Presents with...hypotropia that worsens in upgaze



Vertical Deviations



Double Elevator Palsy

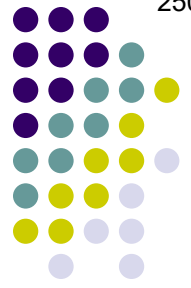
--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

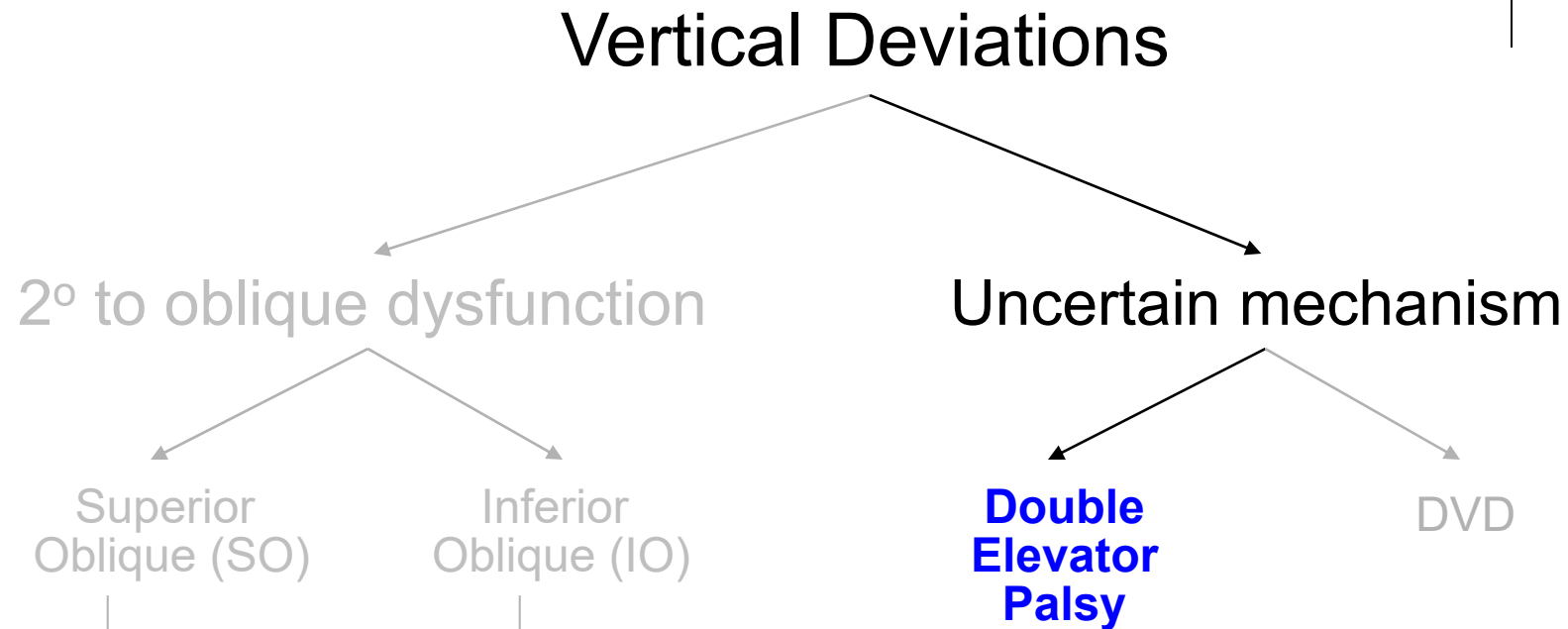
--Due to...restriction or elevation insufficiency (or both)

--Presents with...hypotropia that worsens in upgaze

--Often adopt a... [head position]



Vertical Deviations



Double Elevator Palsy

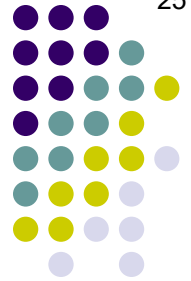
--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

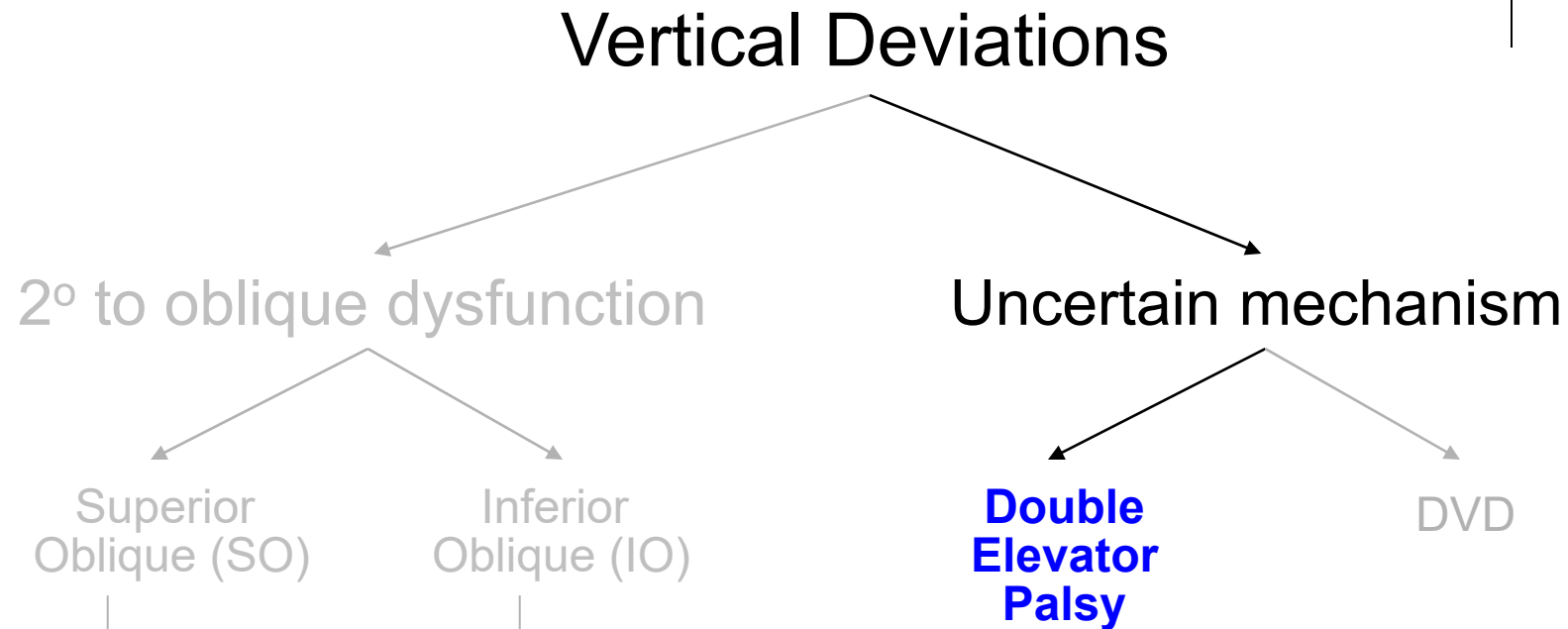
--Due to...restriction or elevation insufficiency (or both)

--Presents with...hypotropia that worsens in upgaze

--Often adopt a...chin-up position



Vertical Deviations



Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

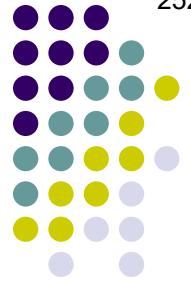
--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

--Due to...restriction or elevation insufficiency (or both)

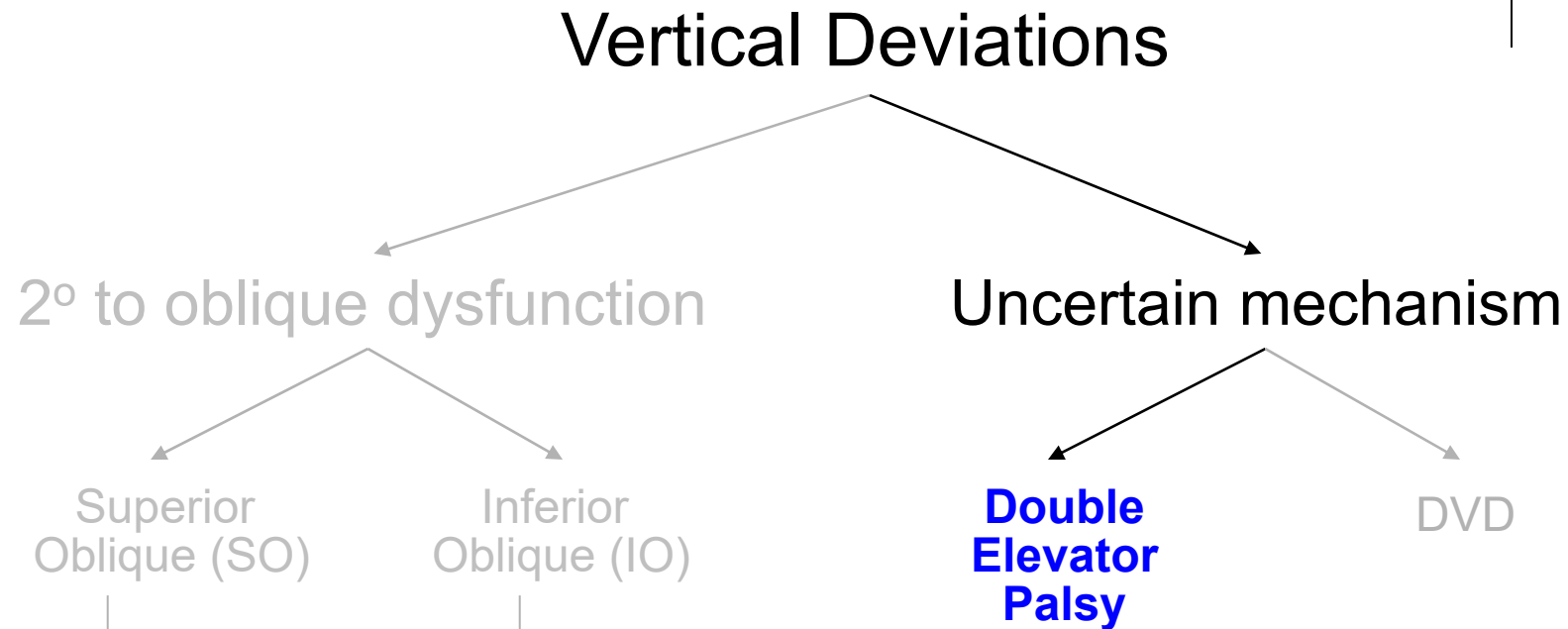
--Presents with...hypotropia that worsens in upgaze

--Often adopt a...chin-up position

--50% have... [another EOM problem]



Vertical Deviations



Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

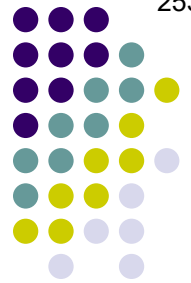
--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

--Due to...restriction or elevation insufficiency (or both)

