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AGE-RELATED EYE CHANGES AND THEIR MANAGEMENT

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FINANCIAL DISCLOSURE

Shana Barrett Zeitlin, O.D. has no financial interests to disclose.

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WHAT AGE WOULD YOU CONSIDER "OLD"?

- Currently ~62 million adults ages 65 and older living in the US
 - By 2054, estimate is 84 million
- Life expectancy for those born in:
 - 2024: age 79.25
 - 1984: age 74.58
 - 1954: age 68.90

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WHAT'S POTENTIALLY DIFFERENT ABOUT PEOPLE AS THEY AGE?

- Multiple chronic illnesses
- Multiple medications
- Physiologic changes lead to adverse drug effects, altered illness presentations
- Cognitive/functional limitations
- Increased importance of social/familial support
- What about the eyes?

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PRESBYOPIA | "Old Eyes"

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PRESBYOPIA

- Gradual loss of the eye's ability to focus on nearby objects
- USA: about 139 million people are >45y
- Symptoms:
 - Difficulty reading small print, especially in low light
 - Needing to hold reading material at arm's length
 - Eye strain, headaches, or fatigue after near work
- It's a natural part of aging. But why?
 - Progressive decrease in the accommodative capacity of the crystalline lens

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WHAT IS ACCOMMODATION?

- Ability of the eye to increase the refractive power of the crystalline lens in order to focus near objects on the retina
- The eye changes refractive power by altering the shape and position of its crystalline lens
- Near triad: miosis, convergence, accommodation

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OCULAR STRUCTURES INVOLVED IN PRESBYOPIA

- Crystalline lens**
 - Changes shape to focus light onto the retina
- Zonules**
 - Fibers that hold the lens in place and help in its adjustment for focusing
- Ciliary muscle**
 - Controls the shape of the lens during accommodation
- Iris (sphincter and dilator muscles)**
 - Controls the amount of light entering the eye through the pupil

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THE ACCOMMODATIVE PROCESS

- Relaxed state:**
 - Ciliary muscle is relaxed
 - Zonules are under tension
 - Focused for distant objects
- Accommodated state:**
 - Ciliary muscle contracts
 - Zonules relax
 - Crystalline lens thickens, becomes more convex
 - AC depth decreases
 - Increase in refractive power, brings objects into near focus

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AMPLITUDE OF ACCOMMODATION

- The range over which the eye can focus, measured in diopters (D)
- Decline in amplitude with age
 - Loss of elasticity/flexibility in the crystalline lens
 - Weakening of the ciliary muscle
- Hofstetter formula for expected amplitudes
 - Average: $18.5 - 0.3 \times \text{age}$
 - Minimum: $1.5 - 0.25 \times \text{age}$
 - Maximum: $25 - 0.4 \times \text{age}$

Age	Hofstetter average (D)
5	17.0
10	15.5
15	14.5
20	12.5
25	7.5
30	9.5
35	8.0
40	6.5
45	5.0
50	3.5
55	2.0
60	0.5
65	-1.0

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ACCOMMODATIVE SPASM

- Involuntary and persistent contraction of ciliary muscle
- Leads to excessive focusing power of the lens
- Can result in a continuous state of near focus
- Difficult to relax to see at distance
- What would early presbyopic patients report?

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REFRACTIVE ERROR

- Hyperopes (and latent hyperopes):**
 - Difficulties with near vision may appear sooner
 - Seemingly more pronounced symptoms
 - 42M: "There's something wrong with my eyes. I can't see that. I could see it yesterday!"
- Myopes:**
 - Later onset, or perceived less severe symptoms compared to hyperopes
 - May initially benefit from removing glasses for near tasks
 - 48F: "Oh, I can still read great. I just need you to fix my contacts."
- Accelerants of Presbyopia:**
 - Diabetes, certain medications, excessive near work, etc.

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1. What is the answer?

- A This is right.
- B No, this is.
- C Definitely this.
- D I give up.

PRESBYOPIA MANAGEMENT

Lots of options!

