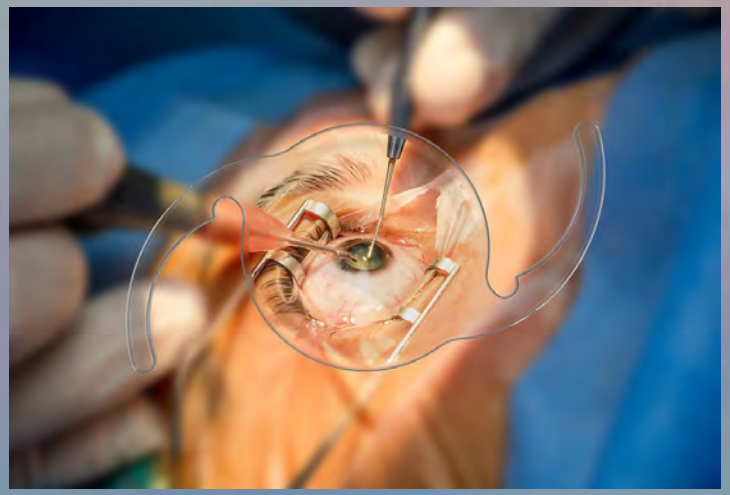
New Presbyopia IOLs

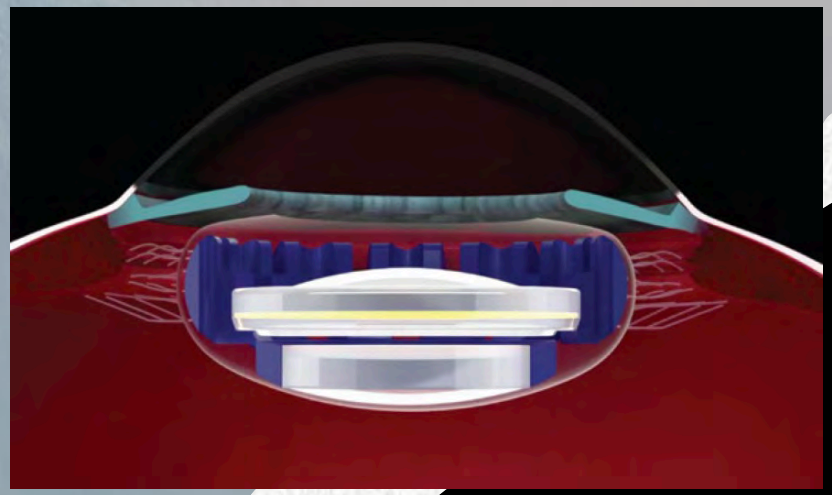
Advantages, disadvantages, patient selection, counseling, and expectations



Gregory D. Searcy, M.D.