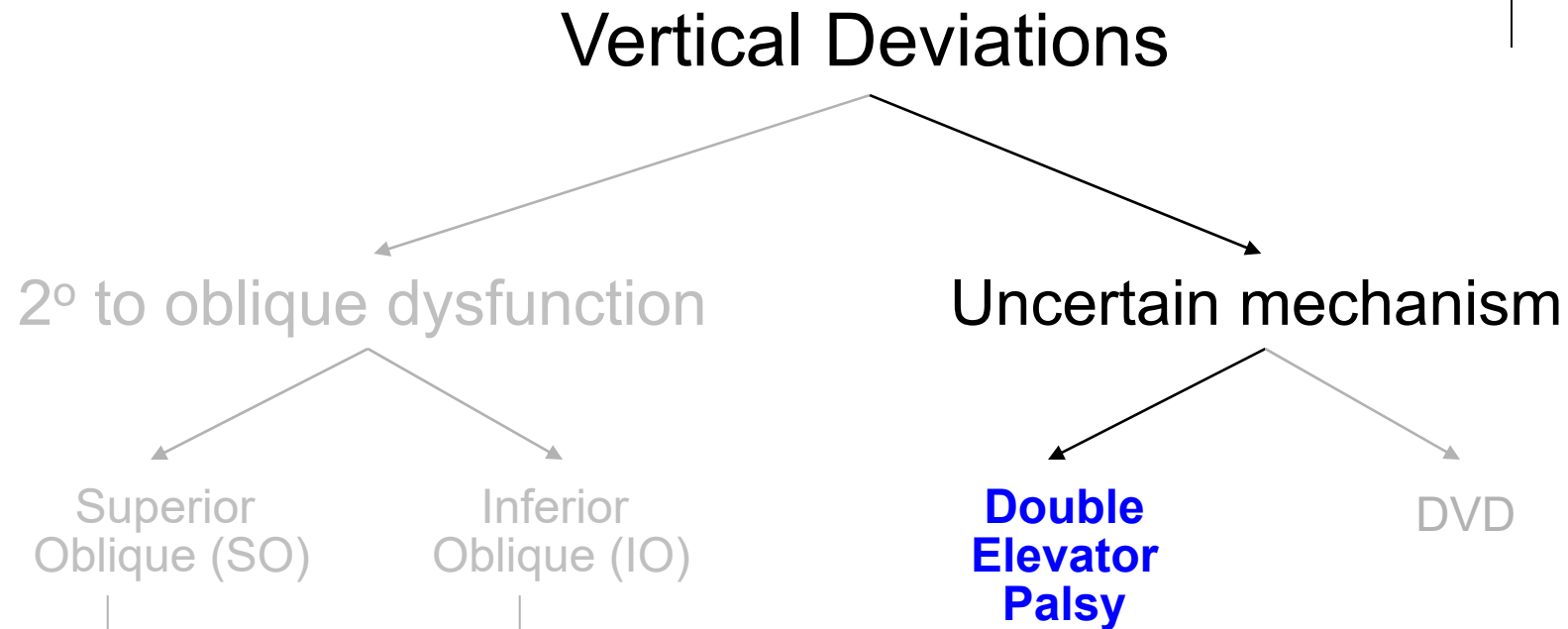
--Presents with...hypotropia that worsens in upgaze

--Often adopt a...chin-up position

--50% have...concomitant ptosis (1/3 of these with...[eponymous condition])



Vertical Deviations



Double Elevator Palsy

--aka...**Monocular Elevation Deficiency**

--Catch-all term for a strabismus involving...decreased elevation in all fields of gaze

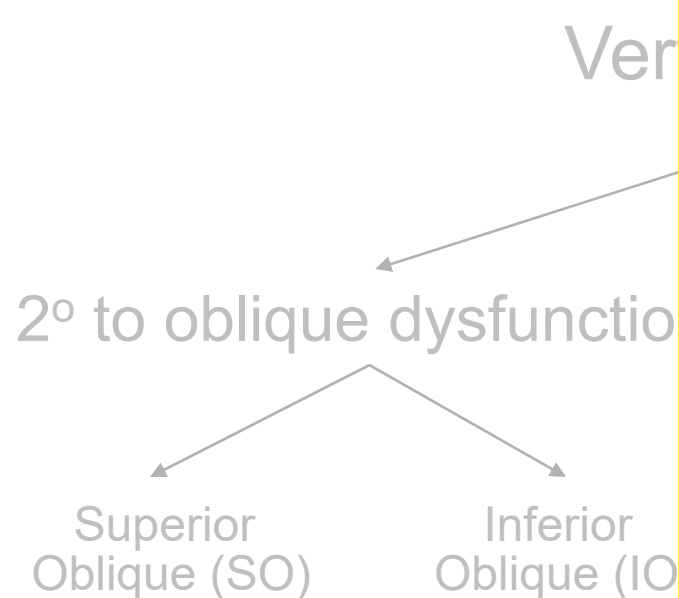
--Due to...restriction or elevation insufficiency (or both)

--Presents with...hypotropia that worsens in upgaze

--Often adopt a...chin-up position

--50% have...concomitant ptosis (1/3 of these with...Marcus-Gunn jaw wink)

Vertical Deviations



Double Elevator Palsy

--aka...**Monocular Elevation Def**

--Catch-all term for a strabismus in

--Due to...restriction or elevation in

--Presents with...hypotropia that worsens in upgaze

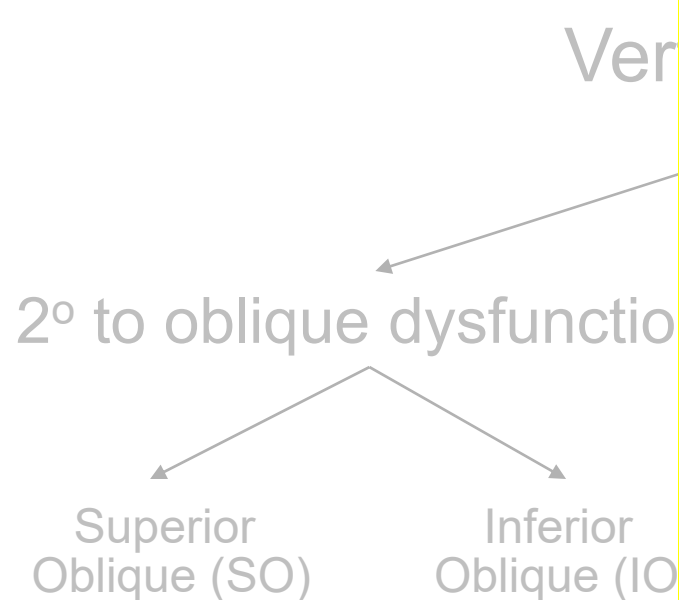
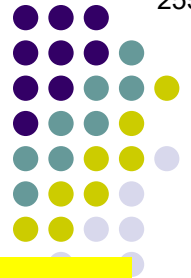
--Often adopt a...chin-up position

--50% have...concomitant ptosis (1/3 of these with...

Marcus-Gunn jaw wink)

Broadly speaking, what sort of disorder is Marcus-Gunn jaw wink (MGJW)?

Vertical Deviations

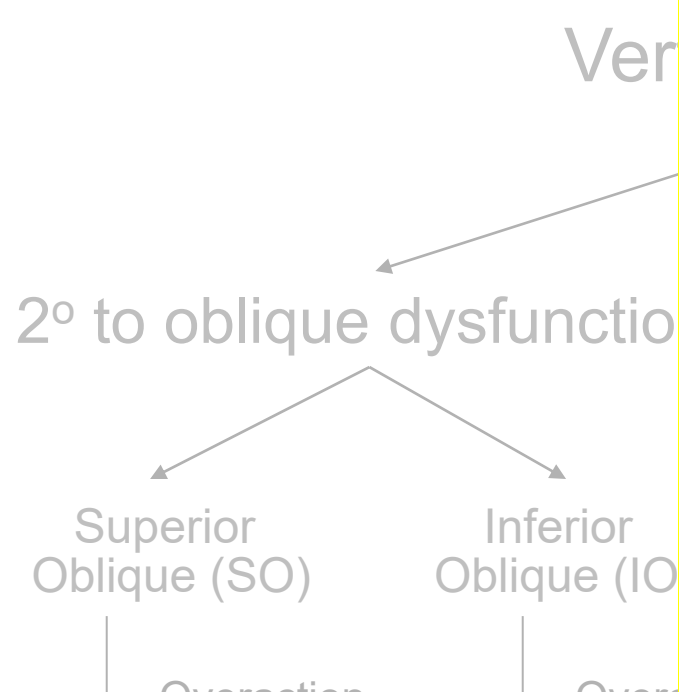
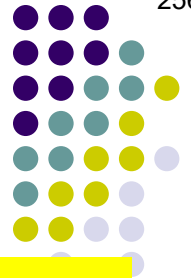


Broadly speaking, what sort of disorder is Marcus-Gunn jaw wink (MGJW)?
It is one of **synkinesis**

Double Elevator Palsy

- aka...**Monocular Elevation Defect**
- Catch-all term for a strabismus in which one eye is elevated
- Due to...restriction or elevation in the vertical movement of the eye
- Presents with...hypotropia that worsens in upgaze
- Often adopt a...chin-up position
- 50% have...concomitant ptosis (1/3 of these with...**Marcus-Gunn jaw wink**)

Vertical Deviations



Double Elevator Palsy

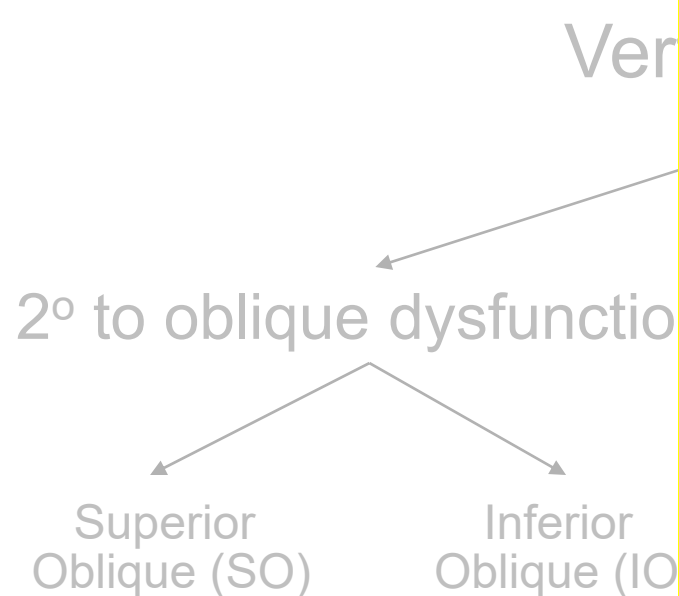
- aka...**Monocular Elevation Deficiency**
- Catch-all term for a strabismus in which one eye is upgazing
- Due to...restriction or elevation in the vertical plane
- Presents with...hypotropia that worsens in upgaze
- Often adopt a...chin-up position
- 50% have...concomitant ptosis (1/3 of these with...**Marcus-Gunn jaw wink**)

Broadly speaking, what sort of disorder is Marcus-Gunn jaw wink (MGJW)?

It is one of **synkinesis**

What does synkinesis refer to?

Vertical Deviations



Broadly speaking, what sort of disorder is Marcus-Gunn jaw wink (MGJW)?

It is one of **synkinesis**

What does synkinesis refer to?

The **involuntary** movement of one bodypart in response to the **voluntary** movement of another

Double Elevator Palsy

--aka...**Monocular Elevation Def**

--Catch-all term for a strabismus in

--Due to...restriction or elevation in

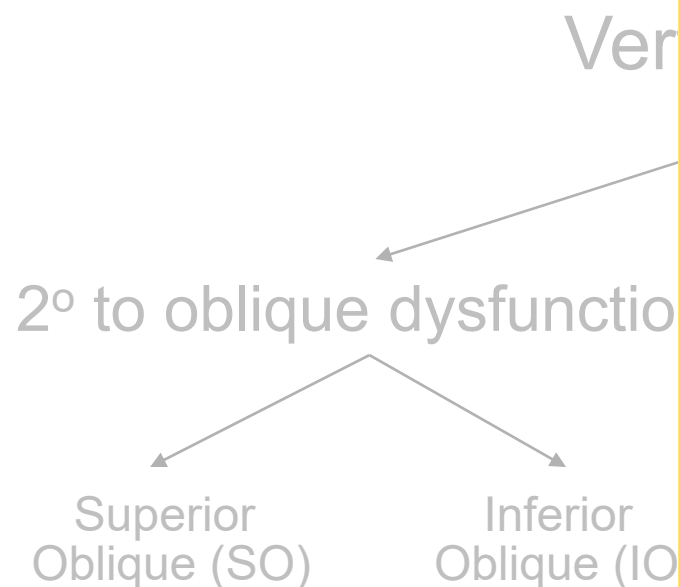
--Presents with...hypotropia that worsens in upgaze

--Often adopt a...chin-up position

--50% have...concomitant ptosis (1/3 of these with...