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SPECTACLES: MULTIFOCAL

- Progressive lenses, bifocals, and trifocals
- Computer progressives
- Onset of prevention... EXPLAIN how the lens works!

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SPECTACLES: MONOFOCAL

- Single vision lenses (DVO/NVO)
- Computer glasses
- Hobbies (sewing, jewelry, puzzles)
- "One good pair"

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SELECTION AND DISPENSING

- Customize lens options based on patient needs and lifestyle!
- Lightweight materials
 - Thinning skin
- Anti-glare and blue light coatings?
- Temple thickness
 - Hearing aids
 - Oxygen cannula

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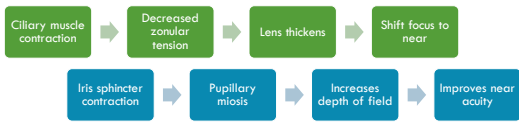
CONTACT LENSES

- Monovision:** one eye corrected for distance, the other for near
- Multifocal:** provide both near and distance correction in each lens
 - Multiple designs, depending on manufacturer
 - Pupil size decreases with age
 - Refractive error matters:
 - Younger, more myopic patients → larger pupils
 - Older, hyperopic patients → smaller pupils
- Monofocal:** DVO with NVO readers on top
- Specialty:** scleral, RGP, hybrid

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EYE DROPS (VIVITY, PILOCARPINE 1.25%)

▪ Binds to muscarinic receptors on smooth muscle cells of **ciliary muscle** and **iris sphincter**



▪ What if pupil constricts too much?

▪ Decreased distance vision, night vision, and visual field

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SURGICAL

- Corneal refractive surgery
 - Induce monovision (usually -0.50 to -1.50 in non-dominant eye)
 - Post-surgical regression?
- Refractive lens exchange (RLE) or cataract surgery
 - Wide variety of IOLs available for use
 - Post-cataract monovision glasses?
- Corneal inlays
 - Aperture optics
 - Central corneal steeping



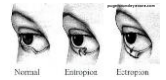
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AGE-RELATED OCULAR DISEASE

Common age-related conditions

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EYELIDS AND ADNEXA



Ectropion:

- Symptoms: drooping lower eyelid, irritation, tearing, exposure keratopathy
- Signs: everted eyelid margin, conjunctival redness, exposure keratitis
- Management: lubricating eye drops, surgical correction



Entropion:

- Symptoms: inward turning eyelid, foreign body sensation, tearing, redness
- Signs: inward-turned eyelid margin, corneal abrasion (lashes), conjunctival redness
- Management: lubricating drops, botulinum toxin injections, surgery



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EYELIDS AND ADNEXA

Prosis and dermatochalasis:

- Symptoms: drooping upper eyelid, difficulty opening the eye, obstructed vision
- Signs: low-lying upper eyelid margin, reduced palpebral fissure height
 - What is the underlying cause of a patient's prosis?
- Management: surgical correction (blepharoplasty), underlying condition treatment



Orbital Fat Loss:

- Symptoms: sunken appearance of the eyes, hollowness around the eyes
 - Prostaglandinid
- Signs: prominent superior orbital rim, enophthalmos, deep sulcus
- Management: dermal fillers, orbital implants

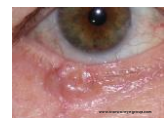


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BASAL CELL CARCINOMA

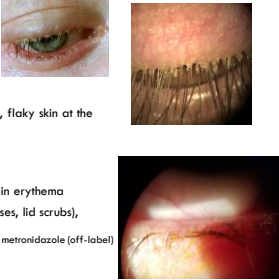
Most common eyelid malignancy

- Symptoms: nodule/lump, open flesh-colored sore, eyelash loss, epiphora
- Signs: (classic) firm, raised, pearly, nodular appearance
- Management: biopsy and resection, potential cryotherapy or radiation



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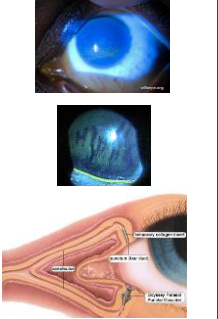
BLEPHARITIS



