## A NEW ERA IN **CATARACT AND REFRACTIVE SURGICAL MANAGEMENT**

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## **DISCLOSURES**

- Ocular Therapeutix
- Glaukos
- Horizon Quidel
- Eyevance

- Ivantis
- Orasis Claris Bio Aldeyra
- RVL
- Oyster Point Allergan
- Alcon
   Visus
- Thea • Bruder
- Glaukos

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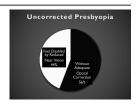
## **GIFTS OF AGING**

- Dryness
- Presbyopia
- Cataracts
- Acquired ptosis/dermatochalasis

"We wrinkle, we grey, we dry up"
-Walt Whitley

## AGING TRENDS

- 2010, 89% adults ≥45 years old in US had presbyopia
- Global prevalence of presbyopia 1.1billion people in 2015
   1.8 billion people by 2050
- Uncorrected presbyopia leads difficulty performing near tasks by 2 to 8 fold
   Potential productivity loss estimated to be \$11billion in those <50YOA



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PRESBYOPIA PATIENT POPULATION IS LARGE & GROWING

• Global market opportunity exceeds \$5 billion¹

- 40% of procedures are performed in the US

• 70¢ million US baby boomer population is at least \$0 years old²

• Presbyopia-correcting procedures are elective

- Pricing determined by market forces, not reimbursement rates; patients expect superior results

• Other surgical options exist but require significant compromise

- Sacrifice intermedute and/or distance acuity

- Loss of effect over time; glare and halo complaints

- Irreversible

WHAT IS PRESBYOPIA?

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## AOA CLINICAL PRACTICE GUIDELINE

- Age related visual impairment resultant from gradual decrease in accommodation expected with age
  - Can have multiple effects on quality of vision and life
  - Accommodative amplitude reduces from 15D in childhood to 1D before age of 60  $\,$

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## COMPLAINTS

- Blurred near vision
- Fatigue
- Delays in focusing at near or distance
- Drowsiness from near work
- Ocular discomfort
- Increased working distance
- Need for brighter light for reading
- Headache Asthenopia
- Squinting
- Diplopia at near

STAGES OF PRESBYOPIA

9 10

## AOA STAGING

- Incipient Presbyopia
  - Earliest stage, reading small print requires extra effort but may not have clinical findings
- Functional Presbyopia
- Declining accommodative amplitude and near task demands with visual difficulties that are confirmed in clinic
- Absolute Presbyopia
  - When virtually no accommodative ability remains

CRST STAGES OF PRESBYOPIA

- Stage I
   42-50YOA
   Crystalline lens starts to stiffen and loses focusing power, loss of near VA
   Develop HOA
- Develop HOA
   Stage 2
   >59 YOA
   Loss of accommodation, light scatter formation and degrading VA
   Decreased contrast and night vision
   Stage 3
   \*45 YOA
   Full caranct\_nucleus of lens yellows and color vision changes
   Poor VA qualky, decreased VA

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## **ALTERNATIVE STAGES**

- Early 42-46 YOA
   +0.75 to 1.25D
   Need help in low light with near, few intermediate problems
   May or may not need readers
- Transition and Adaptation 47-52 YOA
  + 1.75 to 2.00D
  Many move to full time wear
- Total loss of Accommodation >53YOA
  +2.25 D or greater
  More intermediate problems

BUT REALLY, WHAT IS PRESBYOPIA?

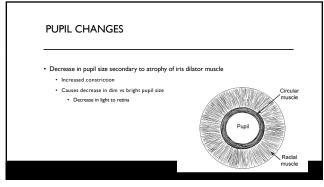
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## ACCOMMODATION Contraction of the anterior radial muscle segment of the ciliary muscle · Moves toward sclera Causes 2. forward rotation of the ciliary process 3. increased tension in equatorial zonules ACCOMMODATED Equatorial zonules determine the optical power ACCOMMODATION IN THE NORMAL EYE changes

## **ACCOMMODATION CHANGES** Changes in the crystalline lens

- Hardening
- Yellowing
- Thickening
- Decreased elasticity of capsule lens material
- · Sclerosis causes anterior shift of equatorial fibers
- - Increased tension in the equatorial zonules
  - Change in angle of zonule insertion

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**PUPIL** 

- Can be helpful

  - · Increased depth of focus
- Resultant improved vision at distance and near
- - Decreased contrast sensitivity
  - Poor vision in low illumination
     Increased visual distortion

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HOW DO YOU DISCUSS PRESBYOPIA?