Marcus-Gunn jaw wink)

Vertical Deviations



Double Elevator Palsy

- aka...**Monocular Elevation Deficiency**
- Catch-all term for a strabismus in which one eye is elevated
- Due to...restriction or elevation in the vertical movement of one eye
- Presents with...hypotropia that worsens in upgaze
- Often adopt a...chin-up position
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Broadly speaking, what sort of disorder is Marcus-Gunn jaw wink (MGJW)?

It is one of **synkinesis**

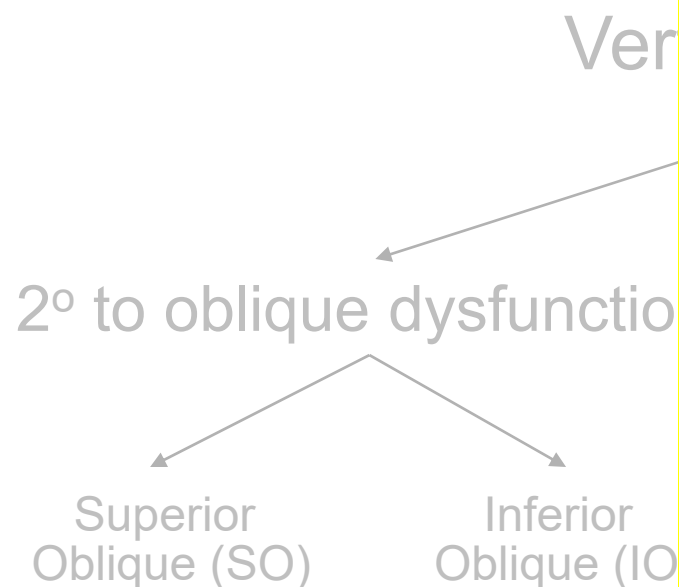
What does synkinesis refer to?

The **involuntary** movement of one bodypart in response to the **voluntary** movement of another

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Marcus-Gunn jaw wink

Vertical Deviations



Double Elevator Palsy

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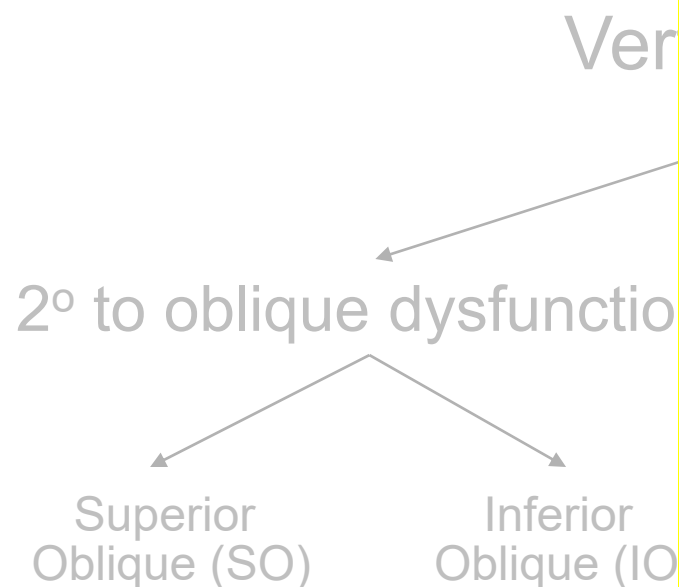
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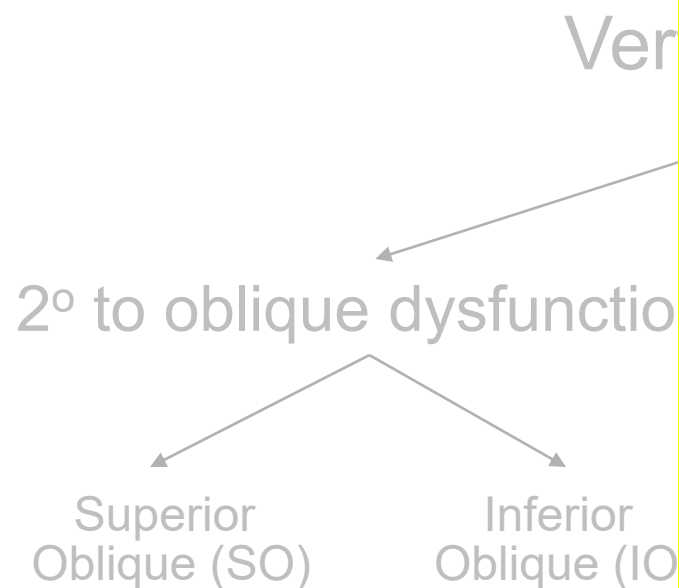
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Vertical Deviations



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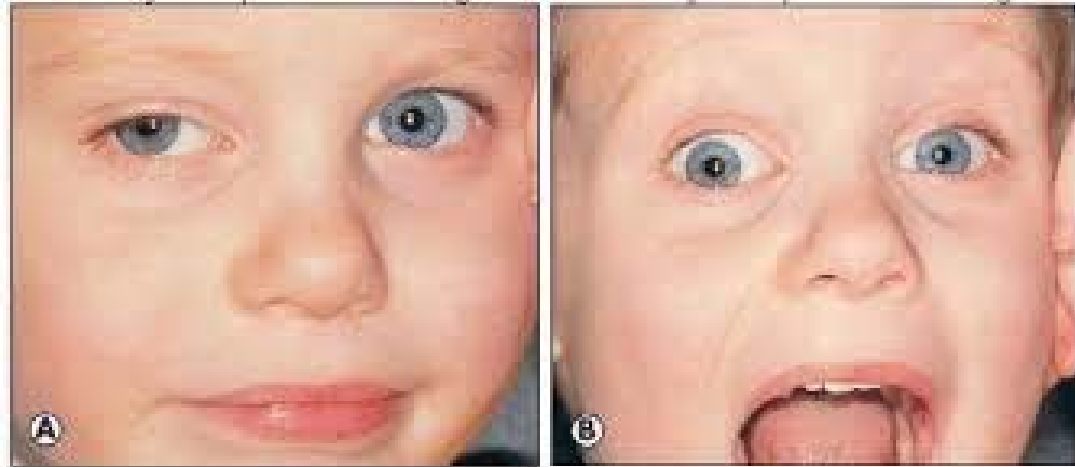
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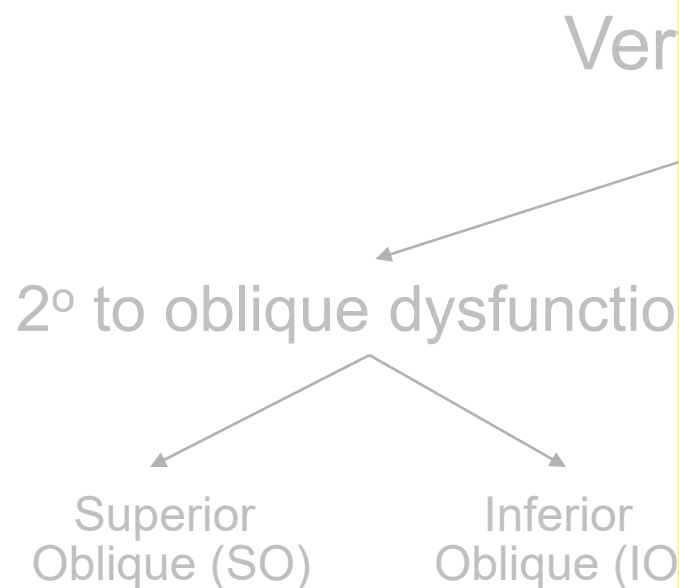


Vertical Deviations



MGJW

Vertical Deviations



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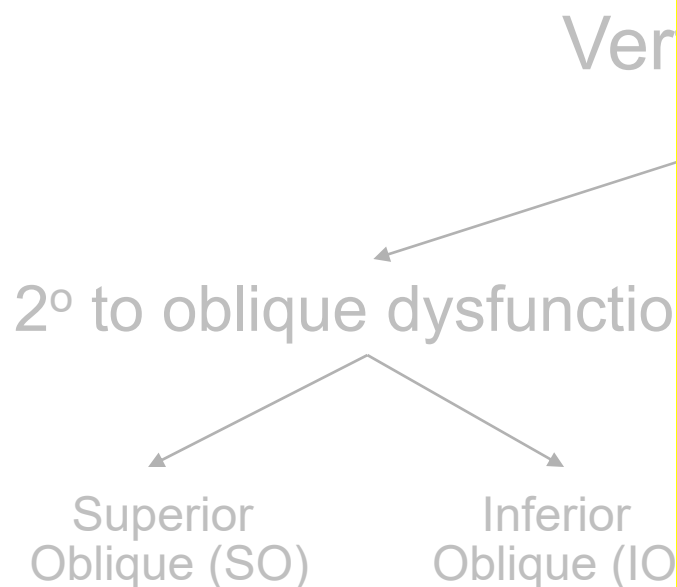
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Which jaw movements are involved?

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Marcus-Gunn jaw wink)

Vertical Deviations



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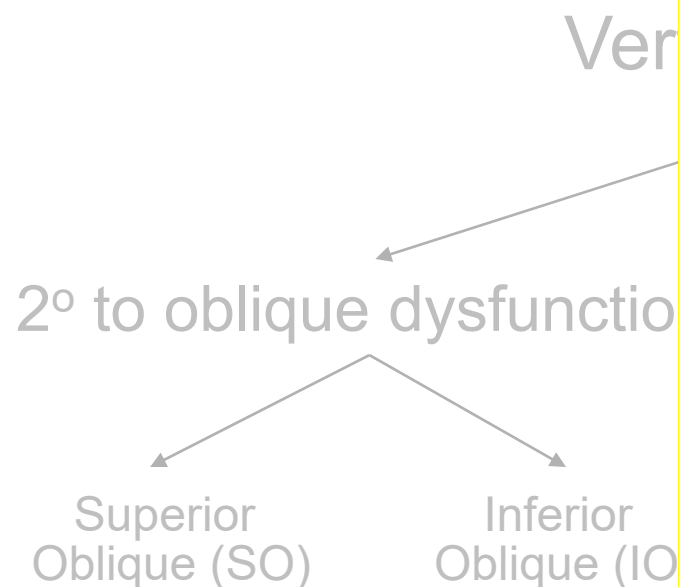
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Which jaw movements are involved?

- Lateral displacement
- Protrusion
- Wide opening
- Clenching

Marcus-Gunn jaw wink

Vertical Deviations



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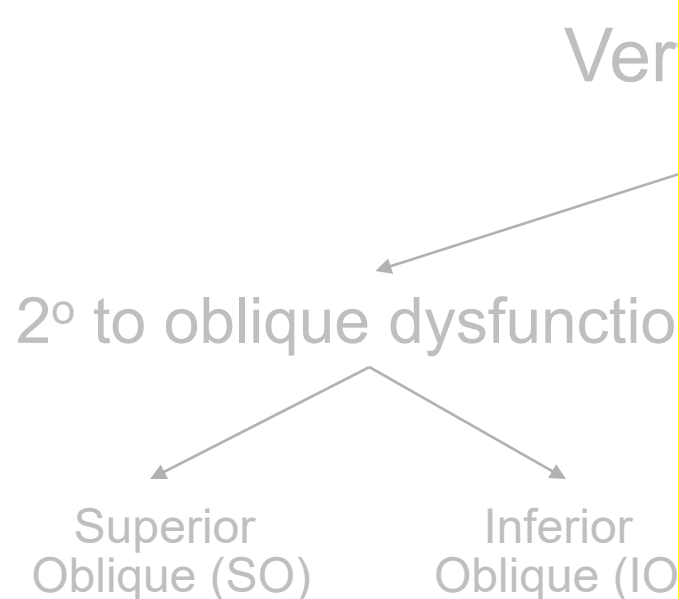
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Vertical Deviations



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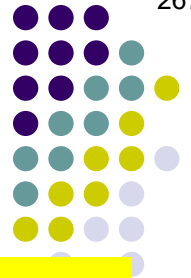
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Marcus-Gunn jaw wink)

Vertical Deviations



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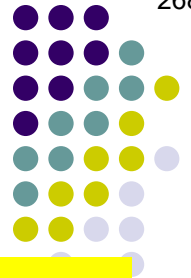
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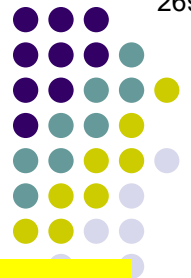
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Duane syndrome, as discussed previously

*Briefly, what **is** Duane syndrome?*

A motility disorder with the following key findings:

--At least some limitation of horizontal movement

-- Attempted adduction causes the globe to retract, and may cause it to up- or downshoot

What is the cause?