- Chronic eyelid inflammation
- Symptoms: redness, itching, burning sensation, flaky skin at the base of eyelashes
 - Staphylococcus aureus
 - Demodex?
 - MGD/rosacea?
- Signs: scaly debris on eyelashes, eyelid margin erythema
- Management: eyelid hygiene (warm compresses, lid scrubs), topical antibiotics or steroids
 - Demodex: Iolitaner, tea tree products, Ivermectin and metronidazole (off-label)
 - MGDs: heat and light therapies, oral tetracyclines

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DRY EYE SYNDROME



- Symptoms
 - Grittiness/FBS
 - Burning, stinging, itching
 - Blurry vision, fluctuating vision
- Signs
 - Reduced tear meniscus
 - Punctate epithelial erosions
 - Decreased tear breakup time
- Management
 - Artificial tears
 - Ointments
 - Heat mask/warm compresses
 - Punctal plugs
 - Topical cyclosporine
 - Autologous serum drops
 - Humidifiers
 - Amniotic membranes?
 - HRT?

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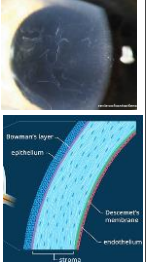
DRY EYE SYNDROME IN OLDER ADULTS



- Age related
 - Production of tears decreases with age
- Hormonal
 - Peri- and post-menopausal women
 - Pregnancy
- Medication related
 - Antihistamines, antidepressants, many others!
- Systemic disease related
 - Sjogren's, thyroid, sleep apnea
 - Sarcoidosis, RA, lupus, psoriasis, IBS, etc.

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ANTERIOR BASEMENT MEMBRANE DYSTROPHY (ABMD):



- Corneal basement membrane extends into corneal epithelium
- Abnormalities interfere with adherence of the epithelial cells to the basement membrane
- Symptoms: fluctuating vision, blurred vision, severe pain especially on awakening, discomfort
- Signs: map-dot-fingerprint patterns on the cornea, corneal erosions
- Management: lubricating ointments, hypertonic saline, corneal debridement, stromal puncture, bandage CL, amniotic membranes
- Risk of RCE (recurrent corneal erosion)

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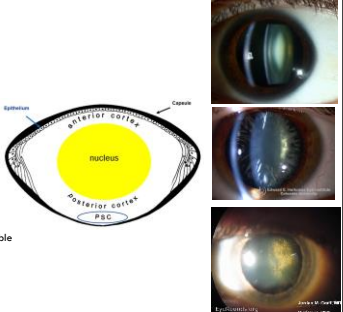
ARCUS SENILIS



- Symptoms: typically asymptomatic, may be noticed by others or when looking in the mirror
- Signs: white or grayish ring around the cornea
- Management: generally, no treatment needed, monitor lipid levels especially if patient is young

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LENS: CATARACT


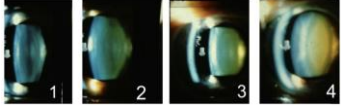


- Symptoms: blurred vision, glare sensitivity, faded colors, difficulty with night vision
- Signs: opacification of the lens, reduced visual acuity
- Management: surgical removal
 - Selection of appropriate IOL based on patient needs
 - Monofocal, toric, multifocal, light-adjustable
 - Timing of surgery?

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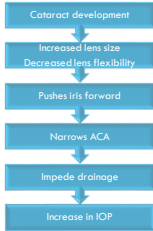
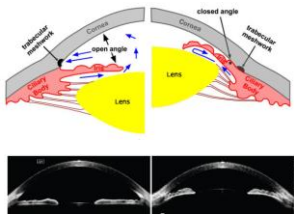
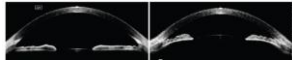
ENVIRONMENTAL ADJUSTMENTS

- Lighting**
 - Pupil size decreases with age → need increased lighting
 - Pinhole effect?
- Glare**
 - Lighting position
 - Anti-glare coatings
- Color perception**
 - "Wine-colored tablecloth"
- Contrast sensitivity**
 - High contrast for reading

