

Esotropia Grand Rounds

Disclosure statement:

Nothing to disclose.

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Course Objectives

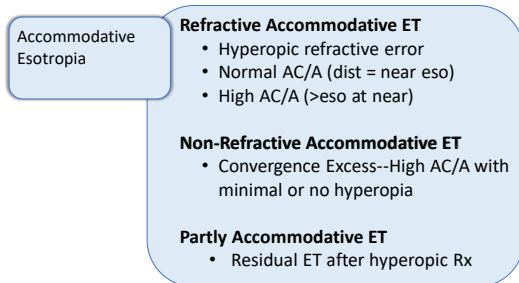
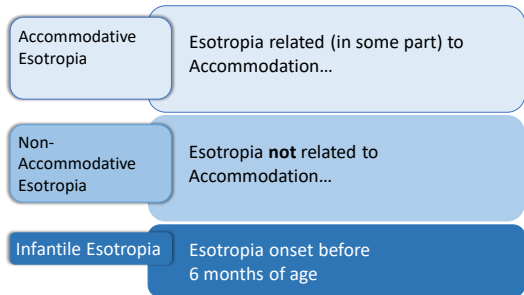
Through a grand rounds format...

- Review general classifications of esotropia
- Identify esotropia warranting neuro consult
- Apply appropriate treatment for each classification of esotropia
- Review literature updates related to diagnosis and management of esotropia



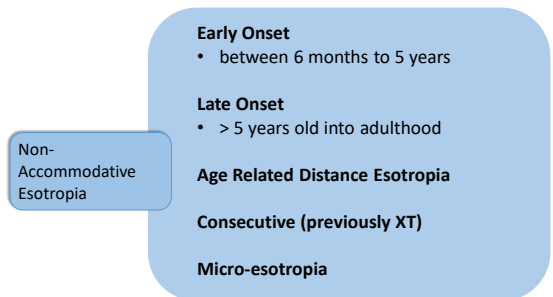
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Infantile Esotropia **Esotropia onset before 6 months of age**

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- Accommodative Esotropia**
 - Refractive Accommodative
 - Non-Refractive Accommodative
 - Partly Accommodative
- Non-Accommodative Esotropia**
 - Early Onset (6 mos → 5 years)
 - Late Onset (>5 years)
 - Age Related Distance ET
 - Consecutive ET
 - Microtropia
- Infantile Esotropia** **Esotropia onset before 6 months of age**

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Management Strategy

- Identify ET requiring neuro work-up**
(is this one dangerous?)
- Address/Manage Esotropia...**
 - Prescribing Plus Lenses
 - Hyperopic Rx
 - Near addition
 - Prescribing BO Prism
 - Prescribing Vision Therapy
 - Surgical Referral

Accommodative Esotropia

Non-Accommodative Esotropia

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Julia -3yo



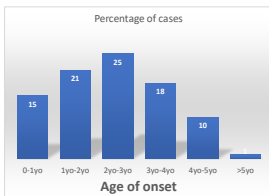
Presents for first exam, mom noticing an inward eye turn when Julia is focused on something. Started about 2 months ago but seems to be more frequent over the past 2 weeks.

VAs	Unreliable but strong aversion to OS occlusion
CT	20° CRET @ D 35° CRET @ N
EOMs/Pupils	EOM's full range, ET is comitant Pupils normal
Wet Ret	+5.00-0.75X180 +4.00
Ocular Health	Unremarkable

Dangerous ET (neuro workup)?

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Childhood Onset Strabismus



Median age of onset 29 mos

Most strabismus have childhood onset...

Excluding parietic, mechanically restrictive, and those associated with systemic or neurological diseases, **90% of all strabismus begin before 6 years of age**

Epidemiology study of 3243 cases of strabismus
Adelstein AM, Scully J. Epidemiological aspects of Squint, Br Med J 3:334,1967

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Signs of dangerous strabismus?



Later onset	Onset at 5(ish) years old or greater
Diplopia	Indicator of later onset strabismus
Ptosis (new)	Ptosis + diplopia in children 2.8x greater risk of life-threatening condition
Ocular neuro signs	Diplopia with incomitance, pupil anomalies, visual field defects
Other neuro signs	Ataxia, speech disorder, cerebellar signs in children 2.5x greater risk of life-threatening condition
Vomiting	Vomiting + diplopia in children 1.7 times greater risk of life-threatening condition

(Raucci et al. Euro J Paediatric Neuro. 2017)

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Julia -3yo



Presents for first exam, mom noticing an inward eye turn when Julia is focused on something. Started about 2 months ago but seems to be more frequent over the past 2 weeks.

VAs	Unreliable but strong aversion to OS occlusion
CT	20 ^Δ CRET @ D 35 ^Δ CRET @ N
EOM's/Pupils	EOM's full range, ET is comitant Pupils normal
Wet Ret	+5.00-0.75X180 +4.00
Ocular Health	Unremarkable

<5yo onset
No neuro signs/symptoms

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Julia -3yo



Aligned D&N w full plus Rx
+5.00-1.75X180 OD
+4.00 OS

Refractive Accommodative ET

Correction of hyperopic refractive error eliminates ET

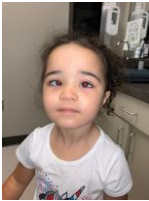
Push Plus (full wet) → monitor closely



Is she at risk for amblyopia?

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Julia -4yo



VA's w hab Rx (HOTV)	20/63 20/25	+5.00-0.75X180 +4.00
CT c Rx	Ortho at distance and near! (CRET without Rx)	
Wet Ret	+6.00-1.00X180 +5.00	
Ocular Health	Unremarkable	

Initiated 2 hours/day patching

→6 months later 20/20 OD and OS

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Arial -4 yo



VA's	20/50 20/60
CT	25 ^Δ CLET @ D 35 ^Δ CLET @ N
EOMs Pupils	Full—comitant deviation Normal—no hx or neuro signs/symptoms
Wet Ret	+6.00 +6.00
Ocular Health	Unremarkable

Prescribed hyperopic Rx...