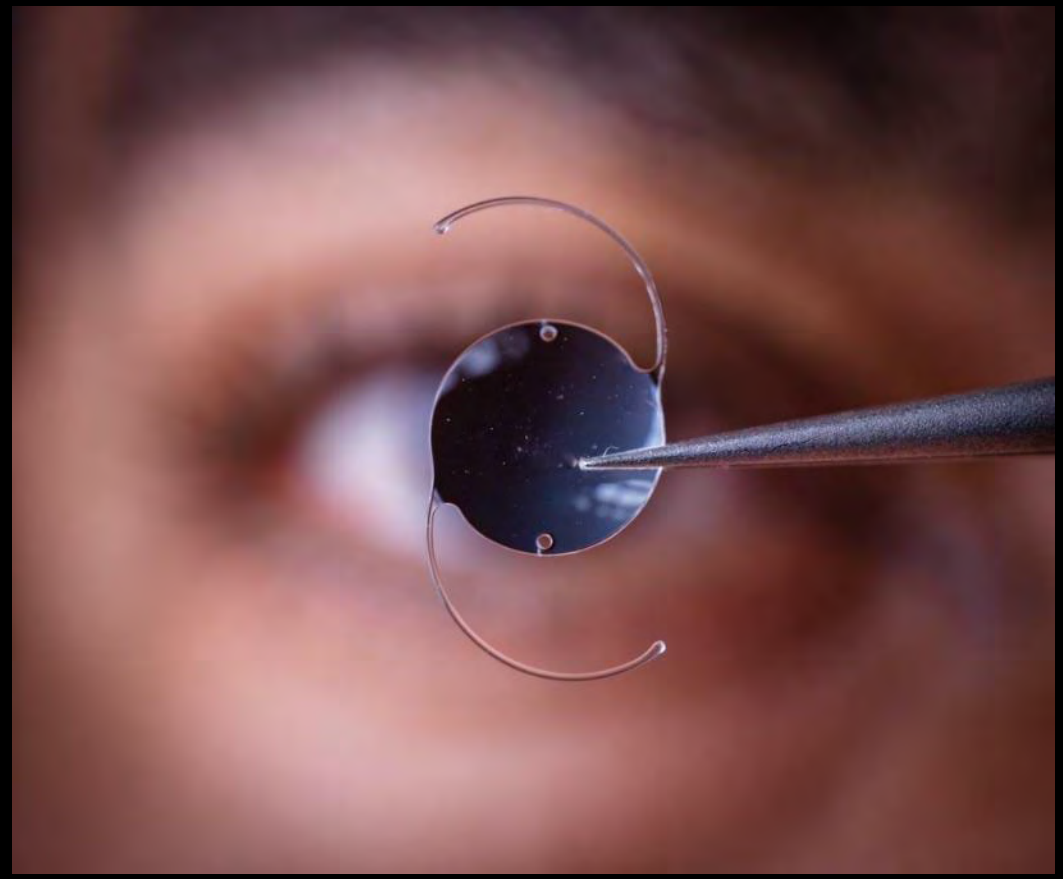
Erdey Searcy Eye Group

Columbus, Ohio



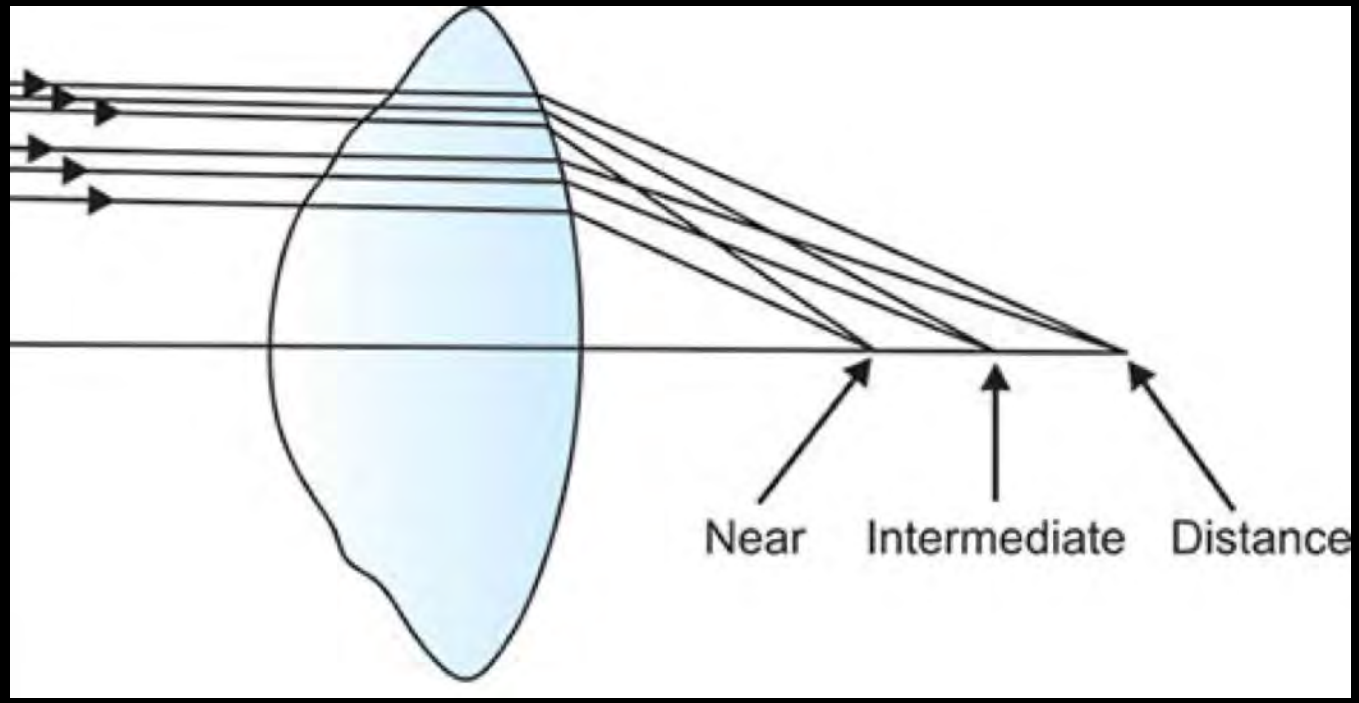
Presbyopia IOL Designs

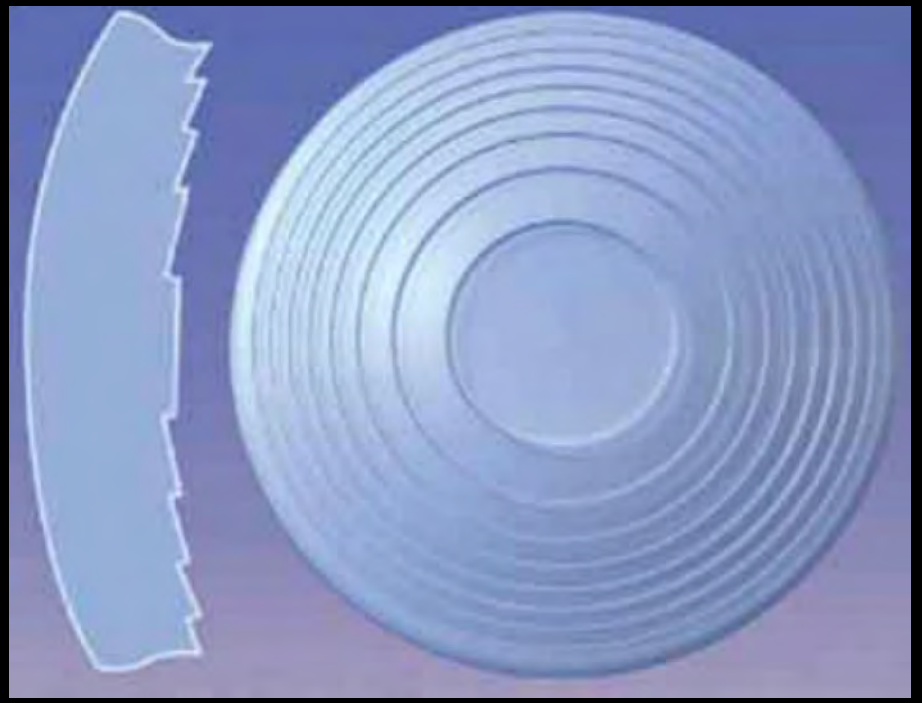
- Refractive
  - Array, ReZoom
- Bifocal diffractive
  - ReSTOR, Tecnis Multifocal
- Trifocal diffractive
  - PanOptix
- “Extended depth of field”
  - Odyssey, Vivity, Apthera, Eyhance
- Light Adjustable Lens



Refractive Multifocal IOLs

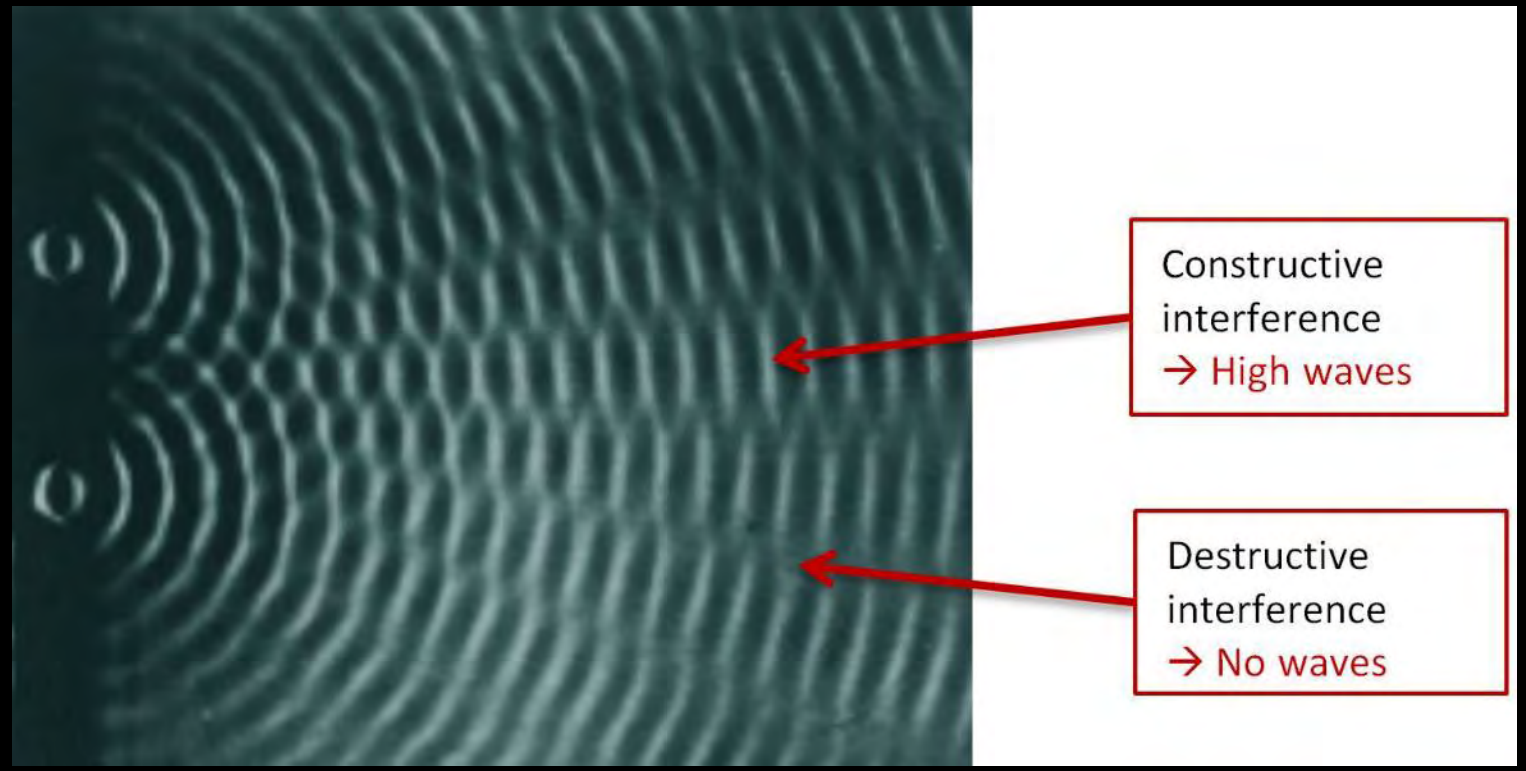
- Concentric zones with different powers
- Disadvantages: Pupil size and lens centration are critical





Diffractive Multifocal IOLs

- Constructive and destructive light interference
- Each zone (eschelette) creates a wavefront of light