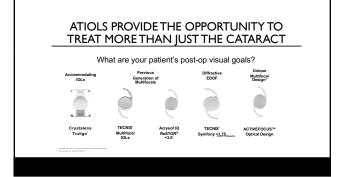
HOW DO YOU TREAT PRESBYOPIA?

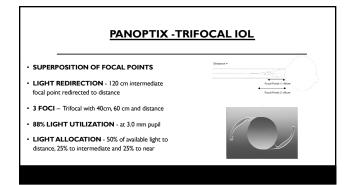
## OPTIONS TRIED AND TRUE - OTC readers - One size fits no one - Prescription glasses - Single vision near or computer glasses - Bifccal - Progressives - Contact lenses - Monovision - Multifocal

- Refractive lens exchange or cataract surgery
- Monovision
- Single vision datance with glasses for near
- Single vision near with glasses for distance
- Premium POLS

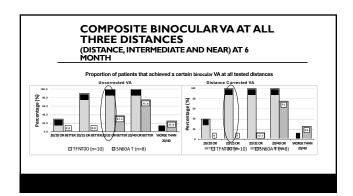
- CXL
- PXL
- PXL
- PEARL
- LASIK/PRK
- Monovision

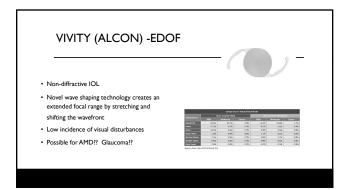
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## TECNIS SYNERGY AND TORIC (J&J)-HYBRID MULTIFOCAL/EDOF IOL Combines diffractive multifocal and EDOF technologies (echelette surface to improve light scatter and halo intensity) Continuous vision from distance to 33 cm Eliminates the visual gaps present in trifocal and other multifocal technology, Good performance in low-light conditions Achromatic technology for image contrast Violet-filtering technology reduction in halo intensity for tasks like night driving, 7 as demonstrated in clinical simulations

TECNIS EYHANCE AND EYHANCE TORIC(J&J)-ENHANCED MONOFOCAL IOL

Monofocal IOL category in improved intermediate vision and 20/20° distance vision

TECNIS Eyhance IOL offers the same well-established low incidence of halo, glare, or starburst as TECNIS® I-piece IOLs

Option for patients with known retinal or corneal irregularities

27 28

# LIGHT ADJUSTABLE LENS (LAL) • FDA Approved for pts with pre-existing astignatism of ≥0.75D undergoing cat sx • Spherical and cylindrical errors up to 2D • First and only lens designed to be adjusted after implantation by UV light • 3 piece IOL design • 6.0mm biconvex optic; 13.0mm overall length • UV absorbing back layer: 50-100 µm

## FDA CLINICAL RESULTS

- Randomized, pivotal study comparing the Light Adjustable Lens to a commercially available monofocal lens in 600 patients with pre-existing astigmatism at 17 investigational sites.
- 91.8% of Light Adjustable Lens patients also achieved a result that was within 0.50 D of target manifest refraction spherical equivalent, which is similar to the refractive accuracy seen in recent LASIK studies.
- Study safety parameters were based on a comparison to the safety and performance endpoints for intraocular lenses (ISO 11979-7), and results showed that 100% of study eyes had a best corrected visual acuity of 20/40 or better at the 6 month po visit.