The nucleus for cranial nerve VI is missing, and the lateral rectus is innervated by cranial nerve III

ne bodypart in response
another

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MGJW?

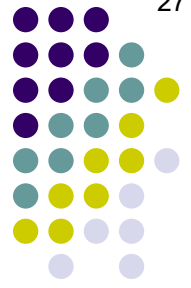
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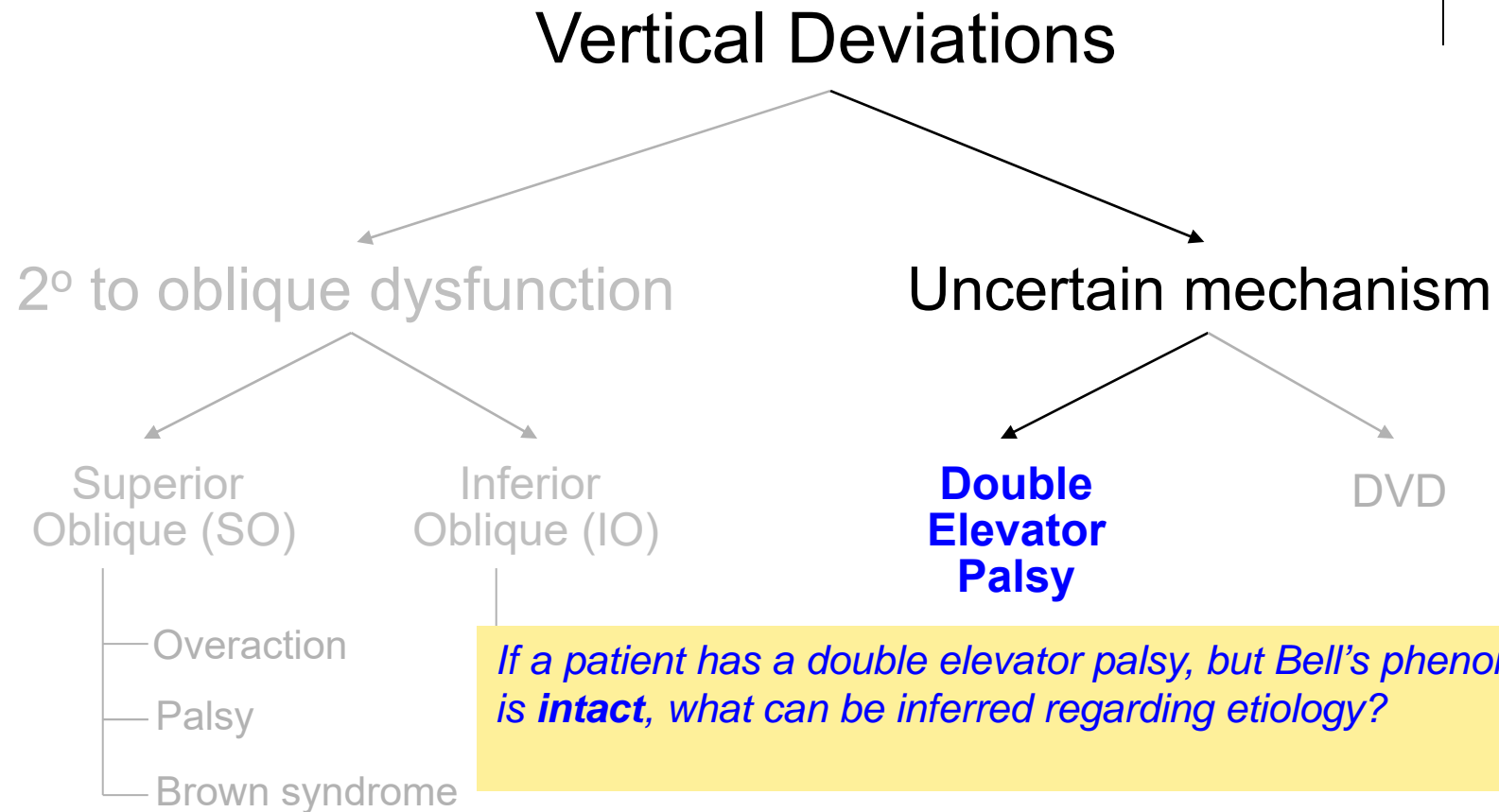
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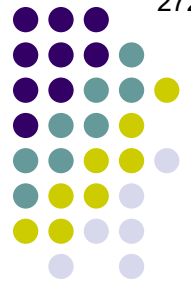
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-Gunn jaw wink)

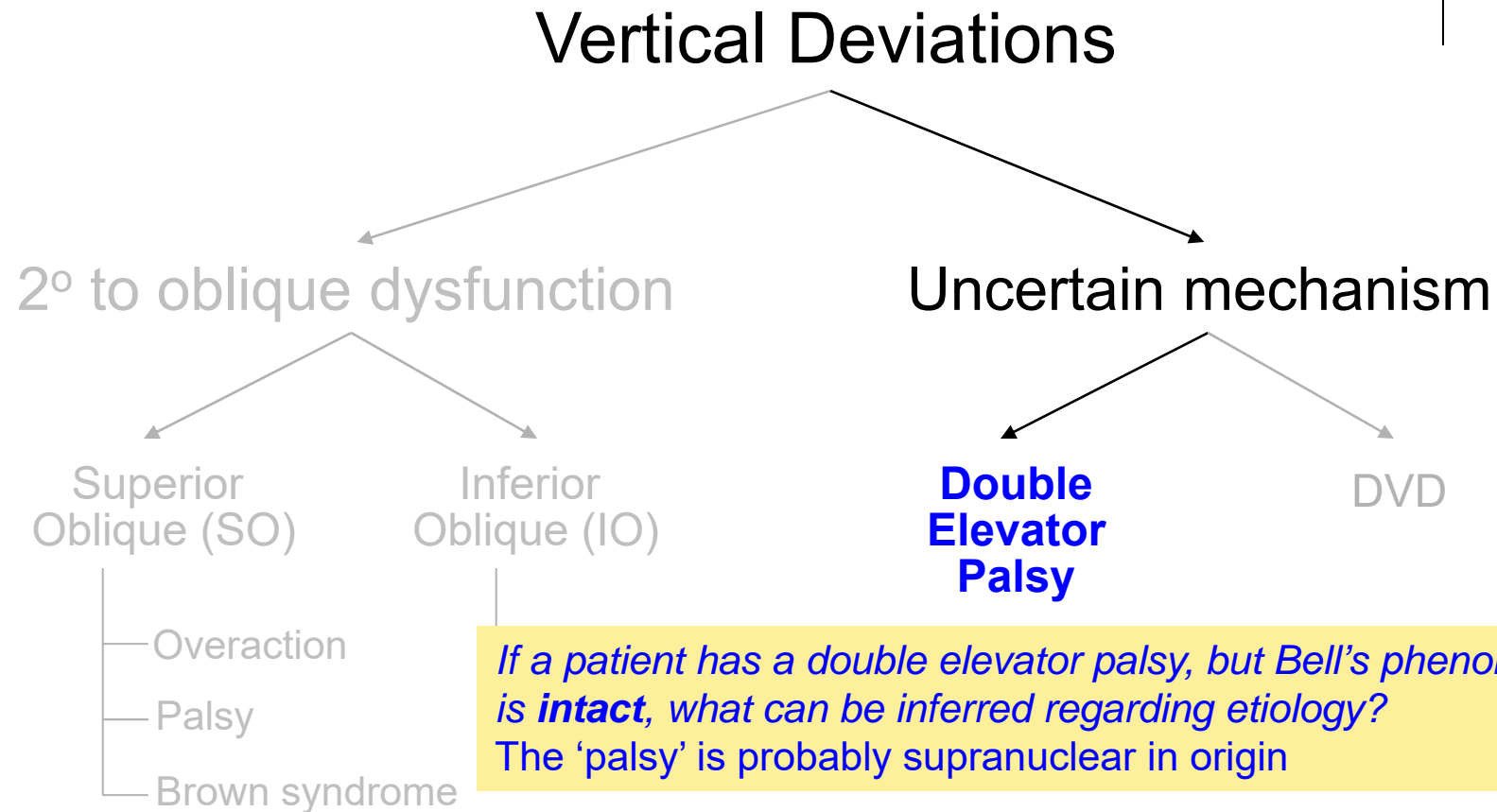


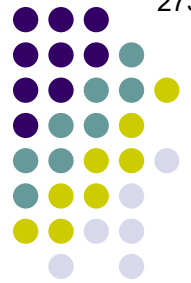
Vertical Deviations



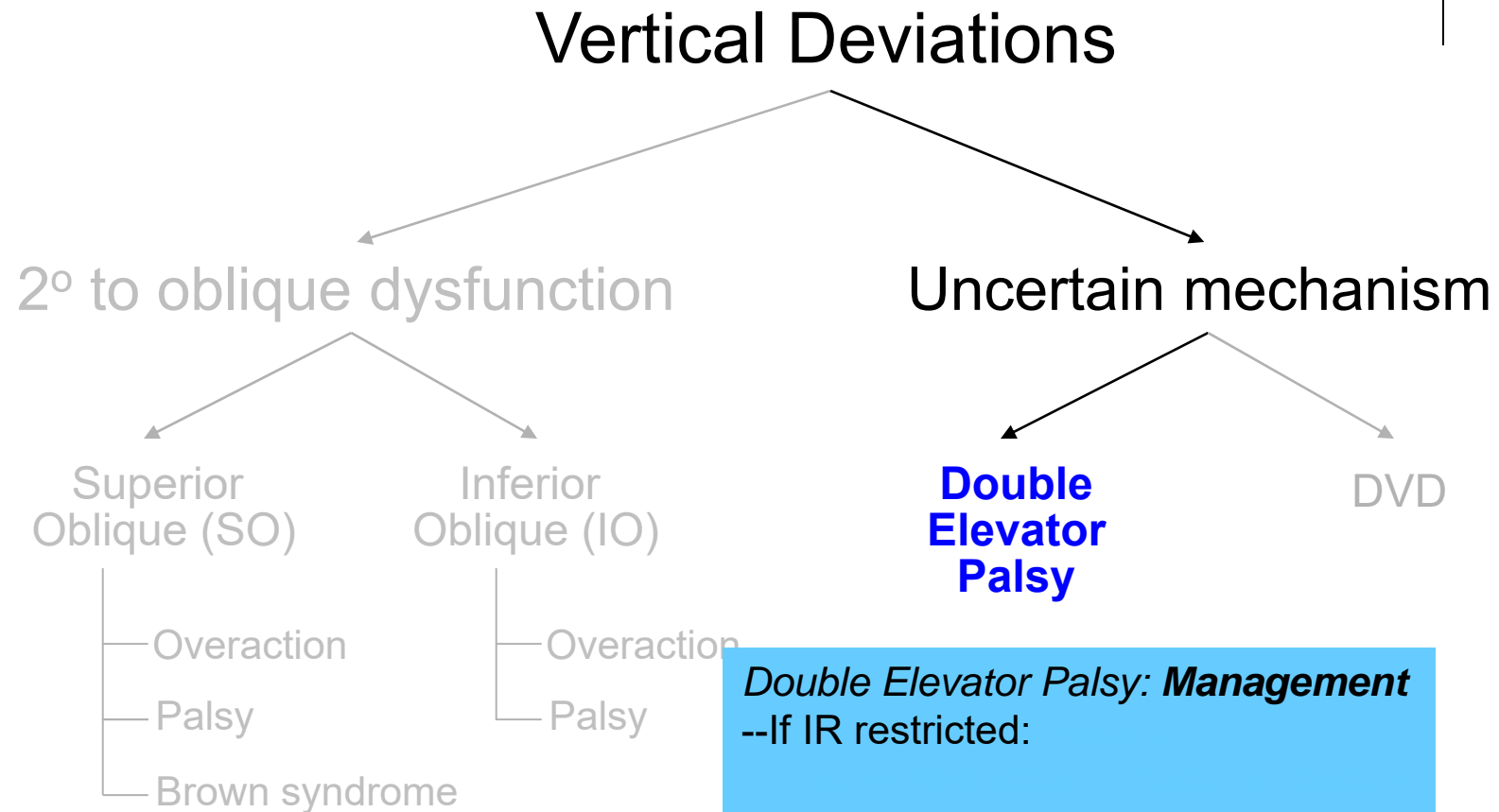


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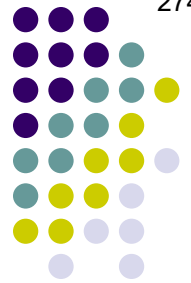