Multifocality

constructive interference at specific points in space

↓

focal points of the lens

Diffractive Multifocal IOLs

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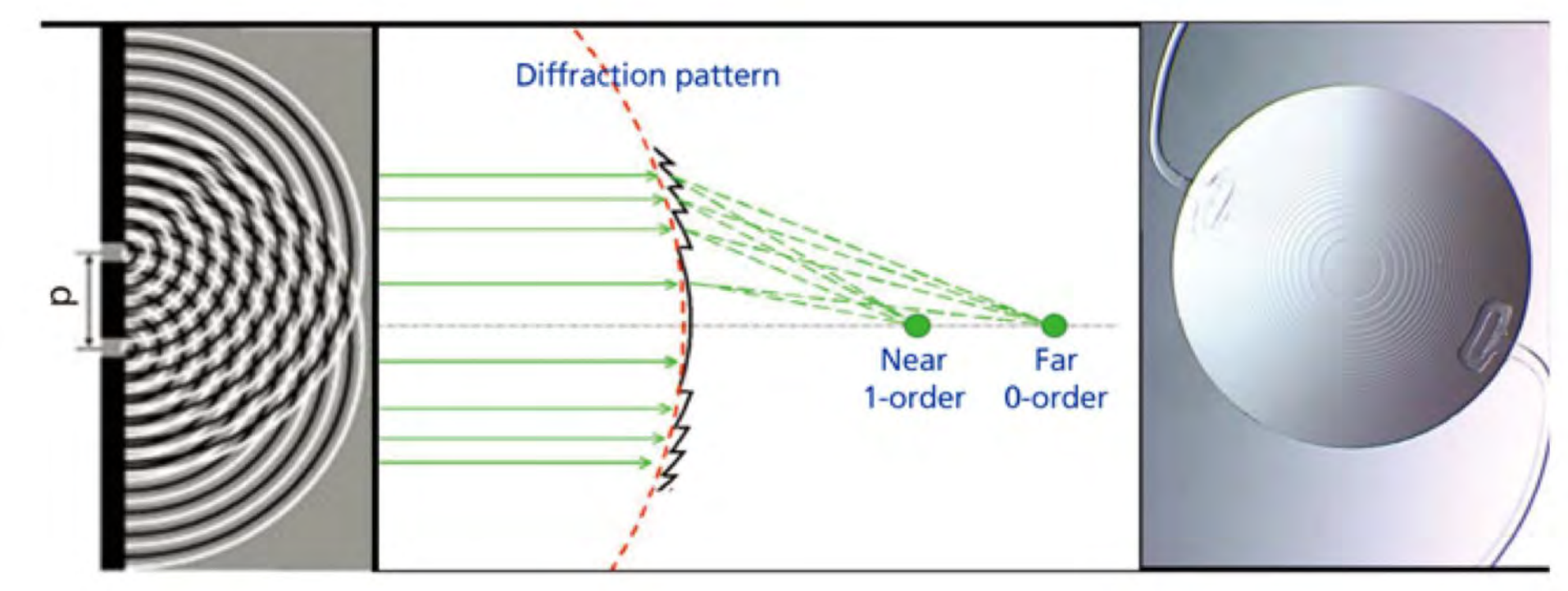

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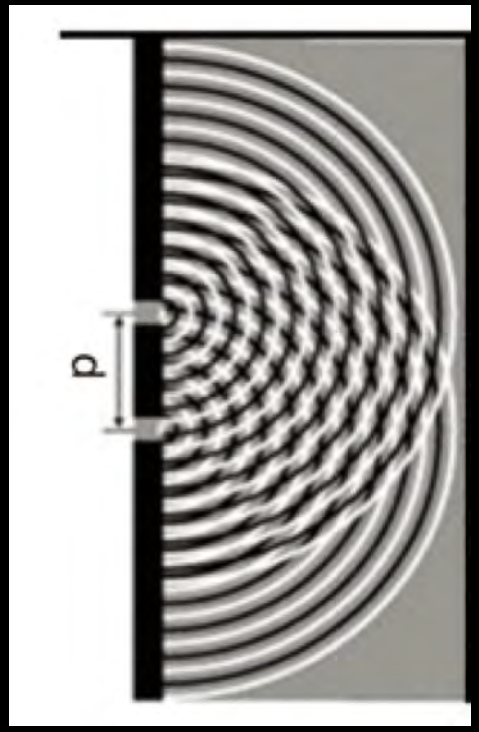


Disadvantage

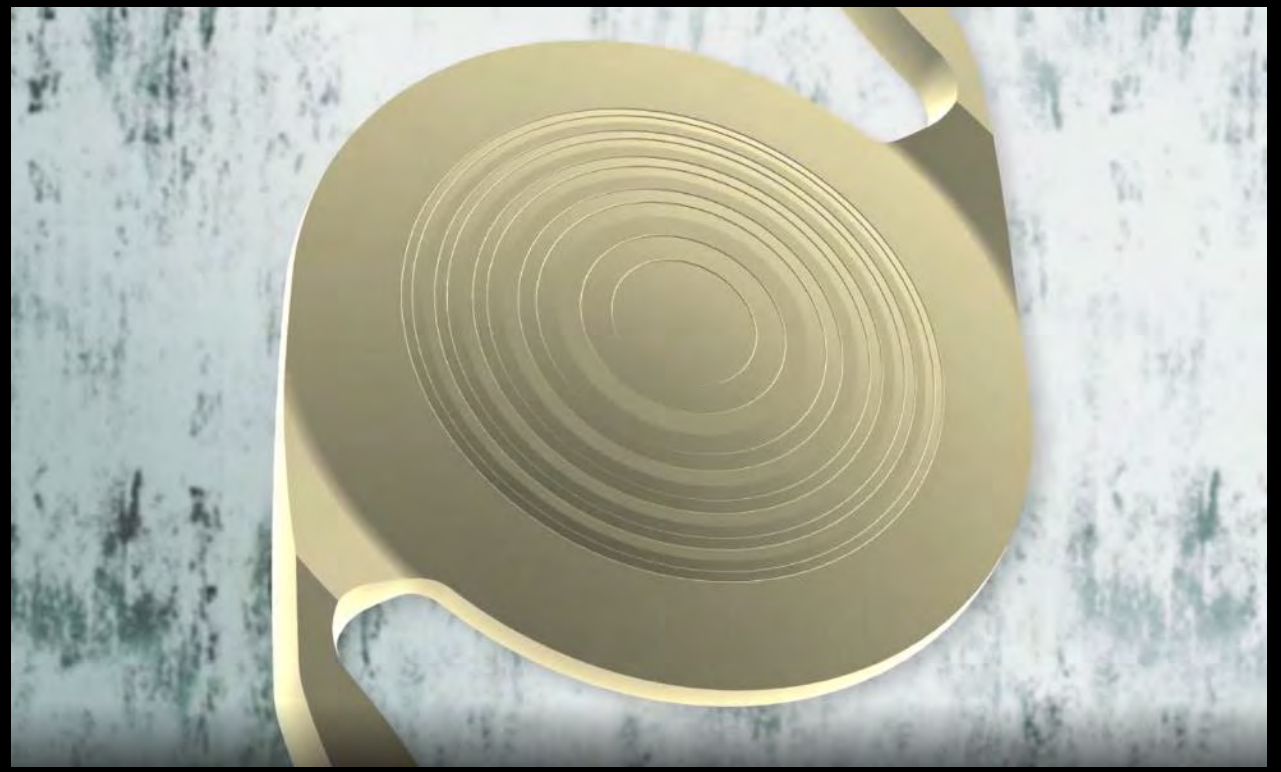
2 foci receive majority of light energy

↓

Impossible to eliminate the other non-functional focal points (~19%)

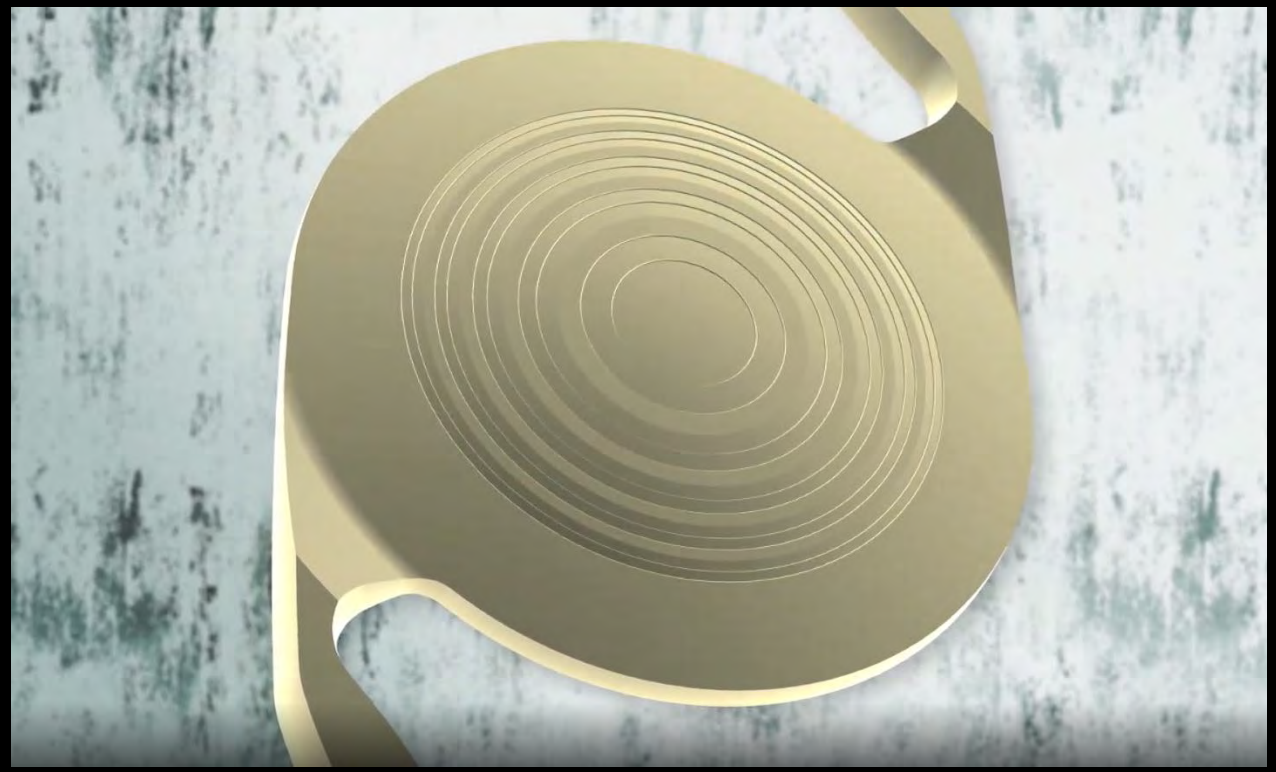
PanOptix Diffractive Multifocal IOL

- Only trifocal IOL in the US
- Actually has 4 focal points
  - Distance (2 foci overlap)
  - 24 inches (+1.67)
  - 16 inches (+2.50)
- Diffractive steps molded onto anterior surface