29 30

# WHAT'S COMING NEXT IN IOL TECHNOLOGY? Modular IOL Systems Accommodating Multifocal / trifocal Extended Depth of Focus

ACCOMMODATING IOL - JUVENE

ONLY TO BE Approved

DISTANCE

ONLY MODULAR CURVATURE-changing, fluid-optic IOL

Two-part IOL - Base and Modular

Advantages

Doesn't split light

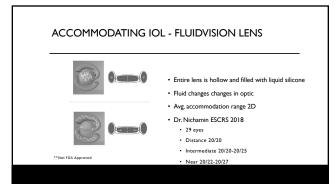
Up to 3D of continuous range vision

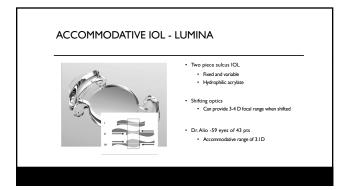
No change in ELP

No PCO up to 4 years

Astigmatism?? Drug Delivery??

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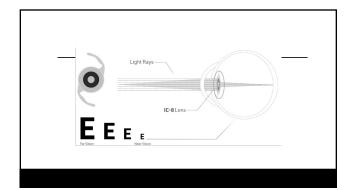


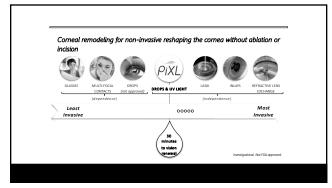
## TRIFOCAL IOL - PHYSIOL Appheric diffractive trifocal 2 diffractive structures that give +3.50 add for N and +1.750 for intermediate Less give and halos Designe for reduce the loss of light energy resulting from any diffractive system Diffractive anterior surface entirely convoluted Height of the diffractive step varied Distributes light to near, intermediate and distant foci adjusted according to the pupil aperture

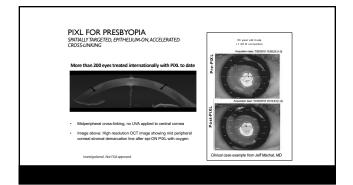
• Filter out unfocused and aberrated peripheral light and allow central lights rays to focus on the retina
• Single-piece hydrophobic acrylic
• Pinhole creating mask
• PVDF & nano-particles of carbon
• 1.36mm aperture
• 3.23mm total diameter
• 3200 microperforations

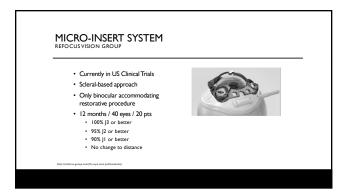
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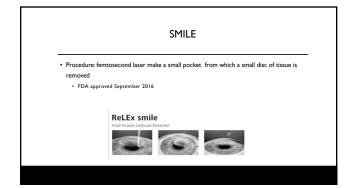




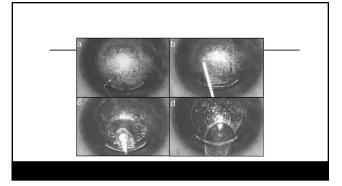


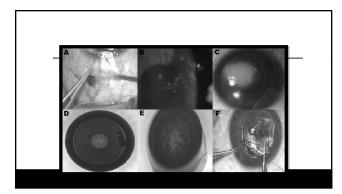
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RELEX SMILE: SMALL INCISION LENTICULE EXTRACTION

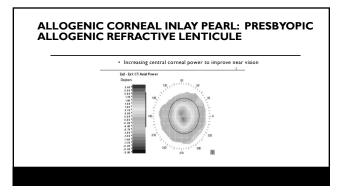


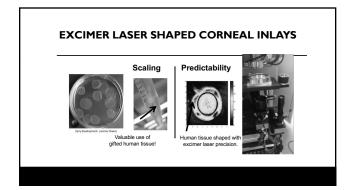
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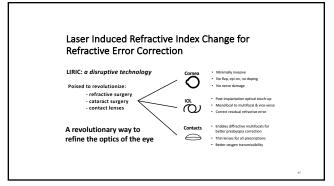




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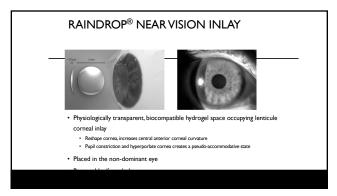