<5yo onset
No neuro signs/symptoms

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Arial -4 yo



Follow up with Rx:

VA 20/20, 20/32

Ortho @ D and N
(SV lenses aligned her at distance and near)

Refractive Accommodative ET



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Arial -6yo



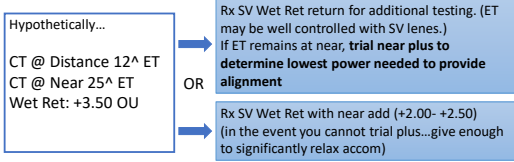
VAs	20/20 20/25++
CT w hab Rx	3 ^Δ EP @ D 12 ^Δ EP @ N
CT w/o Rx	30 ^Δ ILET D&N
Stereo	50 sec/500 global

Slightly more plus found on subsequent wet ret
...could increase plus?
...near eso > distance eso, should we consider an add?

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Prescribing an add

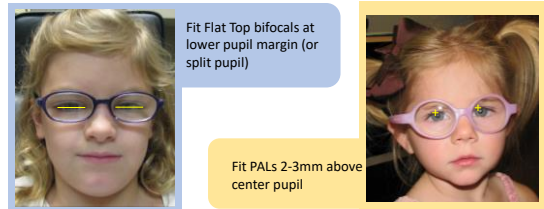
Consider when near eso >> distance eso



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Prescribing an add

Fitting Considerations...



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Callie

Initially seen at 4yo with constant inward right eye turn

- Hyperopic Aniso
 - ET > at near
 - Amblyopia OD
 - Rx Full Plus +
- ➔ +3.00 OD
+1.00 OS

- Managed amblyopia with part time occlusion

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Callie

6yo - Full exam, doing well with glasses but delayed with reading

VA's (ETDS) with hab Rx (+3.00 OD, +1.00 OS)	20/40 20/32
CT @ Dist	Ortho
CT @ Near	18^ IRET (trope 95%)
CT @ Near with +2.00 add	Ortho
Stereo with +2.00 add	50 sec
Wet Ret	+4.25 +2.50

➔ Gave wet ret with +2.00 add



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Callie

6yo - Follow up with new Rx with add

VA's (ETDS) with new Rx (+4.25 OD, +2.50 OS, +2.00 add)	20/32 20/25
CT @ Dist	Ortho
CT @ Near without add	20^ IRET (95% trope)
CT @ Near with +2.00 add	Ortho
Stereo with +2.00 add	30 sec, 250 global
MEM with +2.00 add	+0.75 OU

➔ Add is working GREAT!

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Callie -8 yo

Doing great with glasses!
VA w glasses: 20/20 OD, OS
Hab Rx: +4.25, +2.50 with +2.00 add
Stereo: 20 sec, 250 global

Can we reduce her add?

CT condition	Distance	Near
CT c hab Rx +2.00 add	Ortho	Ortho (through add)
CT c hab Rx +1.00 add	Ortho	4^EP, 25" stereo
CT c hab Rx no add	Ortho	8^EP, 25" stereo
CT s Rx	--	20^IRET (75%trope)

Gave wet ret (+4.00, +2.25) with +1.00 add (weaning her out!)



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Callie ...continued

2018—8 years old

CT condition	Distance	Near	Rx:
CT c hab Rx +2.00 add	Ortho	Ortho (through add)	+4.00 OD +2.50 OS
CT c hab Rx +1.00 add	Ortho	4°EP, 25" stereo	+1.00 add
CT c hab Rx no add	Ortho	8°EP, 25" stereo	
CT s Rx	--	20°IRET (75%trope)	

2019—9 years old

CT condition	Distance	Near	Rx:
CT c hab Rx +1.00 add	Ortho	Ortho (through add)	+4.00 OD +2.50 OS
CT c hab Rx no add	Ortho	2-3 EP 25" stereo	

We were able to wean her out of the near add! (maintained the distance plus)

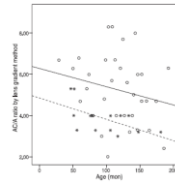


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Bifocals for Life?

Retrospective review of 16 Accommodative ET (CE/ET) treated with bifocals followed for at least 5 years.

- 6 (38%) were able to discontinue bifocals by avg 10.8 yo
- 10 (62%) continued with glasses to last visit (avg age 13.8yo)

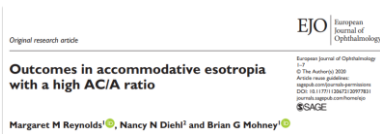


Bifocal Stop Group: Had lower AC/A's
Bifocal Continue Group: Higher AC/A's
Both groups show decrease in AC/A's with time

For CE/ET's, those with lower AC/A's and smaller ET's more likely to wean out of near add

Kim et al, KUO 2012

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Retrospective review of charts at Mayo clinic
93 cases of high AC/A ET treated with bifocals

- 24.5% discontinued bifocal after 3 years
- 36.4% discontinued bifocal after 5 years
- 61.4% discontinued bifocal after 10 years
- 73.8% discontinued bifocal after 15 years

→ We were able to wean Callie out of her add within 5 years

Patients were more likely to discontinue bifocal use if they had surgery for Esotropia

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Clinical Course of RAET



Some will have excellent prognosis for normal BV and stereo if ET resolved with Rx
→ May be able to wean out of add over time

Despite Tx with Plus Rx, up to 50% will show deterioration (return of Esotropia)

- Greater risk if...
 - Higher calculated AC/A
 - Earlier age of onset
 - IOOA
 - Amblyopia

Ludwig et al. Trans Am Ophthalmol Soc, 2003

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Clinical Course of RAET

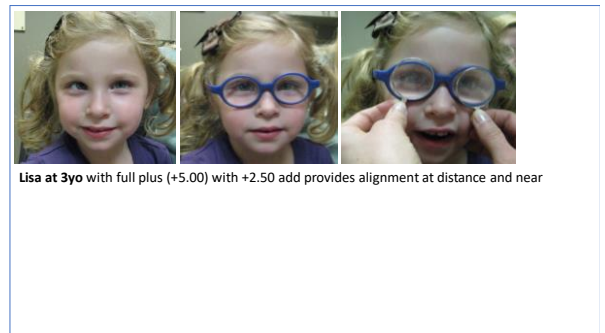
Some will have excellent prognosis for normal BV and stereo if ET resolved with Rx

Despite Tx with Plus Rx, up to 50% will show deterioration (return of Esotropia). Higher risk with earlier age of onset, high AC/A, IOOA, and amblyopia.