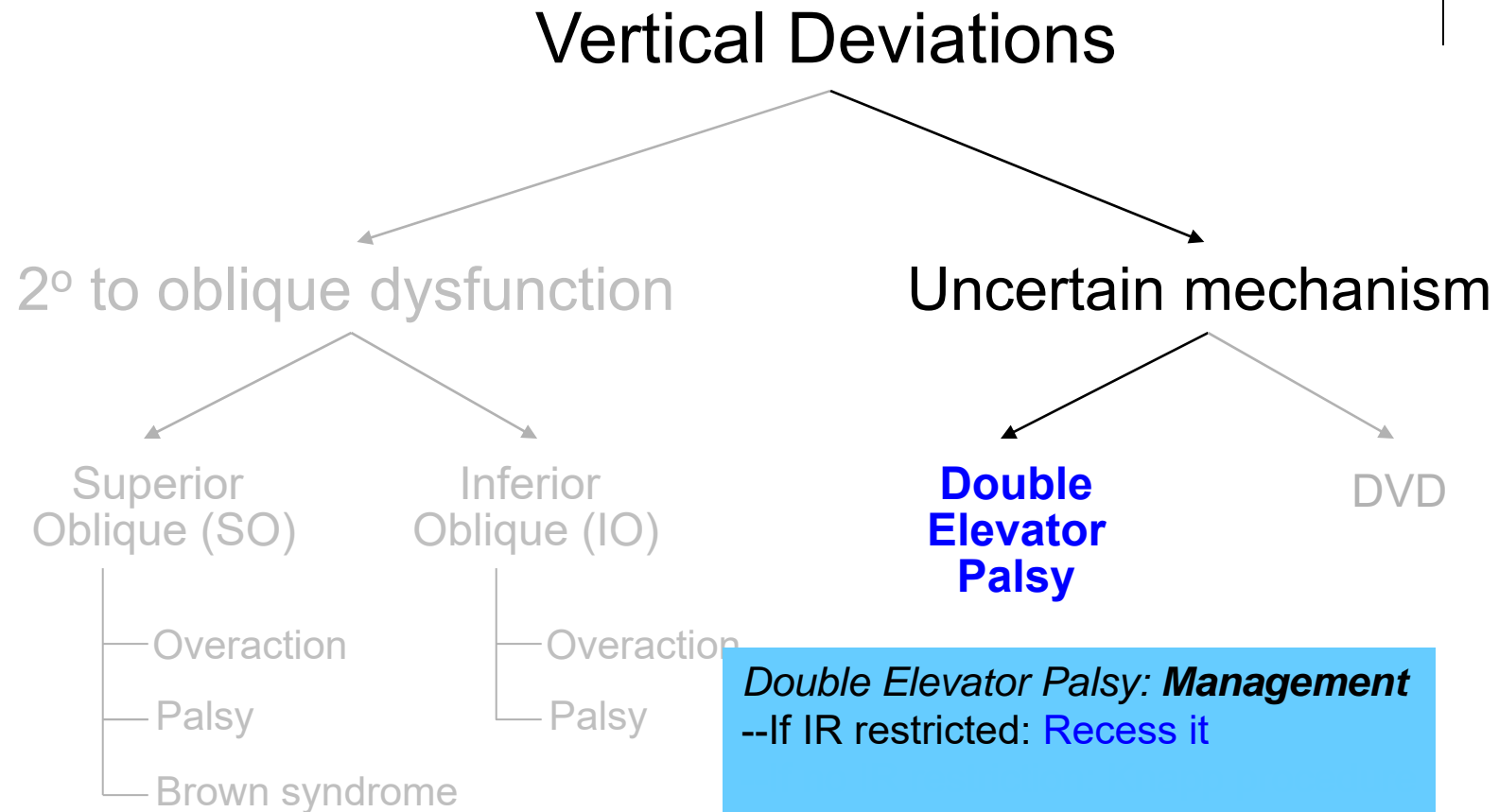
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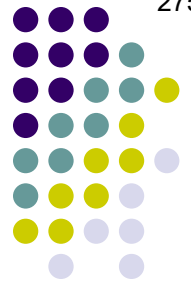
*Double Elevator Palsy: **Management***
 --If IR restricted:



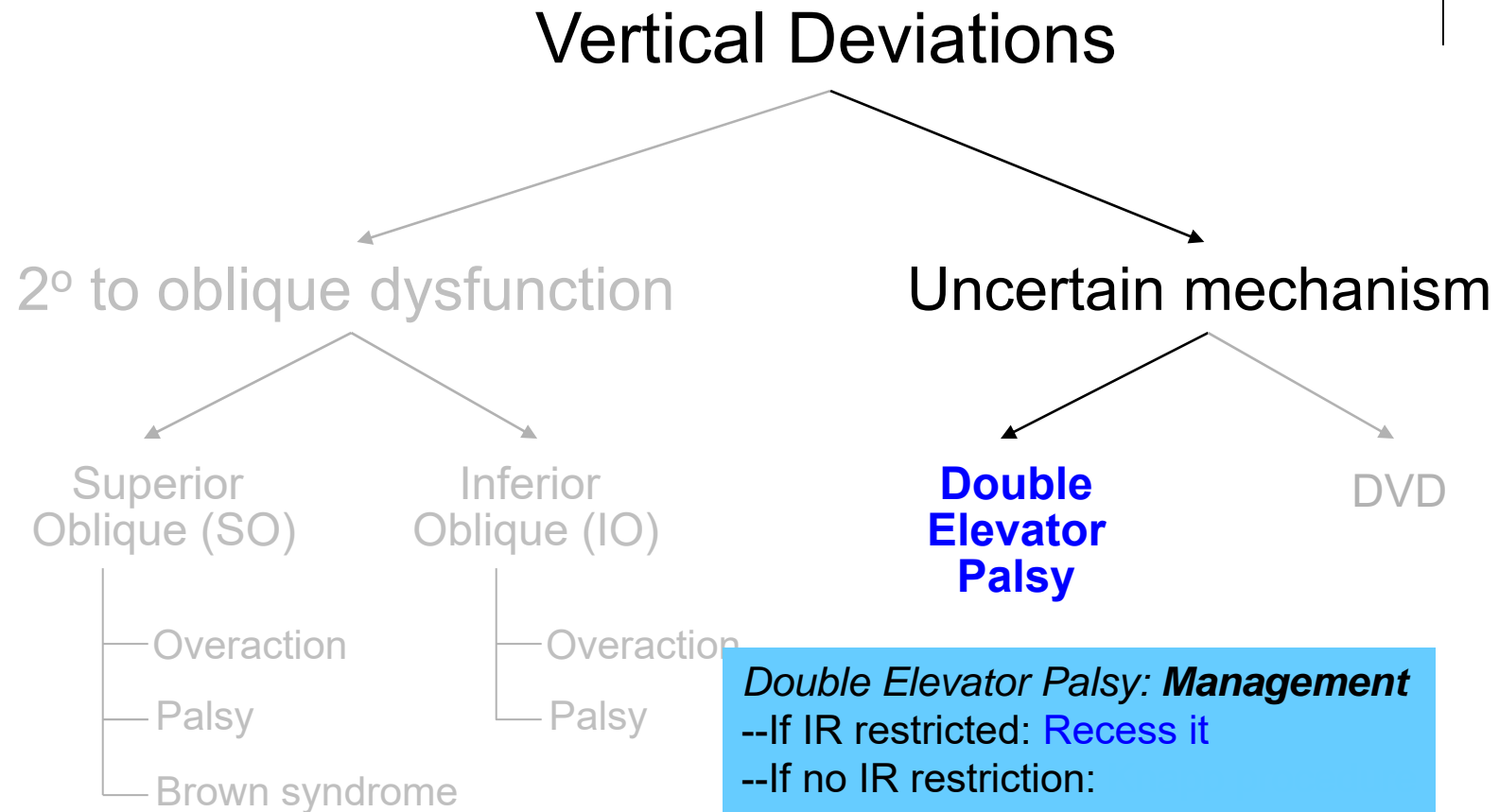
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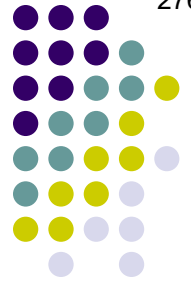
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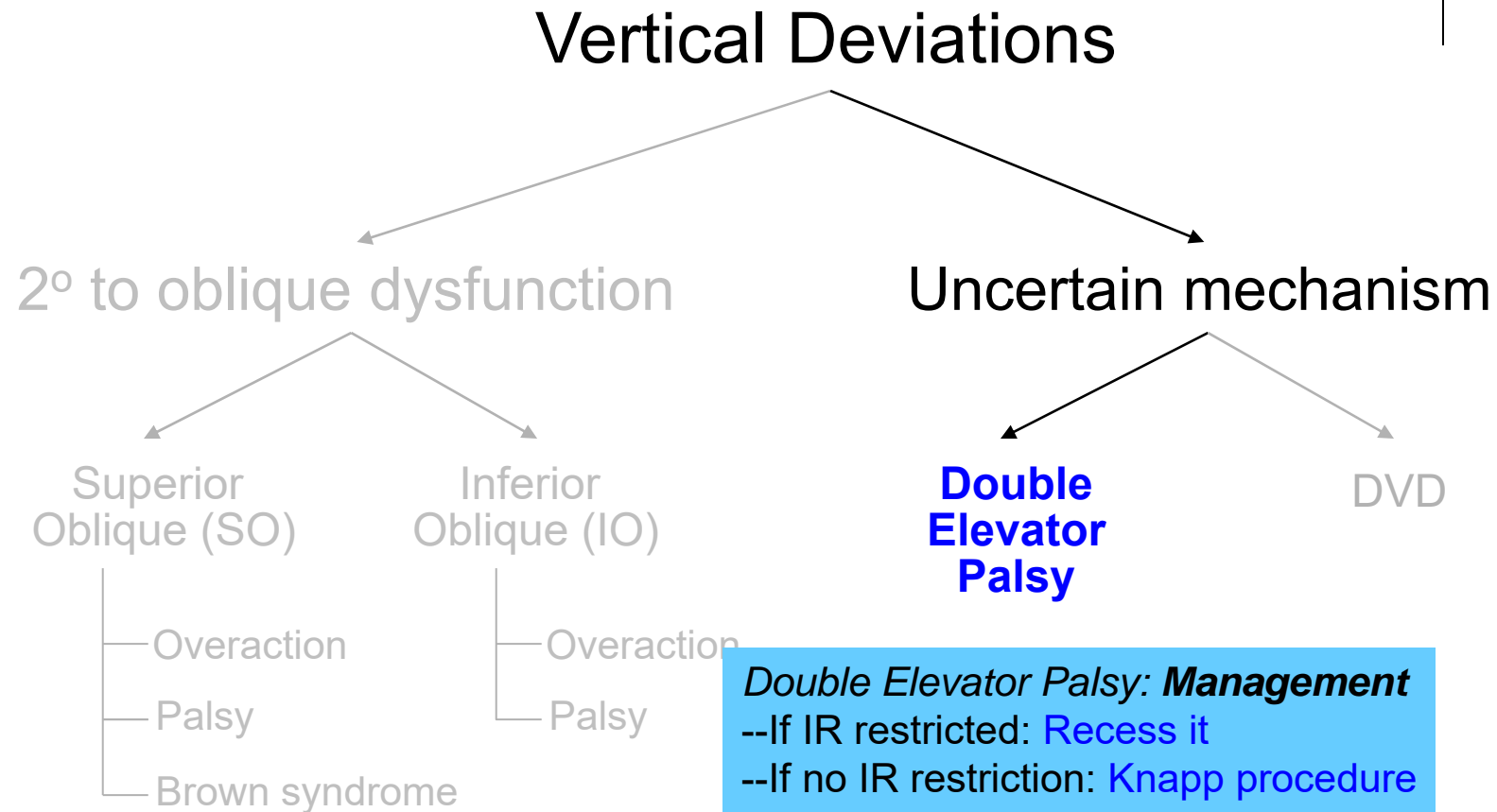
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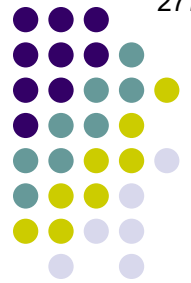