PanOptix Diffractive Multifocal IOL

- Only trifocal IOL in the US
- Actually has 4 focal points
  - Distance (2 foci overlap)
  - 24 inches (+1.67)
  - 16 inches (+2.50)
- 3 mm pupil
  = 88% of light utilized



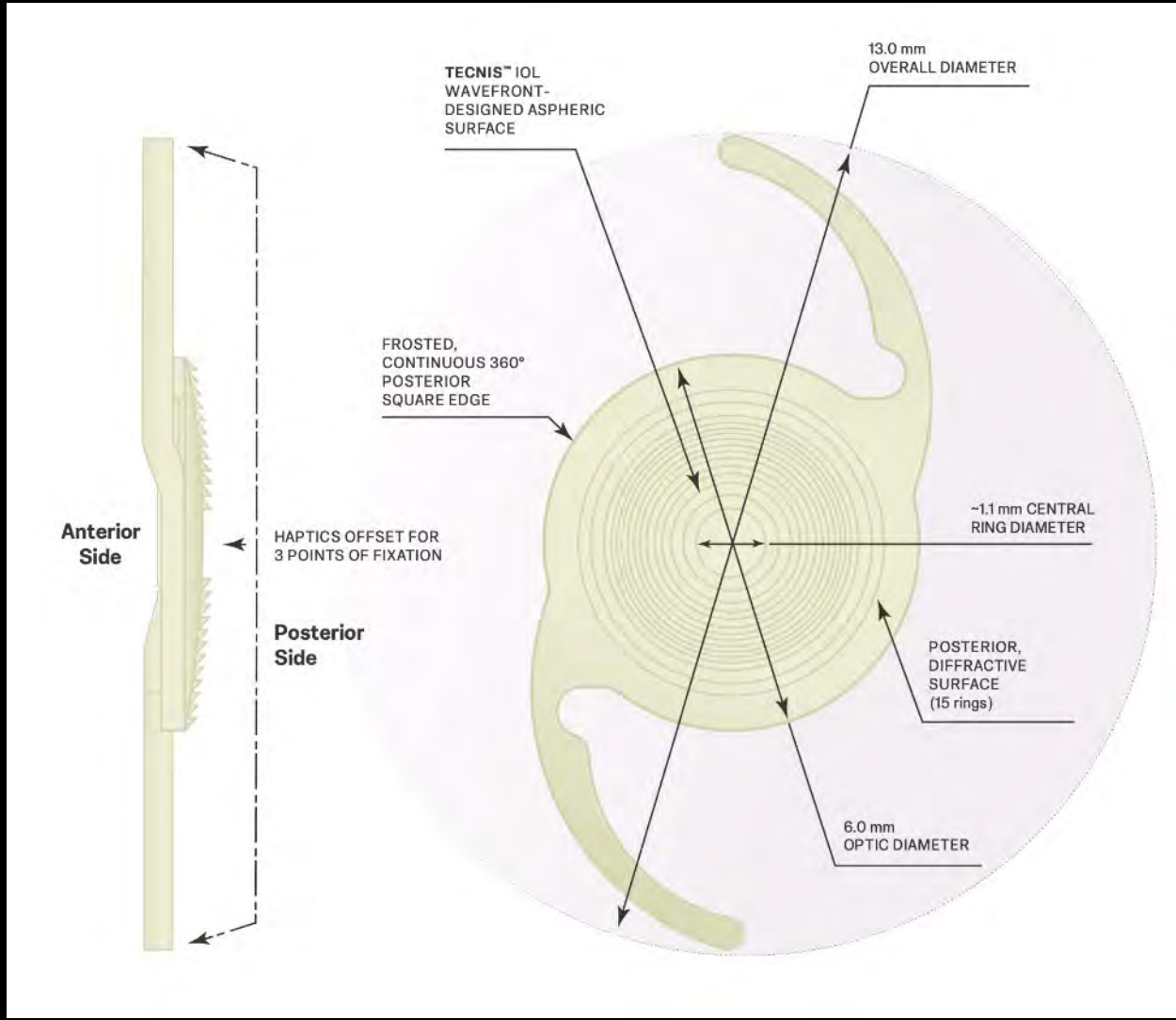
Odyssey Diffractive Multifocal IOL

Aspheric anterior surface
Posterior diffractive surface

"14% smaller print than PanOptix"

93% "no/mild" glare/halo/starbursts

2% "severe" halo



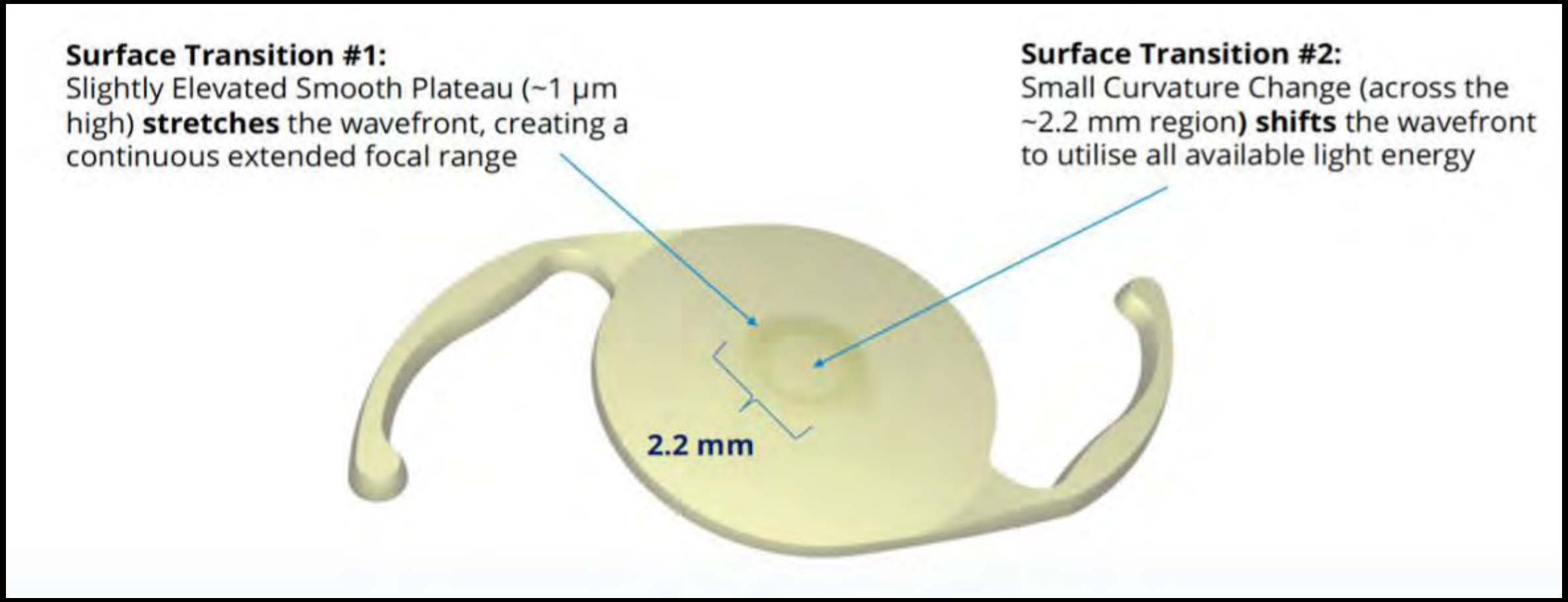
Envy Diffractive Multifocal IOL

- 332 subjects in the US
  - 86% “little to no“ glare, halo or starbursts
    (14% moderate or worse)