Ludwig et al. Trans Am Ophthalmol Soc, 2003


Despite Tx with Plus Rx, some ET's will develop spontaneous consecutive exotropia...

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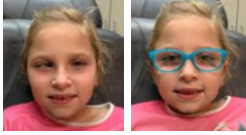


Lisa at 3yo with full plus (+5.00) with +2.50 add provides alignment at distance and near

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Lisa at 3yo with full plus (+5.00) with +2.50 add provides alignment at distance and near



Lisa at 6yo with full plus (+5.00 OU)


- 8-12 $^{\wedge}$ **IRXT** at distance
- alignment at near with add (500 global stereo with R+L)

Tried CT at distance with less plus


- +3.50 OU showed 20 $^{\wedge}$ CRET,
- +4.25 OU showed ortho.

Cut distance plus to +4.25 with +2.50 add


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Lisa at 3yo with full plus (+5.00) with +2.50 add provides alignment at distance and near




Lisa at 6yo –Cut distance plus to +4.25 with +2.50 add to control spontaneous consecutive IXT




Lisa at 8yo –Hab Rx still +4.25 with +2.50 add Ortho at distance
CT Near through distance Rx –14 $^{\wedge}$ CRET
CT Near through +2.50 add –2 $^{\wedge}$ IRET
Nil stereo, W4D Fusion

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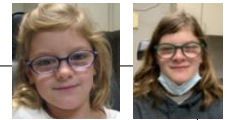
Be vigilant with Refractive ET's



May require adjustments to lens power to maintain alignment (tenuous fusion?)

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Mary

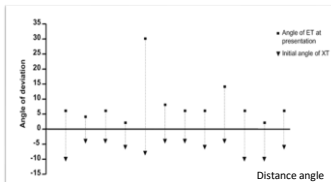


3yo	Received her first pair of glasses +6.50-3.00X010 OD +2.50-1.00X180 OS Aggressively managed her amblyopia OD and provided full plus Rx with add
5yo	Glasses providing good alignment (no stereo)
10yo	Began showing IXT at distance. Decreased distance plus to help manage exo
12yo	10 $^{\wedge}$ CRXT @ distance and 2 $^{\wedge}$ CRET @ near
13yo	8 $^{\wedge}$ CRXT @ distance and 2 $^{\wedge}$ CRET @ near <small>(VA's 20/40 OD, 20/20 OS)</small>

Despite excellent compliance with specs, amblyopia treatment and frequent visits to our clinic, Mary developed a consecutive Exotropia.

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Spontaneous Consecutive Exotropia



Retrospective (UK) study found 14 subjects with SCXT

XT presented at distance in all subjects

No relationship between initial ET angle and initial XT angle

Amblyopia NOT a risk factor

Senior et al. Strabismus. 2009

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Clinical Course of RAET

- Some will have excellent prognosis for normal BV and stereo if ET resolved with Rx
- Despite Tx with Plus Rx, up to 50% will show deterioration (return of Esotropia). Higher risk with earlier age of onset, high AC/A, IOOA, and amblyopia. Ludwig et al. Trans Am Ophthalmol Soc. 2003
- Despite Tx with Plus Rx, some ET's will develop spontaneous consecutive exotropia. Higher risk with earlier age of onset, hyperopia of +5.00 or greater, lack of stereo/fusion, and DVD. Senior et al. Strabismus 2009 Shin et al. Jap J Ophth. 2020

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Are Bifocals Helping the high AC/A Eso's?

Pratt-Johnson & Tilson (1985)– retrospective review of 99 patients with at least 20Δ of esotropia greater at near than distance treated with bifocals or single vision lenses

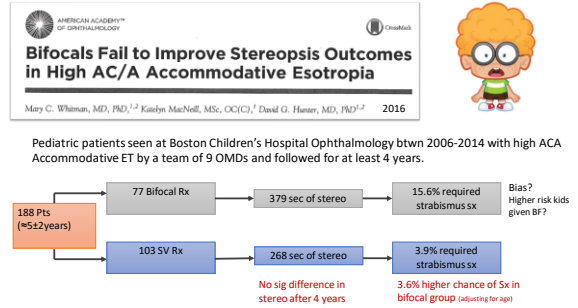
Follow-up from 4-16 years:

- No difference in sensory outcomes (central and peripheral fusion using synoptophore in addition to near Titmus stereoacuity)
- Bifocal group more frequently underwent surgery (22.5%) vs SVL (12.5%)

Reynolds et al. (2020)- Retrospective review of study of 93 high AC/A ET patients at Mayo Clinic

- Bifocals were discontinued by the majority of children within 10 years
- Use of bifocals was not associated with improved stereopsis
- Use of bifocals was not associated with higher likelihood of surgery

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The verdict on Bifocals for high AC/A Eso's?

- High ACA Esotropes with good alignment at distance may have similar outcomes with or without a bifocal
- Conflicting literature regarding harm or benefit of bifocal lenses



Bottom Line...

- If BF improves function (better fusion/stereo) at near, consider Rxing an add
- If BF doesn't provide improved fusion (no improvement in stereo and/or ET remains at near), may be of little benefit

More research needed (PEDIG Esotropia Study 3 coming soon!)

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Presley—3y, 11 mos

Mom concerned about eye turn

VA s Rx	20/200 OD, 20/20 OS
CT @ Distance	35^ CRET
CT @ Near	> 40^ CRET
EOMs/Pupils/Ocular Health	Full motility Normal pupils and health
Wet Ret	+3.50-2.00X005 +2.50



Amblyopia?
 Initial treatment plan?