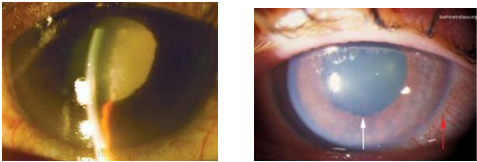
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NARROWING ANTERIOR CHAMBER ANGLE

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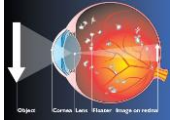

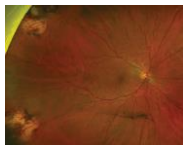
ANGLE CLOSURE GLAUCOMA CAN BE LENS-INDUCED



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VITREOUS FLOATERS

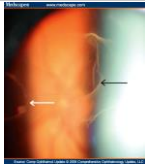
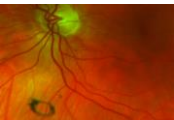
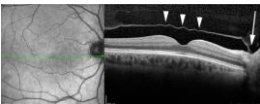
- Collagen fibers clumped together that cast shadows on the retina
- Symptoms: dark spots or lines that move with eye movement
- Signs: visible vitreous opacities on slit-lamp exam, BIO, fundus photos
- Management: observation, YAG vitreolysis, vitrectomy

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POSTERIOR VITREOUS DETACHMENT



- Symptoms: Sudden onset of floaters, flashes of light
- Signs: Separation of the vitreous from the retina, Weiss ring
- Management: Monitor for retinal tears/detachment, patient education on warning signs

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RETINAL DETACHMENT

- Symptoms: Sudden vision loss, flashes, shadow/curtain over vision
- Signs: Detached retina on funduscopy/retinal photos
 - PVD can precede tear/RD
 - Rhegmatogenous, tractional, serous
- Management: Immediate surgical intervention (e.g., pneumatic retinopexy, vitrectomy)

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EPIRETINAL MEMBRANE

- Symptoms: distorted vision, blurriness, central visual changes
- Signs: wrinkling of the retinal surface, macular pucker
- Management: observation, vitrectomy with membrane peel in advanced cases

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AGE-RELATED MACULAR DEGENERATION

- Symptoms: central vision loss, difficulty reading, distorted vision
- Signs: drusen, pigmentary changes, choroidal neovascularization
- Management: anti-VEGF injections, laser therapy, lifestyle changes, AREDS2 formulas

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GLAUCOMA

- Progressive optic neuropathy: "Glaucomatous cupping"
- Symptoms: Peripheral vision loss, often unnoticed until advanced
- Signs: Elevated intraocular pressure*, optic nerve cupping
- Management: IOP-lowering medications, laser therapy, surgery (e.g., trabeculectomy, MIGS)

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GLAUCOMA TESTING

- IOP (Goldmann)
- Gonioscopy
- Pachymetry
- OCT
- Visual field
 - Typically 24-2 SITA STD
- Fundus photos
- ERG

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ANTERIOR ISCHEMIC OPTIC NEUROPATHY

<p>Non-arteritic (NAION)</p> <ul style="list-style-type: none"> • Symptoms: decreased visual acuity, dyschromatopsia, RAPD, swollen hyperemic optic nerve with splinter hemorrhages, visual field defect (usually inferior or central) • Most are idiopathic <ul style="list-style-type: none"> • Crowded disc? • Disc drusen? • Sleep apnea? 	<p>Arteritic (AAION)</p> <ul style="list-style-type: none"> • Symptoms: rapid onset of unilateral visual loss and/or VFD, RAPD common, pale and swollen disc, flame hemorrhages located adjacent to the disc, narrowed peripapillary arterioles • May have history of TIAs • Most cases secondary to G • Headache, jaw claudication, sc • tenderness
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SYSTEMIC DISEASE