- 110 subjects in Canada
  - 94% “little to no” difficulty viewing close objects
  - 93% “completely to moderately satisfied”
    (7% not satisfied)

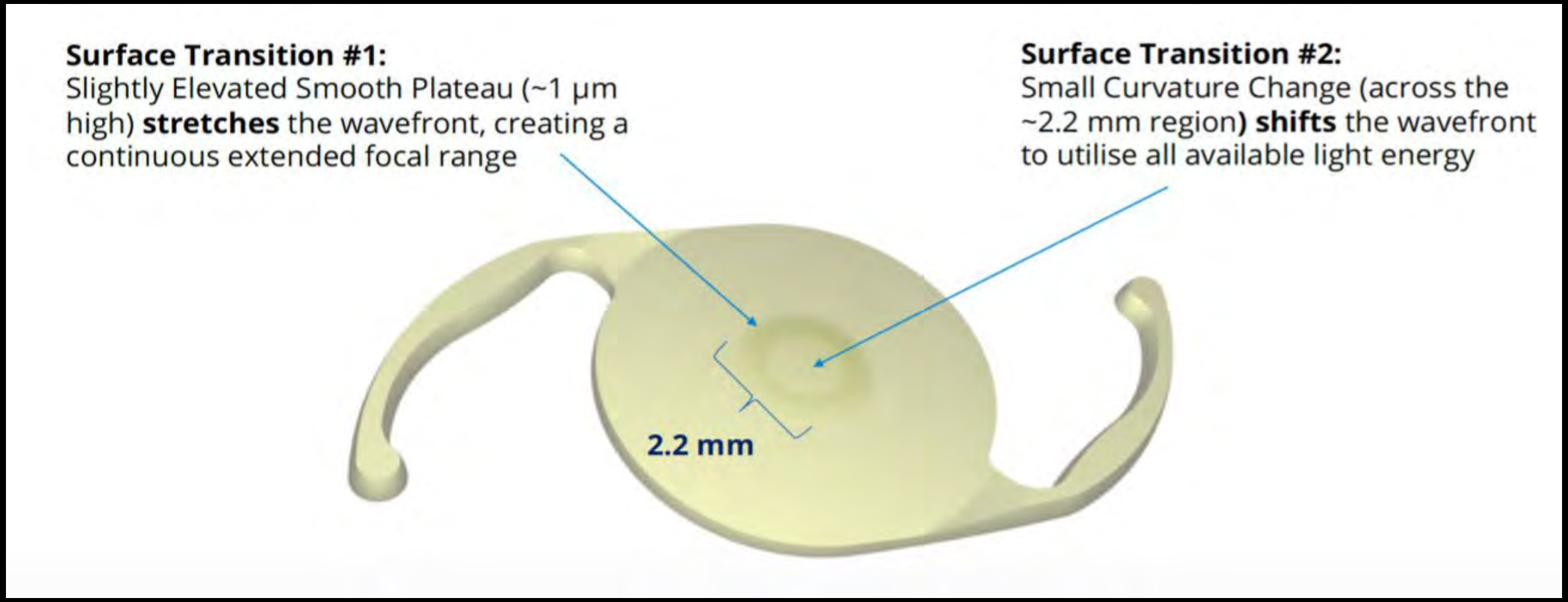
Vivity EDOF Multifocal IOL

- Continuous vision from distance to 26 inches (+1.50)
- Low glare/halos since absence of rings



Vivity EDOF Multifocal IOL

- Curb uncorrected near expectations
- Consider mini-monovision, avoid in low-moderate myopes

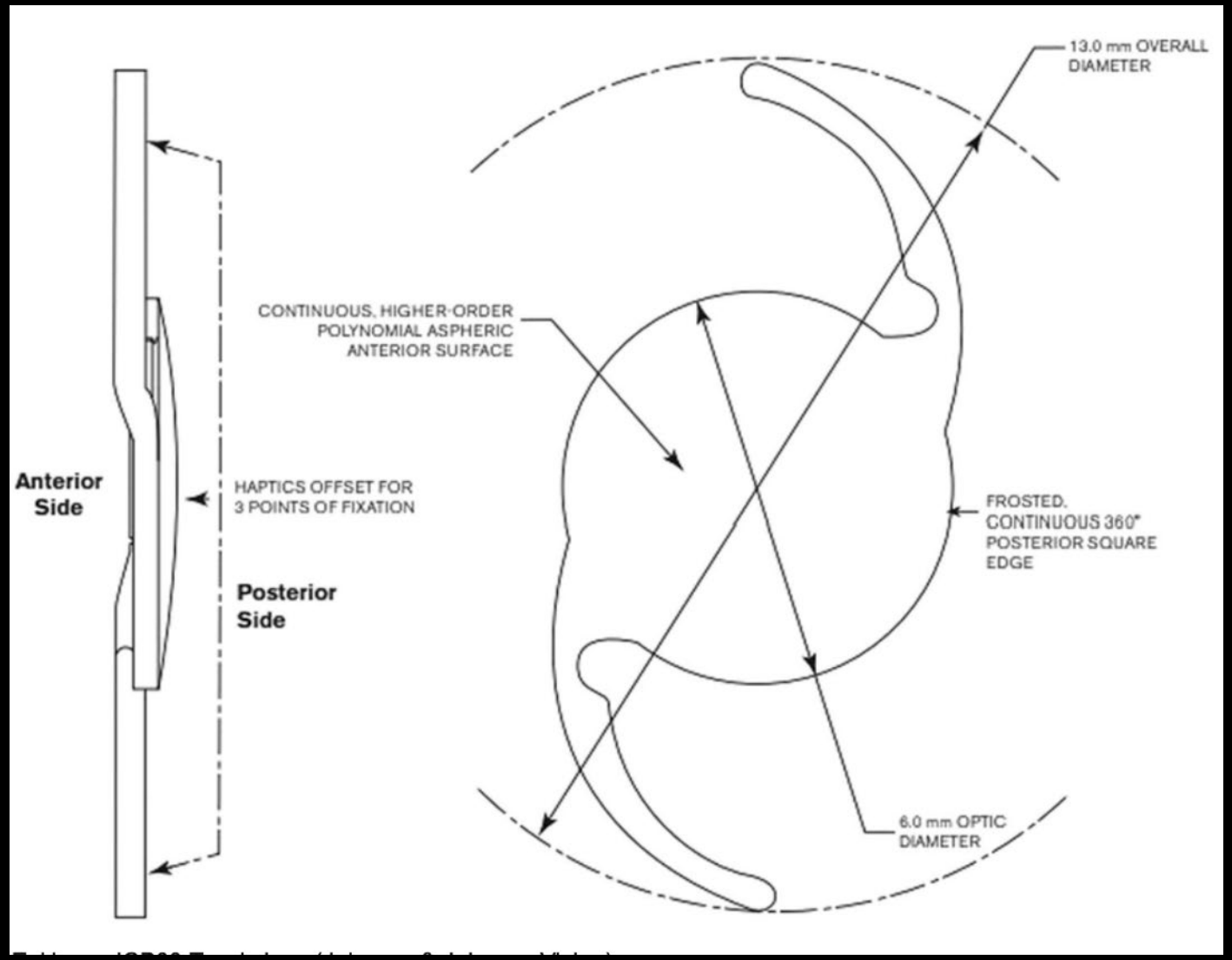


Apthera EDOF Monofocal IOL

- 1st small aperture presbyopia-correcting IOL
  (1.36 mm central aperature)
- Implanted monocularly (-0.75 target)
- “Your preferred monofocal or toric monofocal in the other eye” (distance target)

Eyhance EDOF Monofocal IOL

- Modified anterior aspheric surface
- “Up to 1 D of focus”