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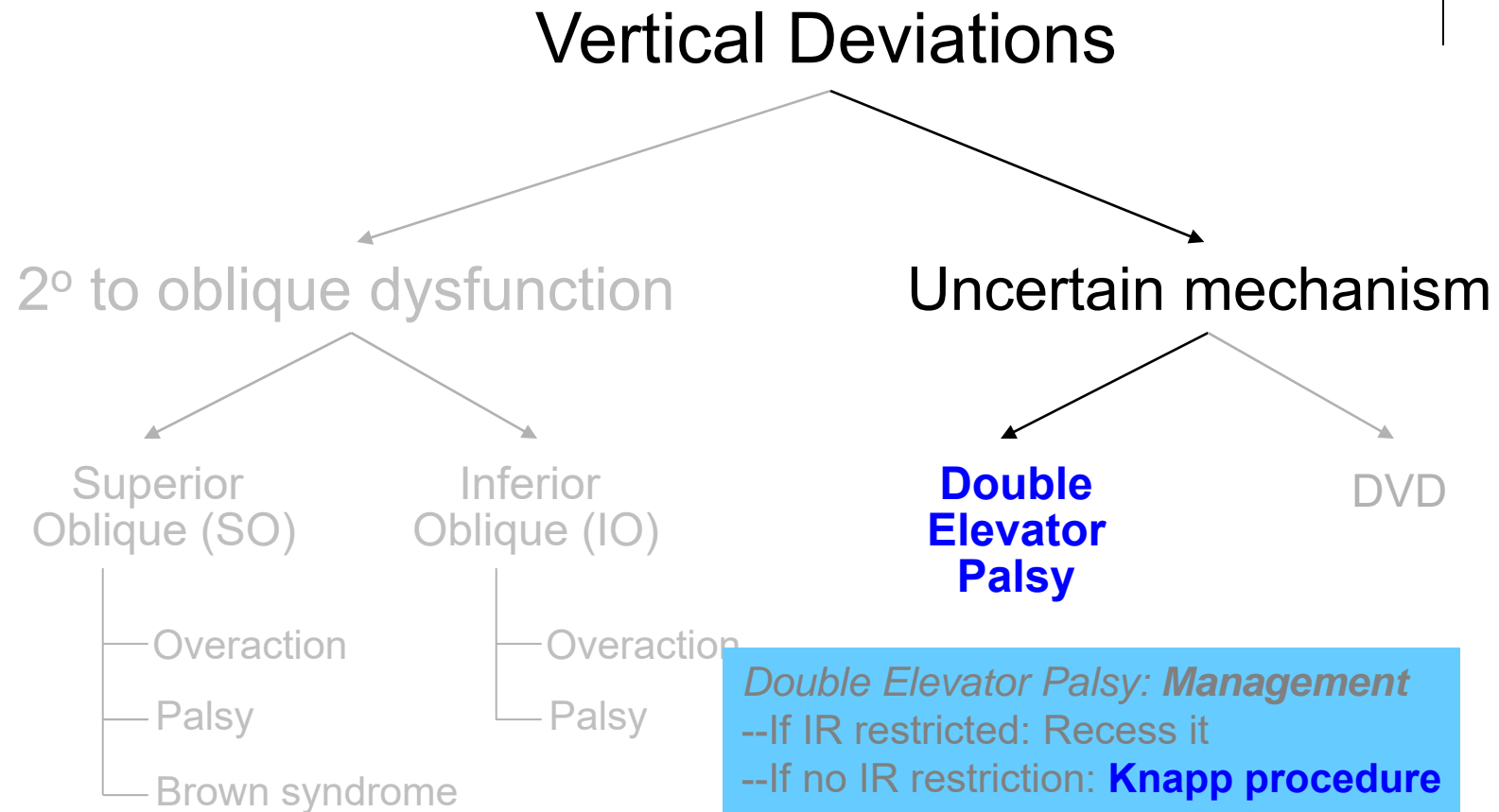


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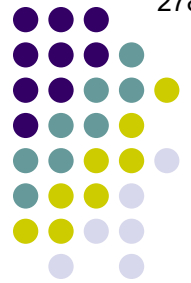


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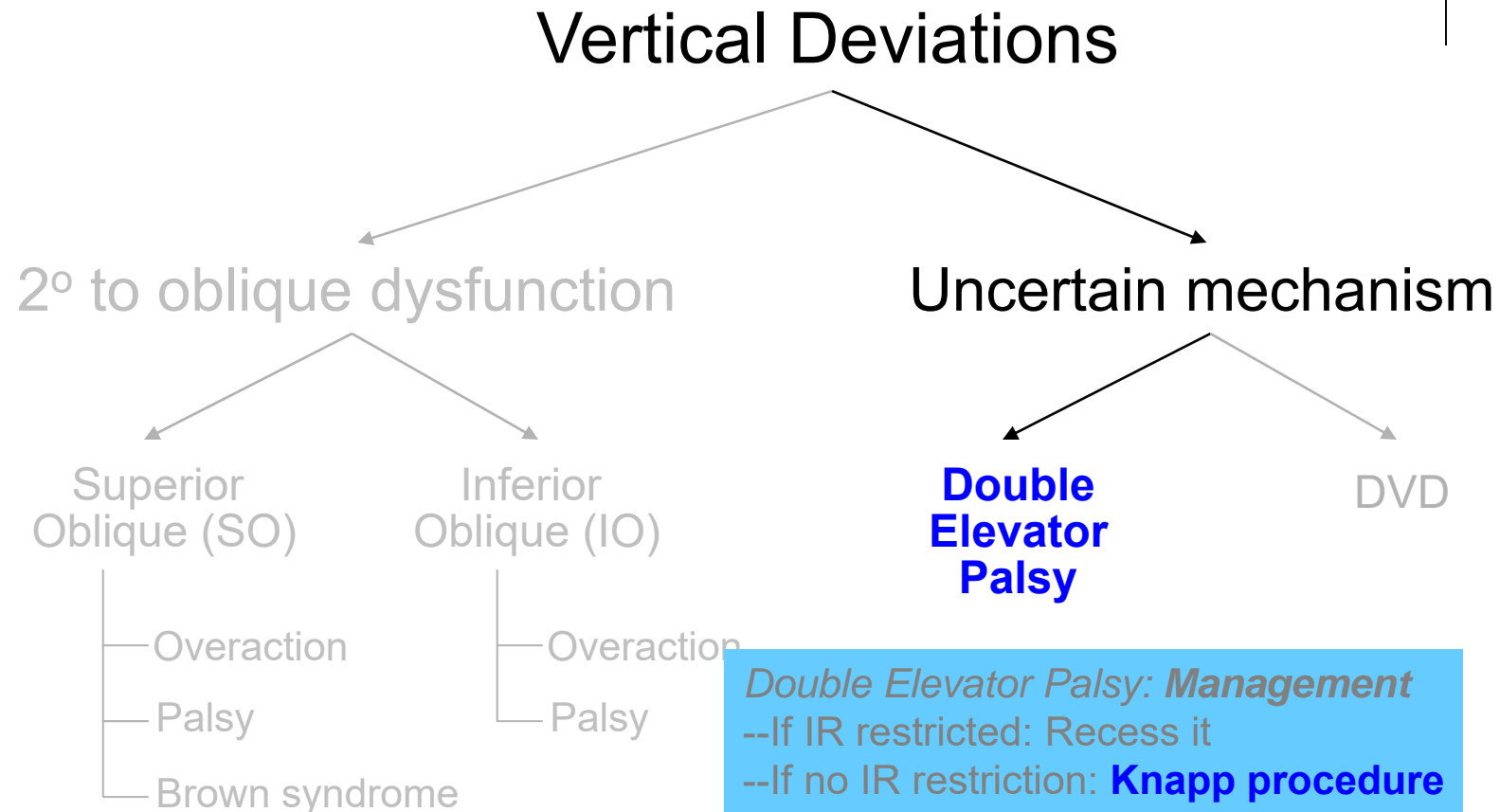
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What is the Knapp procedure?



Vertical Deviations



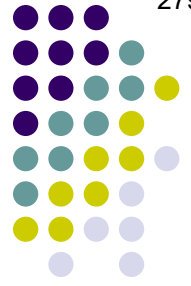
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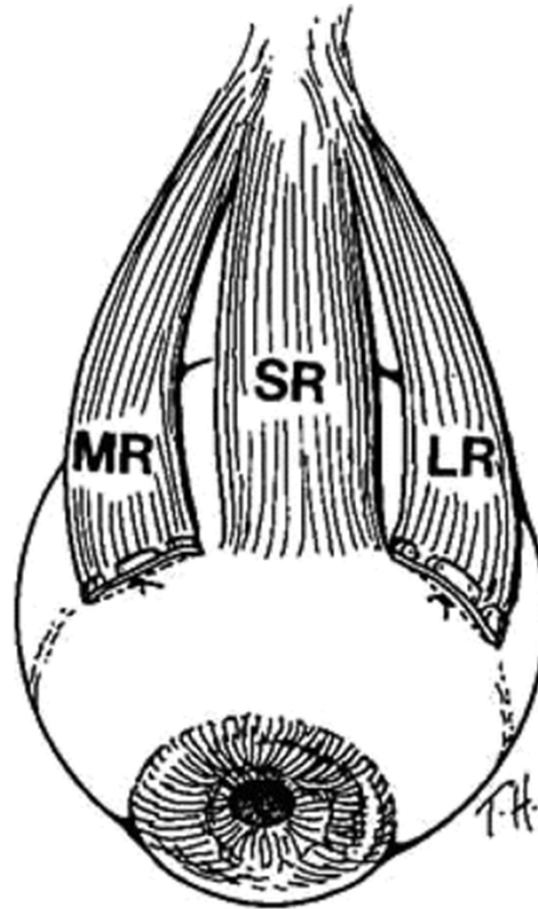
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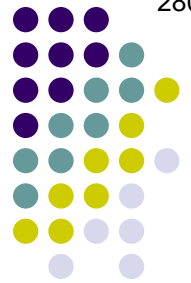
Relocating the LR and MR insertions toward the SR