<Syo onset
 No neuro signs/symptoms

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Presley—Follow up 8 weeks later

Give full plus Rx and rx'd 2-3 hours/day patching OS

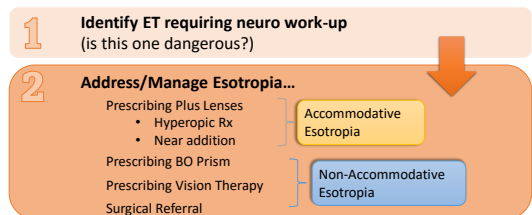
	Without Rx	With Rx
VA s Rx	20/200 OD 20/20 OS	20/63 OD 20/20 OS
CT @ Dist	35^ CRET	25^ CRET
CT @ Near	> 40^ CRET	35^ CRET

Presley's a **Partly** Accommodative Esotropie
 Significant ET remains after full plus Rx...



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Management Strategy



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Management Tools

Plus Lenses/Bifocals

Correct significant hyperopia → $\geq +1.50$ start with lenses

Treat amblyopia

ET near >> ET distance → consider an add if it provides improved alignment/fusion

↳ Give least amount of plus needed to provide fusion



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Management Tools

Plus Lenses/Bifocals

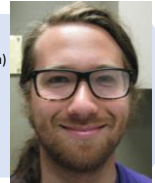
Correct significant hyperopia
Consider bifocal for Convergence Excess ET

BO Prism

If prism Rx provides stable alignment (no prism adaptation) and improved fusion, consider prism rx.

Ground prism for smaller magnitude ET (<15 Δ)

Fresnel prism for larger ET (short term trial)



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Management Tools

Plus Lenses/Bifocals

Correct significant hyperopia
Consider bifocal for Convergence Excess ET

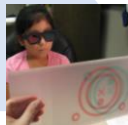
BO Prism

If prism Rx provides stable alignment (no prism adaptation) and improved fusion, consider prism rx. Ground prism for smaller magnitude (<15 Δ) ET.

Vision Therapy

May be helpful to train divergence, decrease suppression, and improve fusion for small-moderate ET.

May be used to aid in weaning out of BO prism.



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Management Tools

Plus Lenses/Bifocals

Correct significant hyperopia
Consider bifocal for Convergence Excess ET

BO Prism

If prism Rx provides stable alignment (no prism adaptation) and improved fusion, consider prism rx. Ground prism for smaller magnitude (<15 Δ) ET.

Vision Therapy

May be helpful to train divergence, decrease suppression, and improve fusion for small-moderate ET.

Surgery

Appropriate management option for moderate to large angle ET

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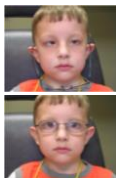
Managing non-accom residual ET

- Rx Full Plus from wet ret
- Rx Add if ET at near > distance
- Treatment for residual ET (after full plus distance and near)

1" → max dist & near plus

Magnitude of residual ET	Fusion Potential (NRC?)	Treatment Options
Less than 15 Δ	Yes	BO prism*, VT to improve BI Ranges, taper prism
Less than 15 Δ	No	Monitor? Aggressive VT?

Has stereo (or flat fusion) with prism



*if patient is stable with prism (doesn't adapt/eat it)
**if asymptomatic

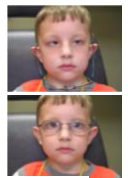
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Managing non-accom residual ET

- Rx Full Plus from wet ret
- Rx Add if ET at near > distance
- Treatment for residual ET (after full plus distance and near)

1" → max dist & near plus

Magnitude of residual ET	Fusion Potential (NRC?)	Treatment Options
Less than 15 Δ	Yes	BO prism*, VT to improve BI Ranges, taper prism
Less than 15 Δ	No	Monitor? Aggressive VT?
Greater than 15 Δ	Yes	BO prism (Fresnel)* until surgery or Botox (consider VT?)
Greater than 15 Δ	No	Surgery or Botox (consider VT?)



*if patient is stable with prism (doesn't adapt/eat it)
**if asymptomatic

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Managing Presley's residual ET

- ✓ **Optical Correction of ametropia and amblyopia tx**
 - Added lens power → With large ET at dist, did not consider...
 - Prism → Could have applied Fresnel to determine if it provided fusion...tough to ascertain fusion with 4yo?
 - Vision Therapy → With large ET (and age), did not consider...
 - Surgery → Good candidate for Sx
Sent her for surgical consult



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Surgical success rates for ET...

Long-term Cosmetic Alignment Following Surgery for Esotropia Versus Exotropia in Childhood: A Comparison Using Survival Curves

Jacqueline N. Parrotti, MD, Marie Kristine Pangamban, MD, MS, Paul E. Frisvold, PhD, Alysa Dicicco, BS, John W. Simons, MD

(It depends on how you define "success"...)

Retrospective review 235 kids undergoing ET sx (mean age 42 months)

- Success defined as kids only requiring 1 surgery and a final deviation of <20Δ deviation in primary gaze (20Δ?!)
- **78% usuccess rate**
- 12% of ET's needed a second surgery

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Surgical success for ET...

Mohan, 2018 (JAAPOS)

- 47, 3-4yo, Partially Refractive Accom ET's who underwent sx
- **10 year follow up**
- Defined success as <10^ Eso post sx
- **Success Rate 49%**
- 21% decompensated by 3 years post sx (ET reoccurred)

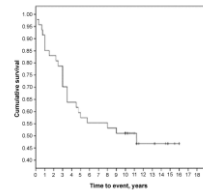


FIG 1. Cumulative probability of surgical success at various durations of follow-up.

Factors associated with better surgical outcomes

- ✓ Strabismus onset after 6 months of age
- ✓ Shorter duration of strabismus before surgery
- ✓ Smaller magnitude strabismus before surgery
- ✓ Purely horizontal strabismus
- ✓ Exotropia (not as favorable for Esotropia)
- ✓ No amblyopia
- ✓ Less post surgical residual strabismus

Initiate amblyopia treatment
If surgery is indicated, do not delay referral to surgeon

Eshaghi et al. Therapeutic Adv in Ophthalmol. 2021
Singh, et al. Cureus 2022

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Presley Follow up...



1 year later...
Glasses are "lost"
Unsuccessful with patching
No follow up with surgeon
Stable findings



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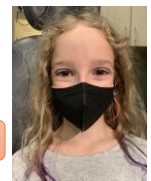
9yo referred for diplopia management

Constant diplopia at distance that started 2 years ago (!!)