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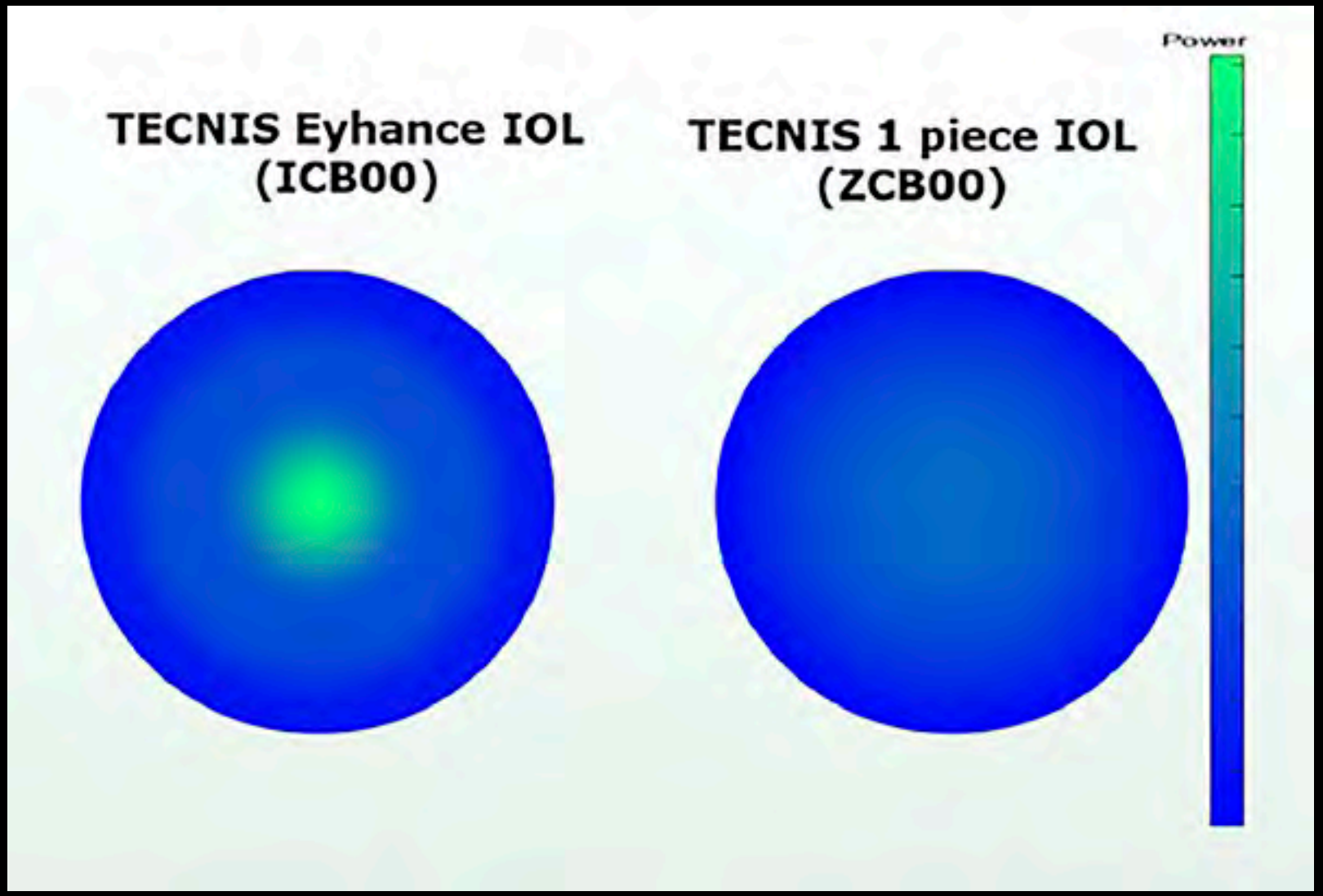
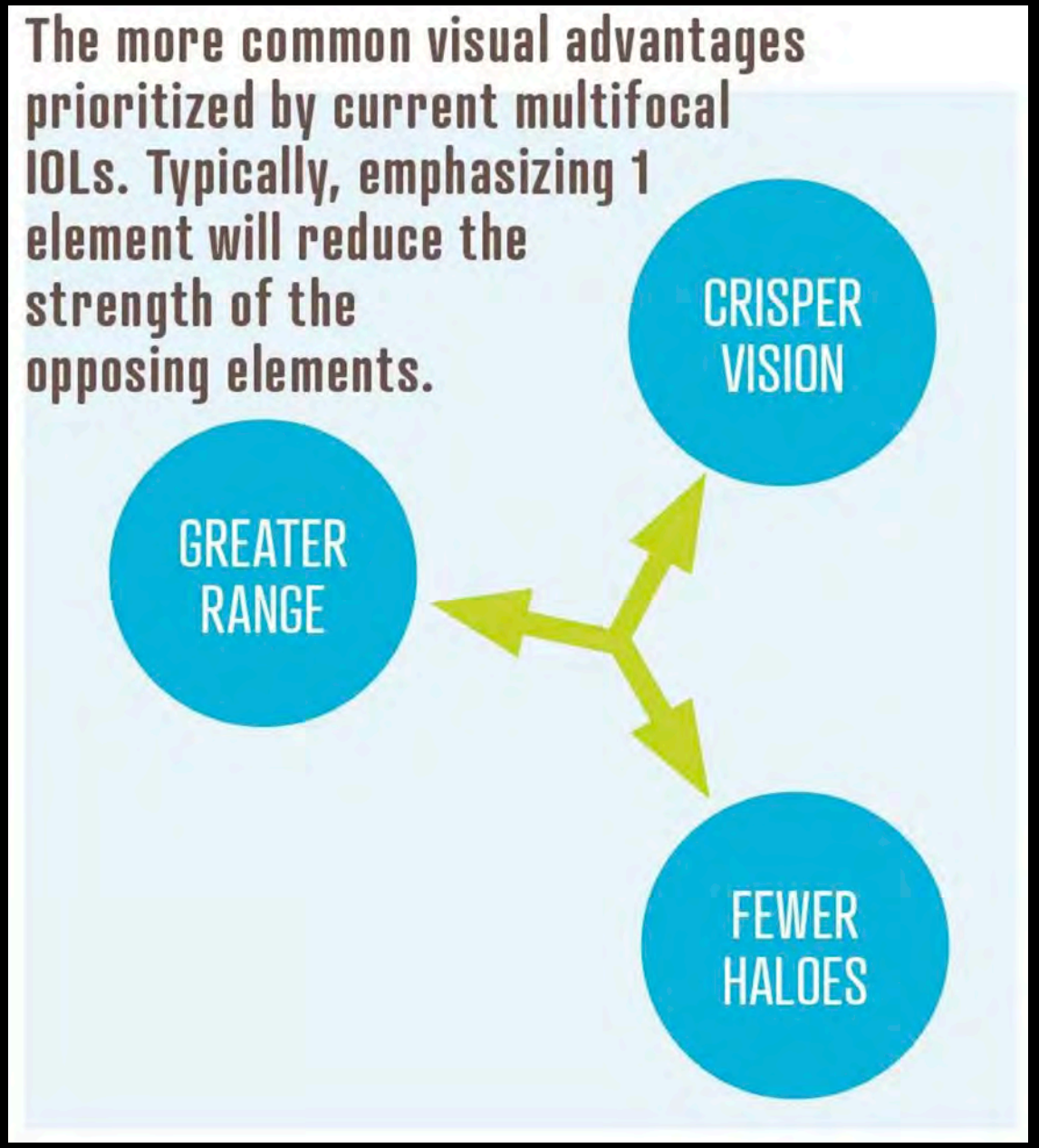