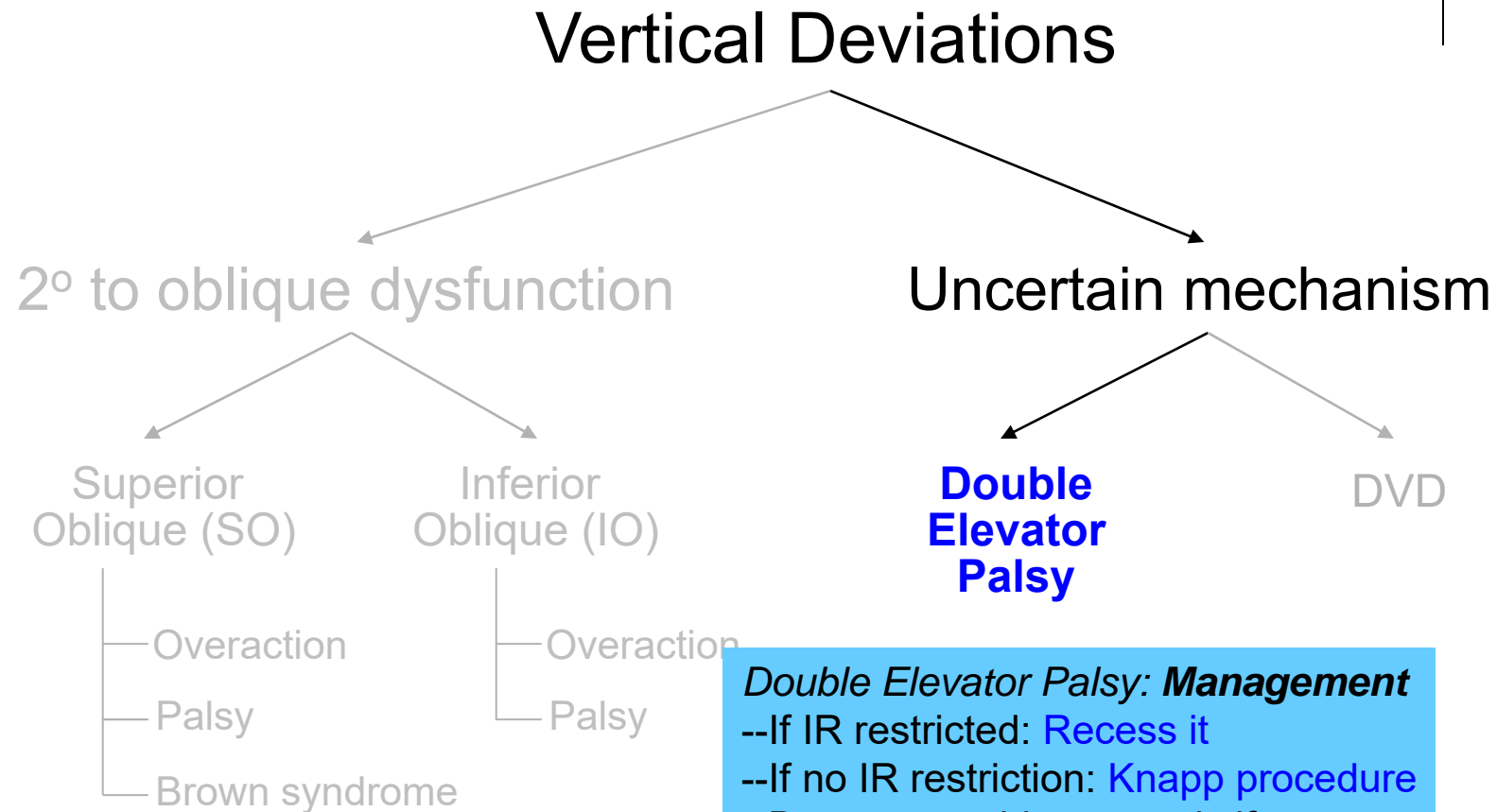
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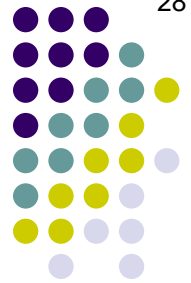
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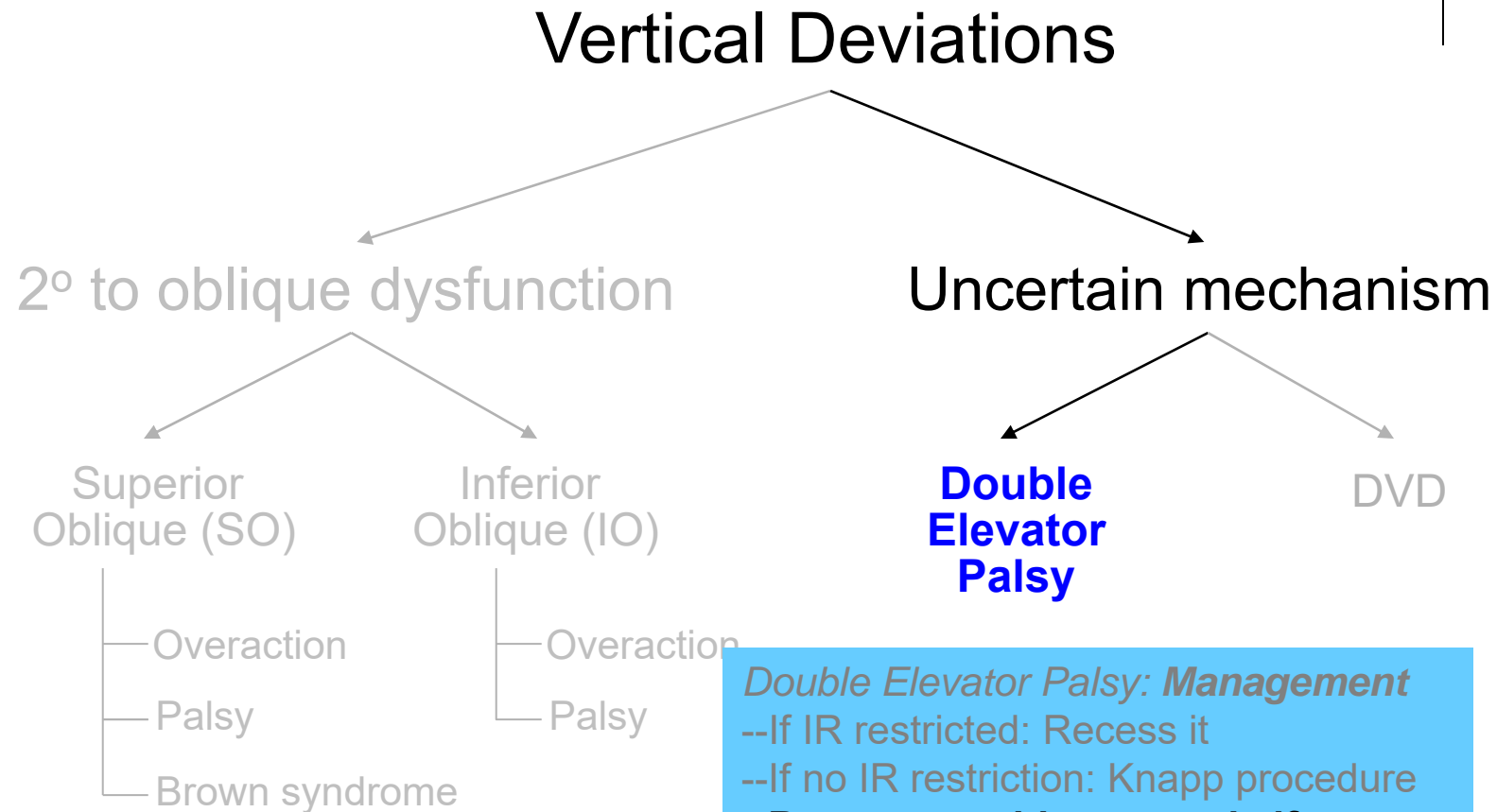
Vertical Deviations



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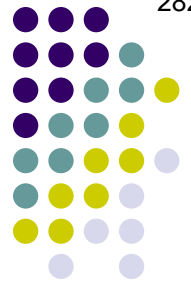


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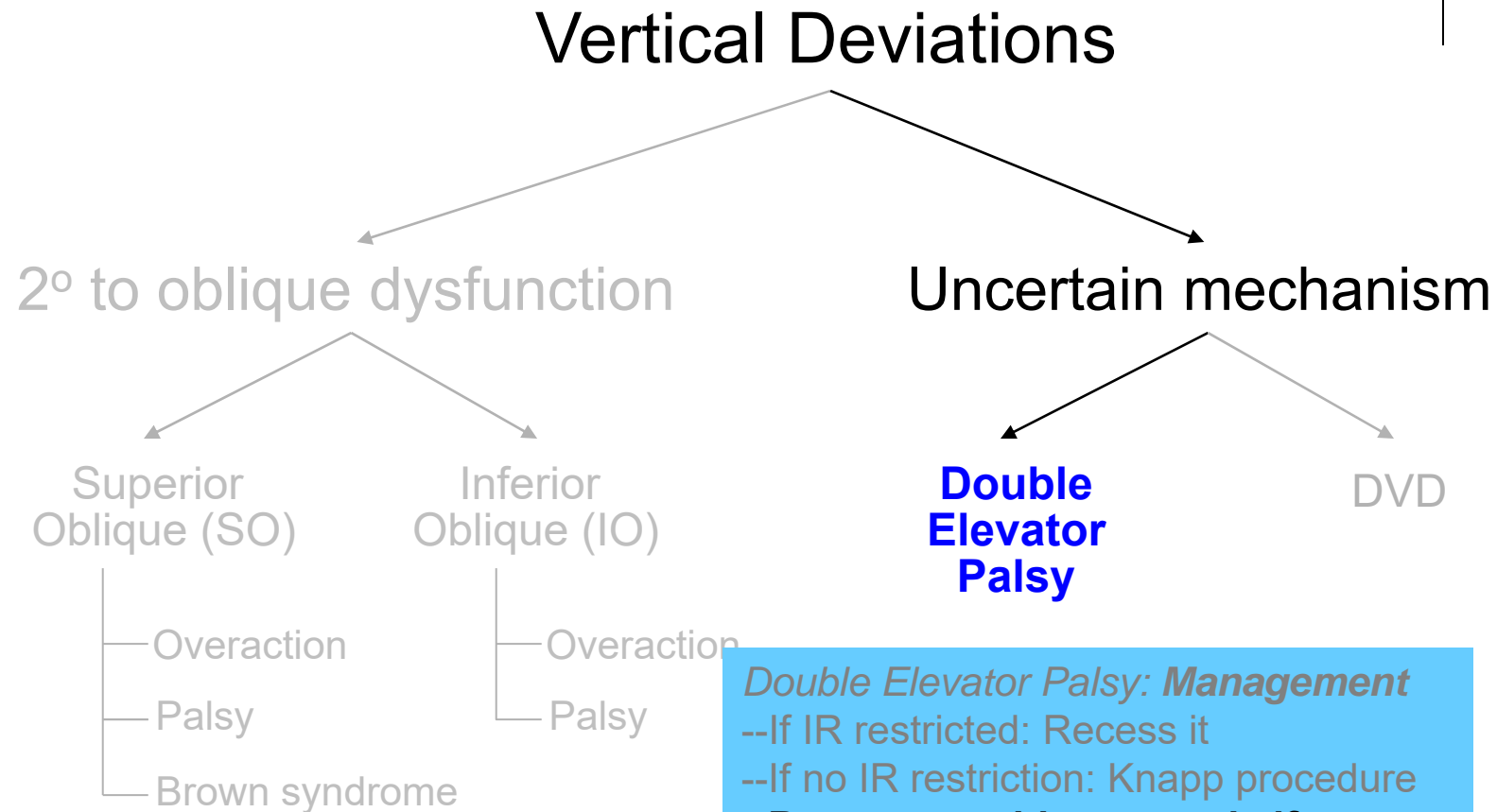


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Why is it important to address the ptosis concurrently?