Referred by outside doctor

M1/wet ret found minimal hyperopic cyl
CT @ D (no Rx): 14^ CAET
CT @ N (no Rx): 10^ IAET
CT @ N (+2.00 readers): 4 EP
Stereo @ N c +2.00 readers: 20 sec, 250 Global

<5yo onset No neuro signs/symptoms → **Acquired Non-Accommodative ET**



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Acquired Non-Accommodative ET

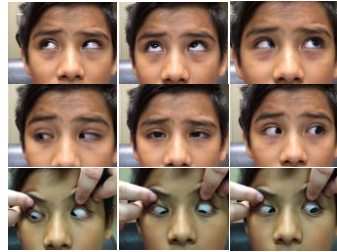
Comitant Esotropia
Occurs after 6 months of age
ET does not change with hyperopic Rx

ANAET occurring before 5yo <ul style="list-style-type: none"> Rarely diplopic Rarely associated with neuro etiology 	ANAET occurring at and beyond 5yo <ul style="list-style-type: none"> Likely to cause diplopia May be Acute/Sudden with higher concern for neurological etiology May be result of deterioration of longstanding Eso (less risk for neuro)
--	--

Often difficult to discern if ET is acute or decompensating Eso

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Acute Acquired Comitant ET (AACET)



12yo --Constant diplopia started 4 months ago
35° CAET Dist & Near
Comitant, no neuro signs
No trauma

Possible etiologies?

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Acute Acquired Comitant ET Non-Neurological Etiology

Classic (non-neurological) Etiologies

Swan (Type I)—Sudden onset due to interrupted fusion (monocular occlusion or vision loss)



Burian-Franceschetti (Type II)—Result of physical or psychological stress causing large ET



Bielschowski (Type III)—associated with moderate to high myopes performing intense prolonged near work without glasses (convergence without accomm causing convergence spasm)



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Acute Acquired Comitant Esotropia Neurological Etiology

Brain tumors, IIH, seizures, hydrocephalus, etc. can cause late onset, comitant esotropia in the absence of other neurological signs

Frequency of underlying neuro etiology in children is low (6% – 16%) (Chen Medicine 2015; Sheth J Ped Oph Strab 2022)

Risk Factors for Neuro Etiology

- Older children (mean age 7yo) → adults
- Presence of Papilledema (only seen in about 1/3 of neuro etiology)
- Larger ET at distance
- Nystagmus (Chiari malformations, hydrocephalus, tumors)
- Inability to provide fusion with plus and/or prism

Nouraeinejad, Graefes Arch Clin Exp Ophthalmol, May 2023

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Acute Acquired Comitant ET (AACET)



12yo --Constant diplopia started 4 months ago
35° CAET Dist & Near
Comitant, no neuro signs

Often AACET is only presenting sign of brain tumor.
These patients MUST have neuro work up with imaging.

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Acute Acquired Comitant Esotropia caused by Smartphones?



Retrospective review found 12 patients (13yo ± 3years) with AACET who reported viewing smartphones for approx. 6 hrs/day

- Developed Constant ET between 15-45° distance and near
- Neuro-imaging all normal
- After decreasing smartphone use for 1 month, ET angle dec significantly (17.5° ± 6.45°)

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Acute Acquired Comitant Esotropia and Smartphones?

- Cai, 2019—Retrospective review of records of 45 AACET patients
 - 2 (<1%) had neurological etiology (tumor and demyelinating dz)
 - Mean age of onset 21.6 years \pm 6 years
 - 14 (31%) reported >5 hours/day of smart phone use
- Mehta, 2019—Case Report 16yo male
 - -5.00 myope without his CLs on vacation reportedly developed AACET after spending >8hrs/day on smartphone
 - ET improved once he returned to CLs and decreased phone use



Weak evidence, right?..

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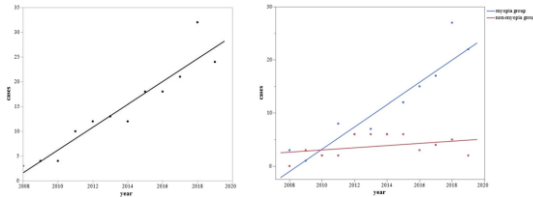
Acute Acquired Comitant Esotropia and Smartphones?

2020→present dozens of papers documenting association between digital near work and AACET

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Acute Acquired Comitant Esotropia and Smartphones?

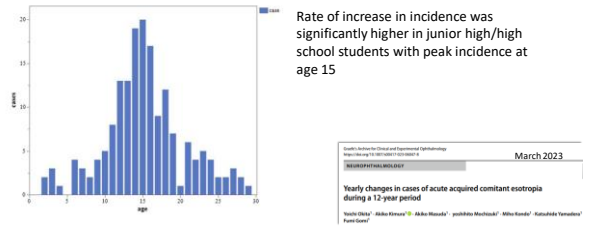
Retrospective Study (2008-2021) in Japanese Ophthalmology Hospital Identified all patients <30yo with AACET – n=171 patients Okita et al, 2023



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Acute Acquired Comitant Esotropia and Smartphones?

Retrospective Study (2008-2021) in Japanese Ophthalmology Hospital Identified all patients <30yo with AACET – n=171 patients



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Acute Acquired Comitant Esotropia and Smartphones?

- Patients at risk:
- ≥ 6 hours/day on smart devices (tablets/smartphones)
 - Short working distances (20cm)
 - Patients of all ages (predominantly teens to young adults)
 - Myopic presbyopes who remove glasses to read
 - Myopes may be higher risk, but all refractive errors represented



Look at that working distance!!

Acute Acquired Comitant Esotropia and Smartphones?

- Proposed Mechanism:
- Accommodative spasm? (most studies did not demonstrate evidence of this)
 - Convergence spasm?
 - Imbalance of convergence/divergence system leading to increased tonus of MR?



- Presentation:
- Onset typically fast
 - Diplopia present (particularly at distance, can't relax convergence)
 - ET range from 12 Δ - 35 Δ
 - ET slightly larger at distance than near

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66

Acute Acquired Comitant Esotropia and Smartphones?