No free lunch in optics

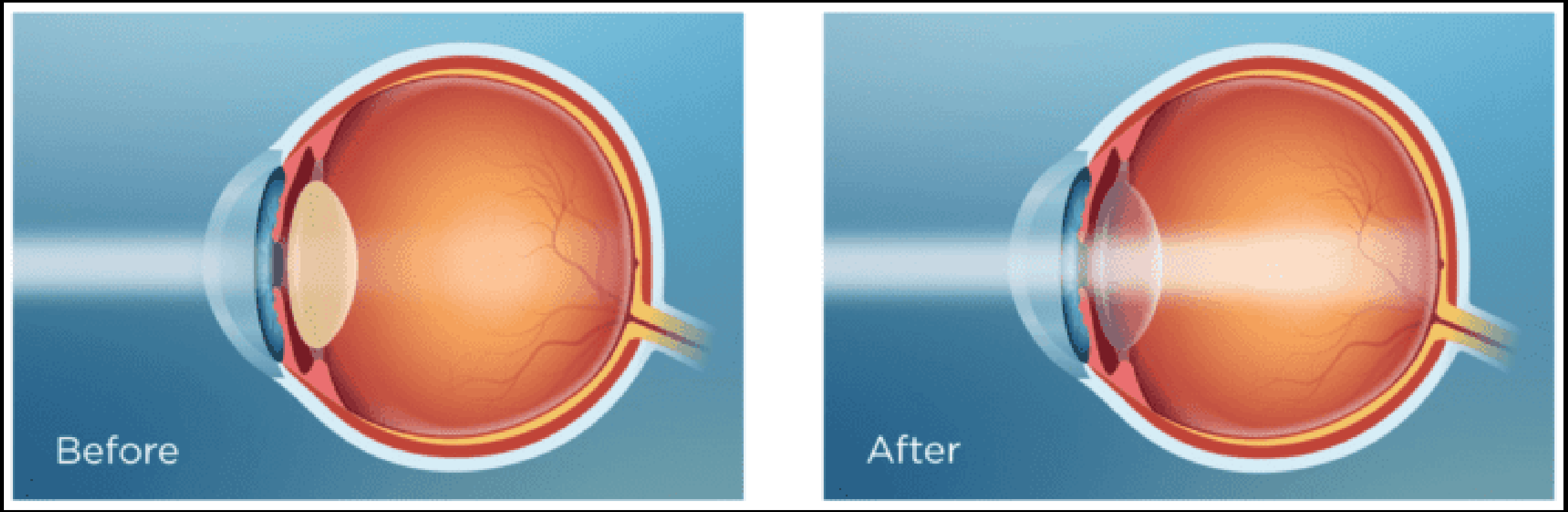
Laws of physics prevent perfect multifocal

Always loss of light to pay with creating different foci

Listen and discuss which IOL strengths are most desirable to each patient personally



All Multifocal IOLs



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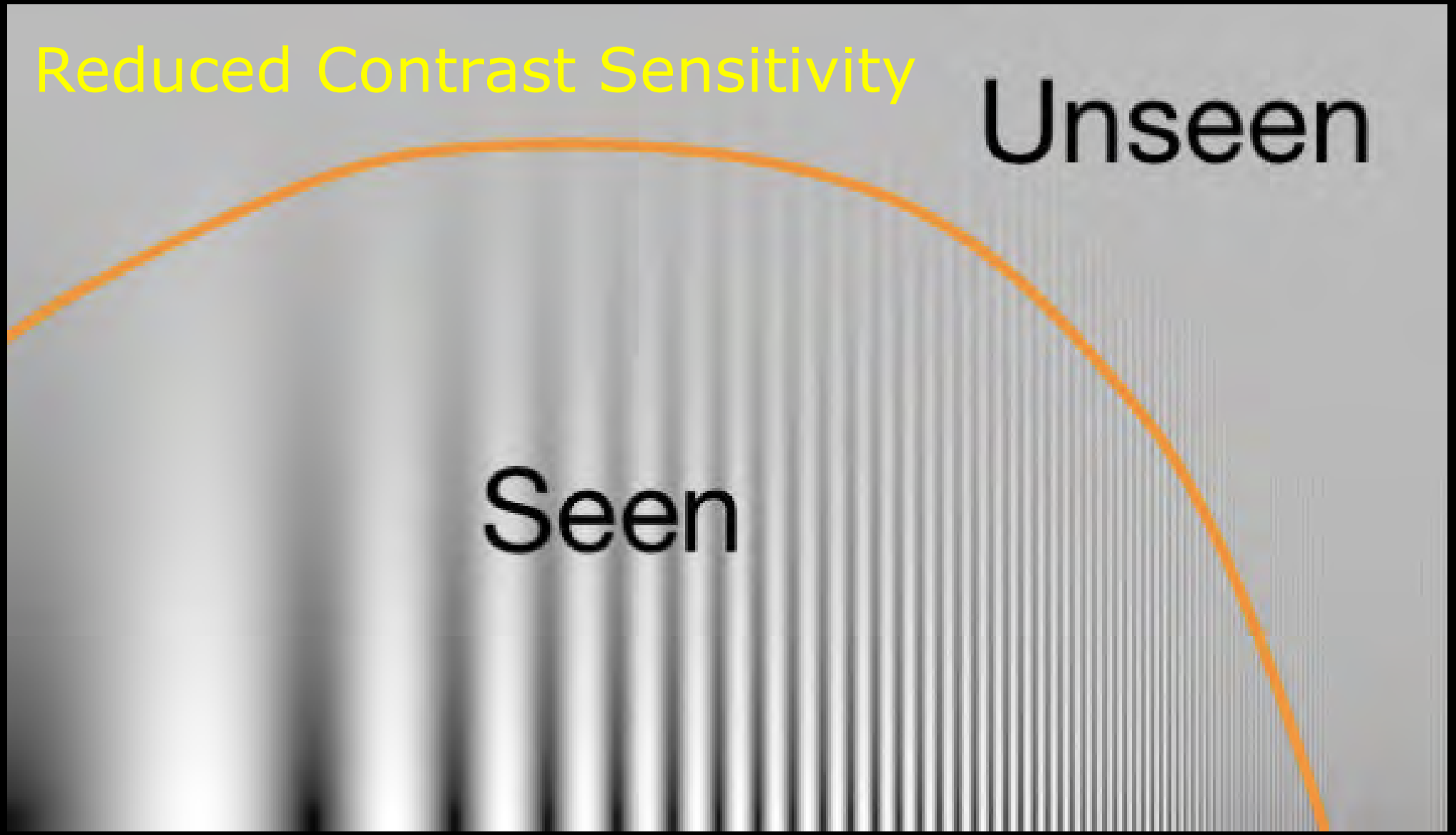
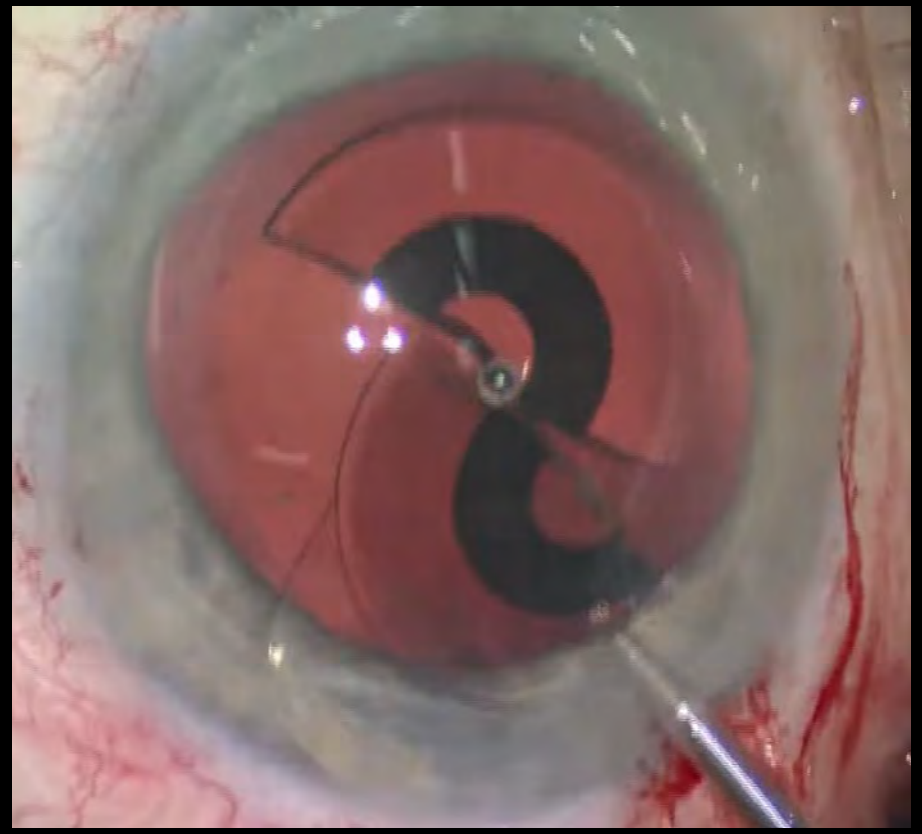


All Multifocal IOLs

Dysphotopsia (glare, halos, starbursts)



LASIK-LIKE RESULTS

Light Treatment After LAL Implantation

Adjustment Beam

Light from LDD directed to LAL

(365 nm)