Ocular manifestations

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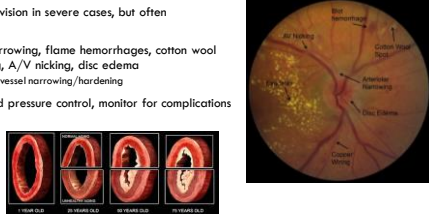
TEMPORAL (GIANT CELL) ARTERITIS



- Systemic, inflammatory, vascular syndrome affecting the temporal arteries
- Symptoms:
 - Sudden, severe vision loss, typically unilateral but will become bilateral if untreated
 - Scalp tenderness, jaw claudication, headaches
 - General symptoms like fatigue, fever, and weight loss (PMR)
- Signs:
 - Swollen, tender temporal artery
 - Elevated erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP)
 - Fundus examination may show optic disc edema or pale optic nerve
- Management:
 - Immediate initiation of high-dose corticosteroids to prevent further vision loss
 - Temporal artery biopsy to confirm diagnosis
 - Long-term steroid therapy with monitoring for side effects

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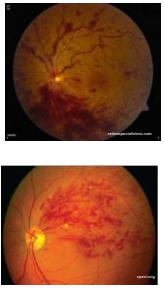
HYPERTENSION / HYPERTENSIVE RETINOPATHY



- Symptoms: blurred vision in severe cases, but often asymptomatic
- Signs: arteriolar narrowing, flame hemorrhages, cotton wool spots, copper wiring, A/V nicking, disc edema
- Atherosclerosis: blood vessel narrowing/hardening
- Management: blood pressure control, monitor for complications

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VEIN OCCLUSIONS (CRVO, BRVO)



- CRVO: Usually due to emboli or thrombus at lamina cribrosa
- BRVO: Thrombus at A/V crossings
 - Artery compresses underlying venous wall
- Symptoms: Sudden, unilateral, painless blur, visual field loss (partial or complete)
- Signs: dilated, tortuous veins with superficial hemorrhages, macular edema
- Management: systemic risk factor management, anti-VEGF injections, steroid injections, grid laser

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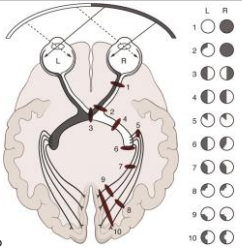
ARTERY OCCLUSIONS (CRAO, BRAO)



- CRAO: Usually due to emboli/thrombus at lamina cribrosa
- BRAO: Emboli/thrombus at other sites
- Symptoms: Sudden, unilateral, painless, profound loss of vision (CF-LP)
- Signs: RAPD present on exam, cherry red spot in macula (CRAO), retinal whitening in area of occlusion
- Management: anticoagulation therapy, systemic risk factor management

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STROKE/CVA: VISUAL FIELD



- Symptoms:
 - Loss of peripheral field of vision (~8% of all CVAs)
 - Difficulty with spatial awareness, reading, increased falls
- Signs:
 - Most common VFD: homonymous hemianopia
 - Possible neglect of the affected visual field
- Management:
 - Vision rehabilitation therapy to improve awareness of VFD
 - Prisms and telescopes
 - Possible field recovery?
 - Treatment of underlying stroke causes (e.g., antithrombotic therapy, blood pressure management)

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STROKE/CVA: EOM PALSIES

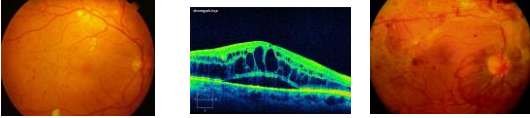


- Symptoms:
 - Double vision (diplopia)
 - Abnormal compensatory head posture
- Signs:
 - Restricted eye movements (CN III, IV, VI)
 - Misalignment of the eyes
- Management:
 - Occlusion, prism glasses
 - EOM surgery in persistent cases
 - Addressing the underlying stroke or systemic cause

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DIABETES / DIABETIC RETINOPATHY

- Symptoms: blurry vision, floaters, vision loss in advanced stages
- Signs: microaneurysms, hemorrhages, macular edema, neovascularization, lens swelling
- Management: glycemic control, anti-VEGF injections, laser photocoagulation



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THANK YOU!

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