Proposed Mechanism:

- Accommodative spasm? (most studies did not demonstrate evidence of this)
- Convergence spasm?
- Imbalance of convergence/divergence system leading to increased tonus of MR?



Presentation:

- Onset typically fast
- Diplopia present (particularly at distance, can't relax convergence)
- ET range from 12Δ- 35Δ
- ET slightly larger at distance than near

Presentation is similar to AACET with neurological etiology.

MUST REFER FOR IMAGING AND NEURO WORKUP

67

9yo referred for diplopia management

- Constant diplopia started 2 years ago, **MRI normal**
- Constant dip at distance without specs, blur with specs

Distance Rx
 +2.00-0.50X005 (20/80)
 +1.50-0.25X163 (20/70)
 Reports blur but single with specs

Curious Rx...

Subjective M1
 +0.75-0.25X005 (20/20)
 +0.75-0.25X175 (20/20)

Better! Now what?

CT @ D (no Rx): 14° CAET
 CT @ N (+2.00 readers?): 4 EP
 Stereo @ N c +2.00 readers: 20 sec, 250 Global



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Acute Acquired Comitant Esotropia Treatment

Treatment Options		
Small ET (<12-15Δ)	Moderate to Large ET (>15-20Δ)	Near work induced ET
<ul style="list-style-type: none"> • Relieving BO Prism (least prism for single) • Titrate prism over time if able • May consider VT to improve NFV ranges 	<ul style="list-style-type: none"> • Relieving BO Prism (may require Fresnel) • May consider VT to improve NFV ranges for smaller angles • Botox or Surgery for persistent larger deviations 	<ul style="list-style-type: none"> • Reduce screen time • Increase working dist • Prism/VT for smaller angles • Surgery/botox for larger persistent angles

Prompt treatment of ET associated with greater success!

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9yo referred for diplopia management

Subjective M1
 +0.75-0.25X005 (20/20)
 +0.75-0.25X175 (20/20)

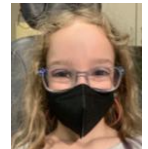
CT @ D (s Rx): 14° CAET
 CT @ D (through TF M1): 14° CAET (clear but double)

Initial Visit:

Tried prism at distance over M1!
 Eliminated diplopia with 6°BO
 CT with M1 and 6°BO
 12° EP @ D
 6° EP @ N
Rx'd M1 with 6°BO Split

2 months later

Loves glasses, rarely diplopic!
 VA 20/20 OD and OS
 CT @ D 14EP
 CT @ N 11EP
 Stereo: 250 G, 20 L
 CT @ D sc 20°CAET



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9yo referred for diplopia management

Initial Visit:

CT @ D (s Rx): 14° CAET
 CT @ D (through TF M1): 14°CAET
Rx'd M1 with 6°BO Split

2 months later

Loves glasses, rarely diplopic!
 CT @ D (over hab): 14EP
 CT @ N (over hab): 11EP
 Stereo: 250 G, 20 L
 CT @ D sc 20°CAET



6 months later

Double vision returning at dist after near work
 CT @ D (over hab 6°BO): 22° ILET
 CT @ N (over hab 6°BO): 20° ILET
 CT @ N with +2.00 add: 10° EP (30' stereo)
 ET is comitant (same in R and L gaze)

Trial prism at distance and found fusion with 4°BO
 Gave Rx with 10°BO Split and +2.00 add

She's decompensating...consider surgical consult?



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Acute Acquired Non-Accomm ET in older patients?

61yo female

Diplopia at distance while driving. Started gradually 3 months ago and worsening.

BCVA 20/20- OD and OS
 CT @ D: 8 CLET
 CT @ N: Ortho
 Pupils: Normal
 Confrontation VF: Normal
 Ocular health: Normal



New onset
 Divergence Insufficient ET
 What do we need to rule out?

72

Acute Acquired Non-Accomm ET in older patients?

61yo female
Diplopia at distance while driving. Started gradually 3 months ago and worsening.

BCVA 20/20- OD and OS
CT @ D: 8 CLET
CT @ N: Ortho
Pupils: Normal
Confrontation VF: Normal
Ocular health: Normal

EOM's → Full range of motion

Rt gaze	Primary	Left gaze
10 CLET	8 CLET	10 CLET

Comitant ET...no apparent LR weakness

Options to manage her diplopia?
Does she need imaging?

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Acute Acquired Comitant Esotropia Treatment

Treatment Options		
Small ET (<12-15Δ)	Moderate to Large ET (>15-20Δ)	Near work induced ET
<ul style="list-style-type: none"> Relieving BO Prism (least prism for single) Titrate prism over time if able May consider VT to improve NFV ranges 	<ul style="list-style-type: none"> Relieving BO Prism (may require Fresnel) May consider VT to improve NFV ranges for smaller angles Botox or Surgery for persistent larger deviations 	<ul style="list-style-type: none"> Reduce screen time Increase working dist Prism/VT for smaller angles Surgery/botox for larger persistent angles

Our 61yo patient has 8° ET at distance, consider prism!

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Acute Acquired Non-Accomm ET in older patients?

61yo female
Diplopia at distance while driving. Started gradually 3 months ago and worsening.
CT @ D: 8 CLET
CT @ N: Ortho
EOMS: Normal (CT 8-10° L, primary gaze)

- Tried BO prism at distance found 6°BO provided fusion at distance and near
- Gave 6°BO OS Fresnel for trial...RTC 4-6 weeks.

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Acute Acquired Non-Accomm ET in older patients?

61yo female--Baseline

Diplopia at distance while driving. Started gradually 3 months ago and worsening.

CT @ D: 8 CLET
CT @ N: Ortho

Gave 6°BO Fresnel OS

4 weeks later (w/Fresnel)

No more double vision at distance (or near) with Fresnel prism. Patient bothered by blur from Fresnel.

CT @ D (with Fresnel): 2°EP
CT @ N (with Fresnel): Ortho
Rx'd specs with 6°BO split.

Why did this happen?
Does she need imaging?