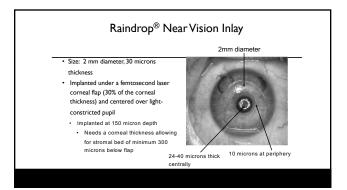




A SWING AND A MISS

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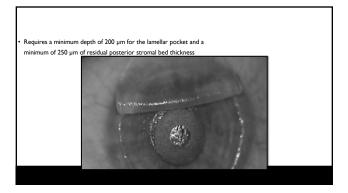
# POSTOP MANAGEMENT: SLIT LAMP EXAMINATION - Haze Development - Faint peripheral circle occurs in almost every case and does not require treatment - If you see any activation and progression, topical steroid treatment is Normal ring, no treatment recommended - Peripheral edge progression Central haze, treatment recommended

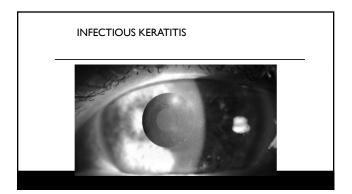
## KAMRA SMALL APERTURE INLAY

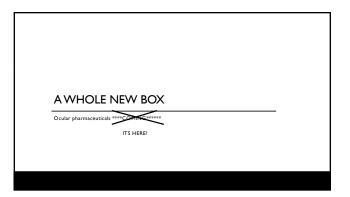
- KAMRA (AcuFocus) is a small aperture inlay
  - 3.8mm outer diameter
  - 5 microns thin
  - 1.6mm inner diameter
- Made from polyvinlidene fluoride
- Over 20,000 inlays implanted worldwide
- US IDE enrollment complete (507 patients)

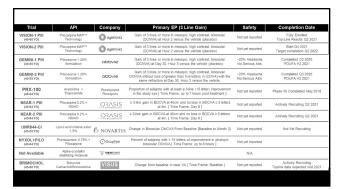


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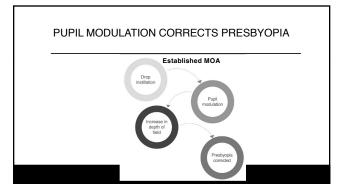




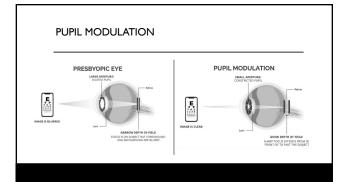


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NOT PICTURED: EYEFOCUS FROM OSRX COMPOUNDING



57 58



PHARMACEUTICAL CATEGORIES

Pilocarpine
Different percentages in multiple formulations
Causes Miosis
Carbachol
Cholinergic agent to decrease pupil size
Acceldine
Targets iris sphincter and avoid ciliary stimulation for pinhole effect
Brimonidine tartrate which is a sympatholytic alpha-2 agonist.
It inhibits the iris dilator muscle contraction and may also inhibit contraction of ciliary muscle by activating alpha-2 receptors.
Brimonidine also helps with increasing bioavailability and duration of action of other ingredients by altering aqueous dynamics.

59 60

## HOW QUICKLY DO THEY WORK?

 Studies show variance of onset within 15-30 minutes and duration of 3-7 hours depending on the drop.

## VUITY (ALLERGAN)

- Currently the only FDA approved presbyopic drop
- · Pilocarpine based
- The pHast technology allows the Pilocarpine HCL to rapidly adjust to the pH of the tear film and increased corneal penetration.<sup>1</sup>
- Phase 3 GEMINI I and 2 studies
- showed that 31% and 26% of patients, respectively, gained 3 lines or more in mesopic, high contrast, binocular distance corrected near visual acuity
   without losing more than 1 line of BCDVA.
- The vehicle arm only noted 8% and 11%, respectively, meeting the same endpoints.