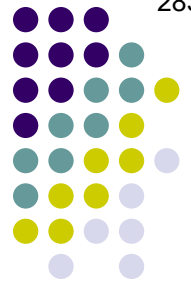
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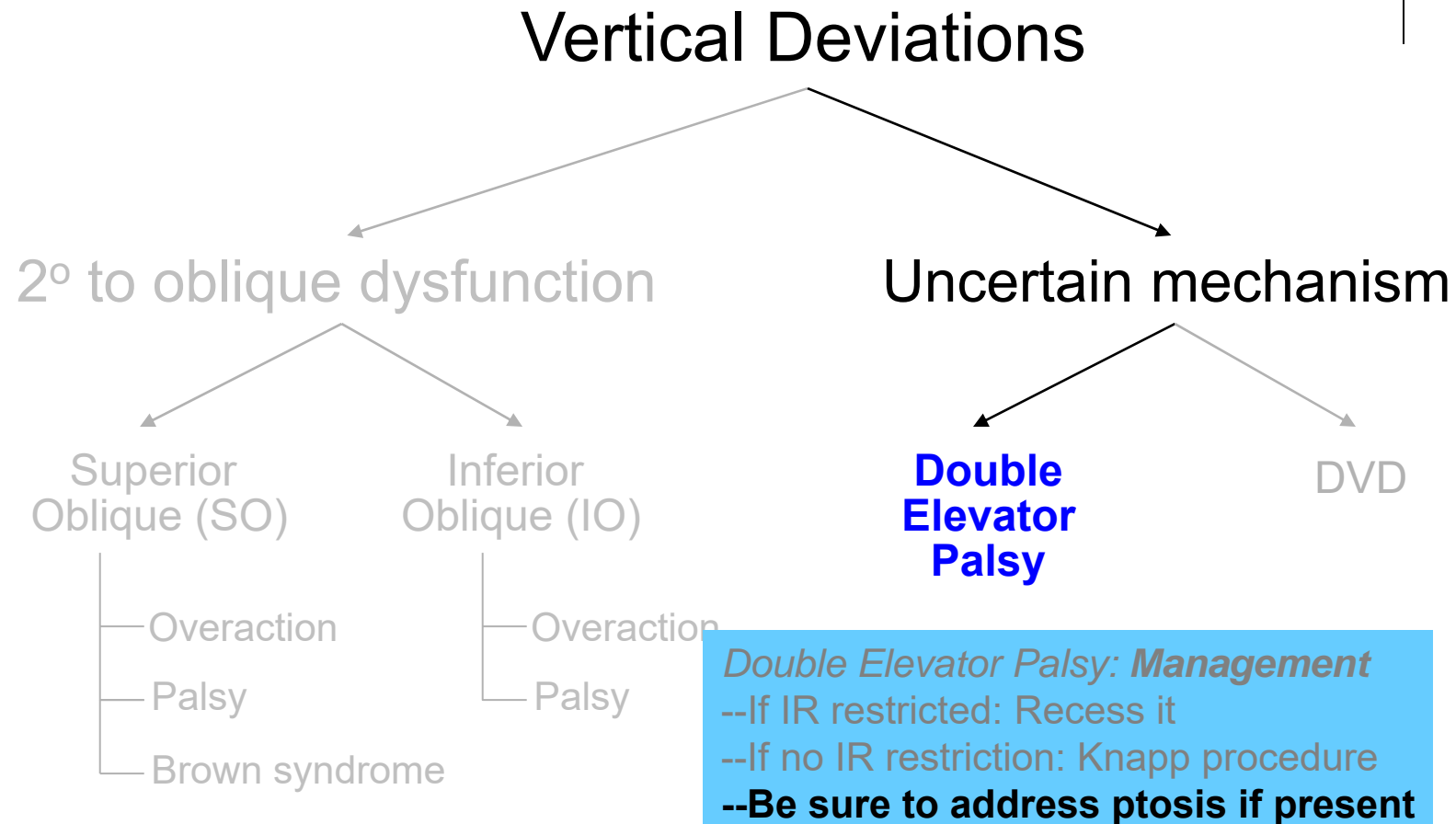
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 You don't want to elevate an eye behind a ptotic lid—it could lead to amblyopia



Vertical Deviations



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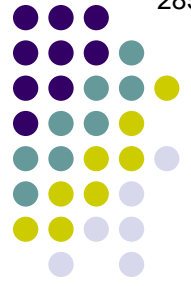
Vertical Deviations

2° to oblique dysfunction

Uncertain mechanism

In this context, what does DVD stand for?

DVD



Vertical Deviations

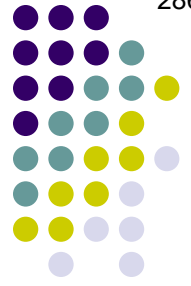
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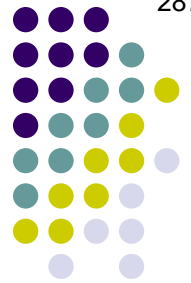
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Who is the typical DVD pt?

DVD



Vertical Deviations

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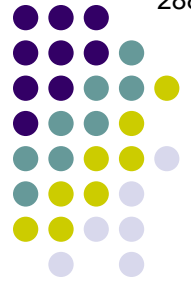
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Who is the typical DVD pt?
A child with infantile/congenital ET or XT

DVD



Vertical Deviations

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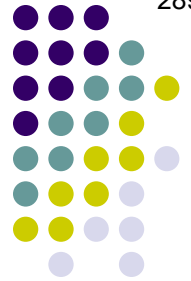
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What is the classic clinical finding?

DVD



Vertical Deviations

Vertical Deviations

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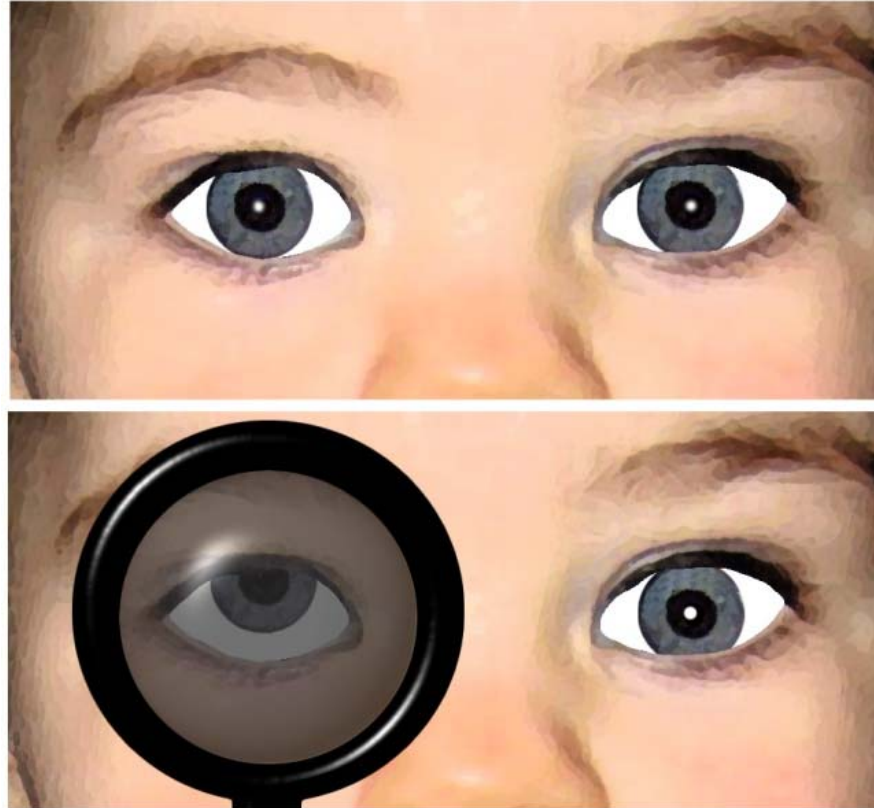
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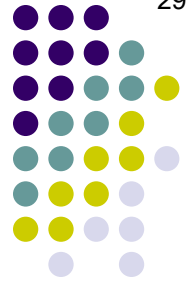
What is the classic clinical finding?
An eye will slowly elevate and extort, either spontaneously (*manifest DVD*) or when occluded (*latent DVD*).

DVD

Vertical Deviations



DVD



Vertical Deviations

Vertical Deviations

2° to oblique dysfunction

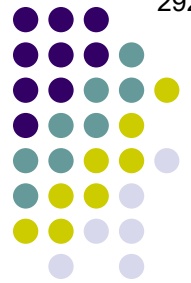
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What is the classic clinical finding?
An eye will slowly elevate and extort, either spontaneously (*manifest DVD*) or when occluded (*latent DVD*). A crucial finding occurs when the drifting eye reorients downward, and it is this--the fellow eye does **not** move downward simultaneously (as would normally be the case).

DVD



Vertical Deviations

Vertical Deviations

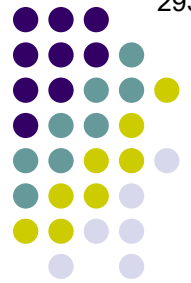
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Why would it 'be the case' that both eyes would move downward simultaneously?

DVD

eye reorients downward, and it is this--the fellow eye does **not** move downward simultaneously **(as would normally be the case).**



Vertical Deviations

Vertical Deviations

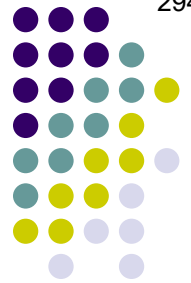
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Why would it 'be the case' that both eyes would move downward simultaneously?
In order to maintain visual cooperation, eye movements are tightly linked—EOMs on each eye are 'yoked' to one another to ensure the eyes move in a coordinated fashion. For example, for rightward gaze the right LR and left MR are yoke muscles.

DVD

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Vertical Deviations

Vertical Deviations

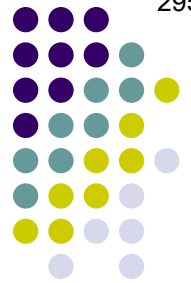
2° to oblique dysfunction

Uncertain mechanism

Why would it 'be the case' that both eyes would move downward simultaneously?
 In order to maintain visual cooperation, eye movements are tightly linked—EOMs on each eye are 'yoked' to one another to ensure the eyes move in a coordinated fashion. For example, for rightward gaze the right LR and left MR are yoke muscles. eponym *law of motor correspondence* states that yoke muscles receive equal innervation.

DVD

eye reorients downward, and it is this--the fellow eye does **not** move downward simultaneously **(as would normally be the case).**



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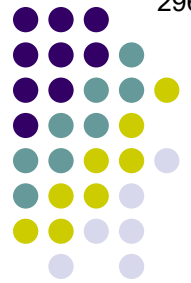
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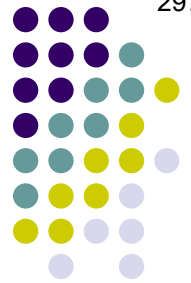
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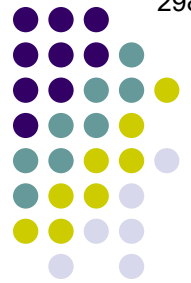
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How does Hering's law relate to DVD?

As noted, in DVD the downward reorientation movement by the drifting eye is not accompanied by a downward movement of the fellow eye. As the muscles that depress the eyes are yoke muscles, this means that DVD represents a violation of Hering's law.

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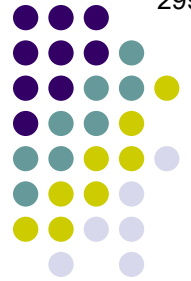
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Another good potential OKAP question, IMO

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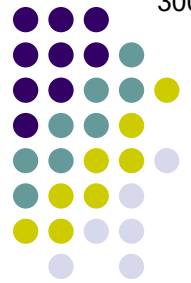
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For example, a DHD? Indeed there is. There is also a dissociated *torsional* deviation (DTD).

Together, DVD, DHD and DTD comprise the *dissociated strabismus complex*.

(All that being said, the only one the *Peds* book discusses at length is DVD.)

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