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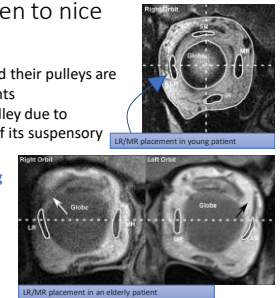
Divergence Insufficiency ET (DIET) Etiologies to consider...

<p>LR Palsy</p> <ul style="list-style-type: none"> Dist Eso >> Near Eso Abduction deficit on EOMs Check CT in Rt/Left gazes for abduction deficit 	<p>Ocular Myasthenia</p> <ul style="list-style-type: none"> Can affect any ocular muscle Typically incomitant deviation
<p>Thyroid Myopathy</p> <ul style="list-style-type: none"> May affect motility of any EOM Often have hypo and/or esotropia Look for other signs of TED 	<p>Convergence Spasm</p> <ul style="list-style-type: none"> Typically intermittent and variable May show abduction deficit
	<p>Decompensation/Age Related Distance ET changes to EOM's</p>

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Why does distance ET happen to nice grandparents?

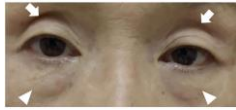
- Pathways of horizontal recti muscles and their pulleys are displaced more inferiorly in older patients
- Inferior sagging of the lateral rectus pulley due to degeneration of the connective tissue of its suspensory ligament
- "Age Related Distance ET" aka "Sagging Eye Syndrome"
- May also have vertical component



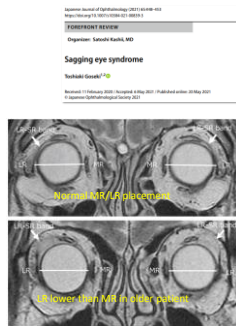
Clark, NCOMITANT STRABISMUS UPDATE, 2015

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Sagging Eye Syndrome



- Facial features of SES**
- Deep superior sulcus (arrows)
 - "baggy eyelids" (arrowhead)
 - blepharoptosis



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Could Age Related Dist ET (ARDET) be related to increased near work demands?

Retrospective review of 646 patients seen over 40 years with acquired ET (all ≥10yo at onset)

Sig increase incidence of ARDET
11.8% from 1978-1998
29.4% from 1999-2018

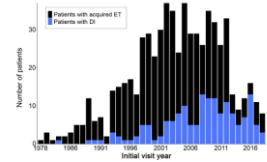


FIG 1. Number of acquired esotropia (ET) patients showing the proportion who had divergence insufficiency (DI), who presented in each year from 1978 through 2018.

Chen et al. JAAPOS Oct 2021

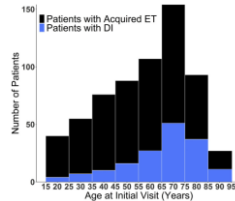
80

Could Age Related Dist ET (ARDET) be related to increased near work demands?

Retrospective review of 646 patients seen over 40 years with acquired ET (all ≥10yo at onset)

Sig increase incidence of ARDET
11.8% from 1978-1998
29.4% from 1999-2018

Increase incidence of Distance ET true for all age cohorts up to age 75yo



Authors speculate that rise in ARDET result of environmental factors.
→Prolonged near work may increase MR tonus

Chen et al. JAAPOS Oct 2021

81

ARDET etiology and clinical course

Exact mechanisms unclear

- Sagging muscle pulleys may contribute to gradual increase in eso with age
- Increased near work demands may increase MR tonus making it difficult to diverge (particularly at distance)?
- Use of PALs inappropriately (not looking through enough plus power) may contribute to convergence effort?



More common in older (>70yo) patients

50% chance deviation will increase by 6Δ or more over 15 year follow up (Claxton et al. Strabismus, 2022)

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Do Older Patients with Age Related Dist ET Require Neuro imaging?

Characteristics and surgical results in patients with age-related divergence insufficiency esotropia
Michael X. Repka, MD, MBA, and Eric Downing, MD 2014

- Consecutive elderly patients with ARDET seen at Johns Hopkins between 1977-2011
- 85 patients (mean age 74)
 - Only 8% (7 patients) diagnosed with neurological disease
 - 5 had previously been diagnosed with LR Palsy with normal imaging
 - Authors speculate that the 5 patients with LR palsy diagnosis were actually ARDET

Repka's Conclusions: "When the angle is small, there is no lateral incomitance, and the onset is not acute, it seems that careful clinical monitoring without neuroimaging or neurological consultation is reasonable. Should the patients worsen, additional evaluation would be appropriate."

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Acute Acquired Non-Accomm ET in older patients?

4 weeks later (w/Fresnel)

No more double vision at distance (or near) with Fresnel prism. Patient bothered by blur from Fresnel.

CT @ D (with Fresnel): 2^Δ EP
CT @ N (with Fresnel): Ortho
Rx'd specs with 6^Δ BO split.

Why did this happen? Hx and findings consistent with ARDET

Does she need imaging? No neuro signs however she is < 70yo. Recommended imaging

61yo female--Baseline

Diplopia at distance while driving. Started gradually 3 months ago and worsening.

CT @ D: 8 CLET
CT @ N: Ortho

Gave 6^Δ BO Fresnel OS

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66yo female

Reported double vision that started 4-5 years ago
Initially double only while driving, now she's double all the time at any distance beyond 4 feet.
Previous doctor tried combination of MF CLs to help with diplopia but she prefers NVO for near

BCVA (with -7.00ish OU): 20/20 OD and OS
CT @ D: 25 CAET (reports fusion with min 25°BO)
CT @ N: 12 EP/IET
EOM's normal (Full abduction OD and OS and comitant ET)

Moderate/large ET at distance with normal fusion potential → Tx?

85

66yo female

Referred her for surgical consult!

F/U 5 months later...

Had surgery 1 month prior

She's ecstatic! Finally hiking again and not wearing a patch to drive. Some dip early in the morning.