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## ORASIS CSF-I OPTIMAL BALANCE Exceptional near visual acuity No reduction of distance vision & night vision High safety and tolerability profile Improved comfort Preservative free

## ORASIS CSF-I

- Preservative free formulation with proprietary vehicle to allow for optimal balance between efficacy, safety and comfort.
- · pH similar to that of cornea
- Up to twice a day dosing, second dose between 2-3 hours after first
- Phase 3 Study
  - successfully met its primary endpoint of 3 lines of improvement in near vision with no reduction in distance or night vision.
     Almost 70% 2 lines of improvement

  - CSF-I is currently compiling data from Phase 3b study, showing similar to first

63 64

## VISUS THERAPEUTICS

- Brimochol
  - Carbochol 2.25% (cholinergic agent) + brimonidine tartrate 0.2% (alpha-2 agonist)
  - Carbachol is a parasympathomimetic that mimics effect of acetylcholine on both muscarinic
    and nicotinic receptors in the iris sphincter muscle, activating it to decrease the pupil size for
    the "pinhole effect".6
- Previous studies of Brimochol showed an average improvement in near vision of more than 5 lines with no complaints of brow ache or loss in distance vision.<sup>3</sup>

## LENZ THERAPEUTICS

- LNZ100
  - Acecli
    - Targets iris sphincter and avoids ciliary stimulation
  - Phase 2B trials
  - LNZ100 exhibited 81% of patients gaining at least 2-line improvement and 53% gaining at least 3-line improvement at 30 minutes
  - with no change to BCDVA.<sup>4</sup>
- LNZ101
  - LNZ101 is a mix of accelidine and brimonidine, for a combined effect.

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## OCUPHIRE PHARMA

- Nyxol with low dose pilocarpine
- Nyxol® is 0.75% phentolamine, a nonselective alpha adrenergic antagonist that inhibits
  the contraction of smooth muscle of the iris, while Pilocarpine activates the sphincter<sup>4</sup>
- met primary endpoints of 3 lines or more binocular NV in 63% of patients vs 28% in placebo.

## WHAT MAKES THEM DIFFERENT: THE LONG SHORT

- Yuity (Allergan): The pHast technology allows the Pilocarpine HCL to rapidly adjust to the pH of the tear film and increased corneal
  penetration.<sup>1</sup>
- CSF-1 (Orasis): Preservative free formulation with proprietary vehicle to allow for optimal balance between efficacy, safety and comfort.<sup>2</sup>
- Microline (Exenoxia): Opcişt with MAP technology uniquely administers the medication as a spray into the eye versus a drop.
   GI S-102 (Glaubeas): Unitarieş Luton, a cream-based delivery of pilocarpine applied to the outer surface of the syelid. Allows for transformal delivery applied topicity to the skin.
- Nxxol + Low-dose Pilo (Ocuphire): Nyxol® is 0.75% phentolamine, a nonselective alpha adrenergic antagonist that inhibits the
  contraction of smooth muscle of the iris, while Pilocarpine activates the sphincter<sup>4</sup>
- LNZ100/LNZ101 (Lenz Therapeutics) LNZ100 utilizes aceclidine only which has shown to target the iris sphincter only and avoid ciliary muscle activation. 5 LNZ101 is a mix of aceclidine and brimonidine, for a combined effect. 5
- Brimochel (Visus): Brimichol is combination of carbachol and brimonidine tartrate. Carbachol is a parasympathominetic that mimics effect of aery/choine on bod muscarinic and nicotinic receptors in the iris sphincter muscle, activating it to decrease the pupil size for the 'pinhole affect'.

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## OSRX PHARMACEUTICALS

### • EyeFocus

- Is a compounded combination of medications including pilocarpine, but there are currently no possing studies.
- The initial proof of concept study had great promise with 66% of patients having NV of 20/40 or better at 1 hour and 78% of patients maintaining this for 8 hours.

## COMPLETELY OUTSIDE THE BOX......

### • Dioptin (Novartis)

- Lipoic acid-based drop is metabolized by the crystalline lens to help reduce disulfide bonds between proteins that develop with age and restore elasticity and accommodative ability.
- FDA trials are underway for UNR844 (Novartis Pharmaceuticals), which is comprised of lipoic acid choline ester chloride 1.5% and works to restore the accommodative ability of the crystalline lens. Lipoic acid helps to hydrolyze the disulfide bonds within the crystalline lens proteins to soften the lens.<sup>5</sup> Phase 2 studies found an increase in DCNVA of 6.1 letters in the treatment group versus 4.5 letters in the placebo group.<sup>5</sup>

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QUESTIONS?