CT @ D: 9° EP
CT @ N: 9° EP
Small angle LET in Left gaze with diplopia

Recommended VT to train BI ranges

Pt asked for referral for different doctor to manage her CLS



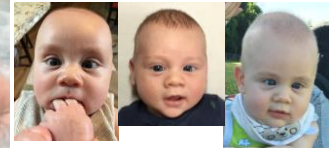
86

Accommodative Esotropia	Refractive Accommodative ✓ Non-Refractive Accommodative ✓ Partly Accommodative ✓	Hyperopic Lenses Bifocals (if improves alignment/fusion at near)
Non-Accommodative Esotropia	Early Onset (6 mos → 5 years) Late Onset (>5 years) ✓ Age Related Distance ET ✓ Consecutive ET Microtropia	BO Prism If patient doesn't prism adapt and prism provides improved fusion
Infantile Esotropia	Esotropia onset before 6 months of age	Vision Therapy Train divergence, improve fusion, wean out of BO prism Surgery Moderate/Large ET

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My cousin calls...

Cousin: My 5 month old is "cross-eyed"...the doctor says we should do surgery.
Are there other options?
What age should he have the surgery?



Me: Got any more photos? (I love baby pics)

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Infantile Esotropia



- Begins in **neurologically normal** children **before** 6 months of age (2-5 months)
- 8% of all ET's
- **Normal for newborns to have transient eye turn before 3 months**

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Infantile Esotropia

- "Congenital" Esotropia—old term; not truly congenital
- Large, constant deviation (40-60Δ) distance and near
 - High risk of amblyopia if unilateral
 - Low hyperopic Rx (glasses make little difference in angle)

Often associated with:
DVD (50%)
Latent Nystagmus
IOOA
Cross Fixation



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Infantile ET Management



- Refractive error if significant hyperopia (>+2.50)
- Amblyopia treatment
- Monitor for stable findings >15PD on consecutive visits?
 - Some spontaneously resolve, but these are usually intermittent ET and less than 40 PD (27%)
- Surgery is standard of care
 - Timing of sx controversial (usually 6mo-2 yrs)
 - Earlier sx associated with greater chance for “measurable stereo”
 - Multiple surgeries often needed
- Botulinum Toxin type A injections may be done as an alternative to sx

Cerman et al. JAAPOS. 2012

91

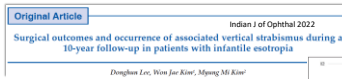
Surgical Outcomes for Infantile ET



- Retrospective review of 122 infantile ET's
- All treated with EOM surgery and followed for a minimum of 10 years
- **52.5%** achieved a “favorable” outcome (ET<10°) at 10 years
- Average number of surgeries was 1.7

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Surgical Outcomes for Infantile ET



Interestingly, they noted the “onset” of IOOA and DVD were often years after surgical intervention

Authors speculated that later diagnosis of DVD may be related to challenges of getting good measures on very young patients...

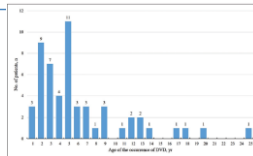
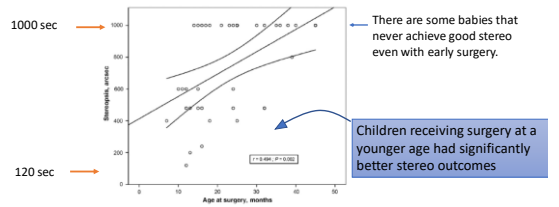


Figure 4: The occurrence of dissociated vertical deviation (DVD) (10y-40y (44.2%)) patients were diagnosed with dissociated vertical deviation (DVD) at a median age of 5 years (range: 1-25 years)

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Timing of Surgery for Infantile ET



38 Infantile ET's with post surgical deviations <10° ET
 “None of the patients operated on before 13 months of age was stereo deficient and no patient operated after 39 months had stereo.”

Cerman et al. JAAPOS 2014

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Review Article

Timing of surgery in essential infantile esotropia – What more do we know since the turn of the century?

Manjushree Bhatte, Manve Flaherty, Frank J Martin 2022

Table 3: Timing of surgery - claimed advantages and disadvantages

	Advantages	Disadvantages
Early surgery	Better stereopsis and binocular vision Reduced incidence and severity of postoperative DVD and inferior oblique overaction. Improved psychosocial and parental bonding Minimizes delay in sensorimotor and gross motor development.	Accurate estimation of the angle of deviation is challenging. Possibility of development of accommodative esotropia as sequelae.
Late surgery	Better accuracy in estimating the angle of deviation Possibility of correction of vertical misalignment if any at same surgical sitting Possibility of treating amblyopia successfully.	Increased incidence and severity of DVD necessitating additional surgery. Poorer fine and gross stereopsis and binocular vision

Conclusions: Surgical intervention within 6 months of ET onset appears to provide best results. (suggests prompt referral most appropriate course of action)

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Infantile Esotropes as Adults

43 yo with history of 4 strabismus surgeries for an inward eye turn (the last one was 20 years ago)

No symptoms (other than blur at near glasses). Denies diplopia.

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Infantile Esotropes as Adults

29yo with history of "eye muscle surgery" as an infant.
 Experiencing diplopia at the end of the day when she's tired.
 12-18° ILET/EP with DVD
 250 seconds of global stereo!

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Pre-surgical

Post-surgical

My response to my cousin...

For such a large angle, constant, early onset ET, surgery is your best option.
 Earlier surgery (between 6-24mos) is associated with better outcomes. (actually surgery within 6 months of ET onset is ideal!)
 Even if you do everything right, there's a chance he'll need another surgery and he may not have great stereo.

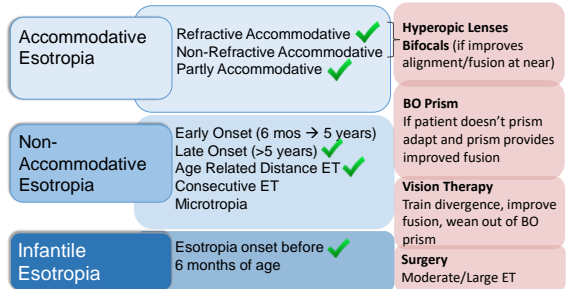
...he'll be great! What a cutie!

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Noah, 12 months post surgical...

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100