Photopolymerization

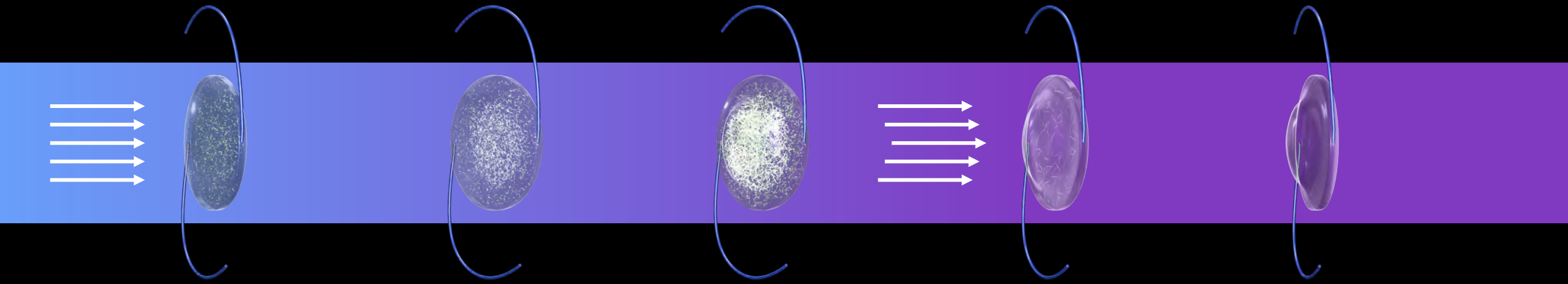
Macromers in light path are photopolymerized

Macromer

Relatively high molecular weight molecule with one end which permits linking together

LASIK-LIKE RESULTS

Light Treatment After LAL Implantation



Adjustment Beam

Light from LDD directed to LAL

(365 nm)

Photopolymerization

Macromers in light path are photopolymerized

Power Change

Unpolymerized macromers move into exposed area

↓

precise shape and power change

Lock-In Beam

Entire lens exposed to light

↓

polymerizing all remaining macromers

Final Result

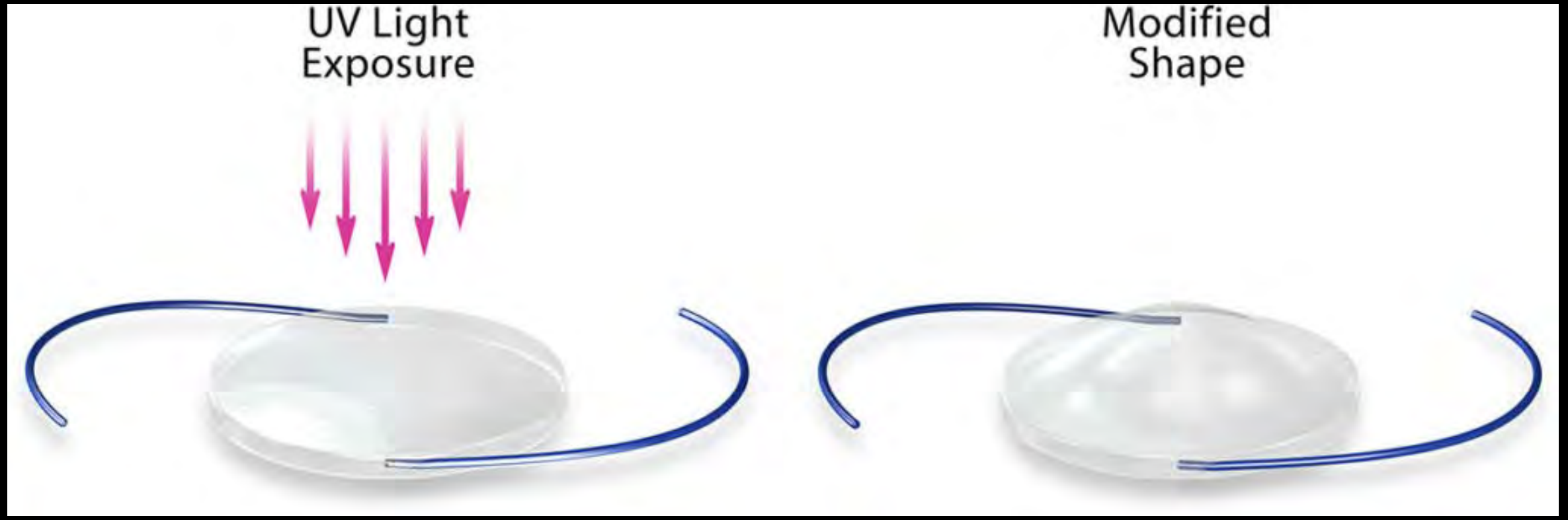
Precise change in LAL power

↓

match individual's desired Rx

LASIK-LIKE RESULTS

Light Treatment After LAL Implantation



Truly Accommodating IOLs

- “Holy Grail” of IOLs = truly accommodating IOL
- Change refractive power by ciliary body contraction (prepresbyopia)

- Current leaders (started human trials)
  - FluidVision (Alcon)
  - Juvene (LensGen, Inc)
  - JelliSee (JelliSee Ophthalmics, Inc)

Truly Accommodating IOLs

- FluidVision (Alcon)
- Fluid inside the lens is moved by ciliary muscle contraction
- Implanted into lens capsule
- 36-month follow-up
  - Excellent visual acuity
  - 3-4 D of accommodative power

Truly Accommodating IOLs

- FluidVision (Alcon)

- Hydrophobic acrylic shell
- Filled with index-matched silicone oil

Near focus = ciliary muscles constrict

↓

Fluid inside the haptics is pushed into the optic

↓

Increased central curvature / power

Truly Accommodating IOLs

- FluidVision (Alcon)

- Hydrophobic acrylic shell
- Filled with index-matched silicone oil

Distance focus = ciliary muscles relax

↓

Fluid moves back from optic into the haptics

↓

Decreased central curvature / power

Truly Accommodating IOLs

- Juvene (LensGen, Inc)

- Curvature-changing liquid filled silicone optic
- Posterior fixed lens which fills the bag

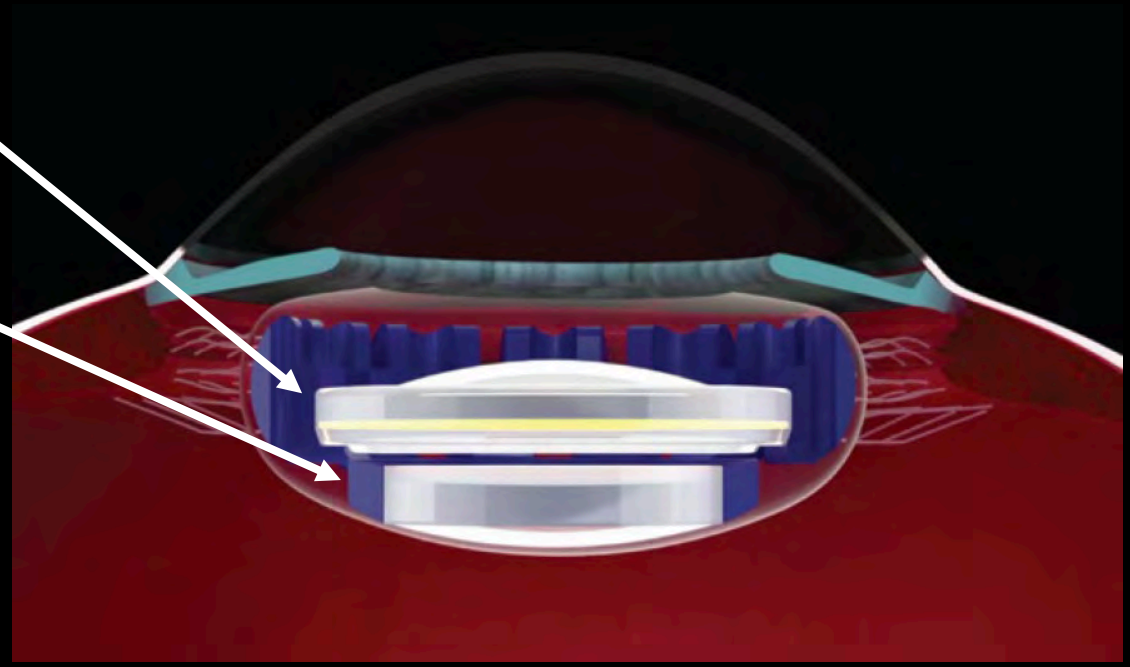
Natural capsular bag forces transfer to base lens

↓

Compresses the anterior fluid-filled lens

↓

Increased central curvature / power



Lens filled entire capsular bag =
more accurate effective lens position

Juvene

Juvene

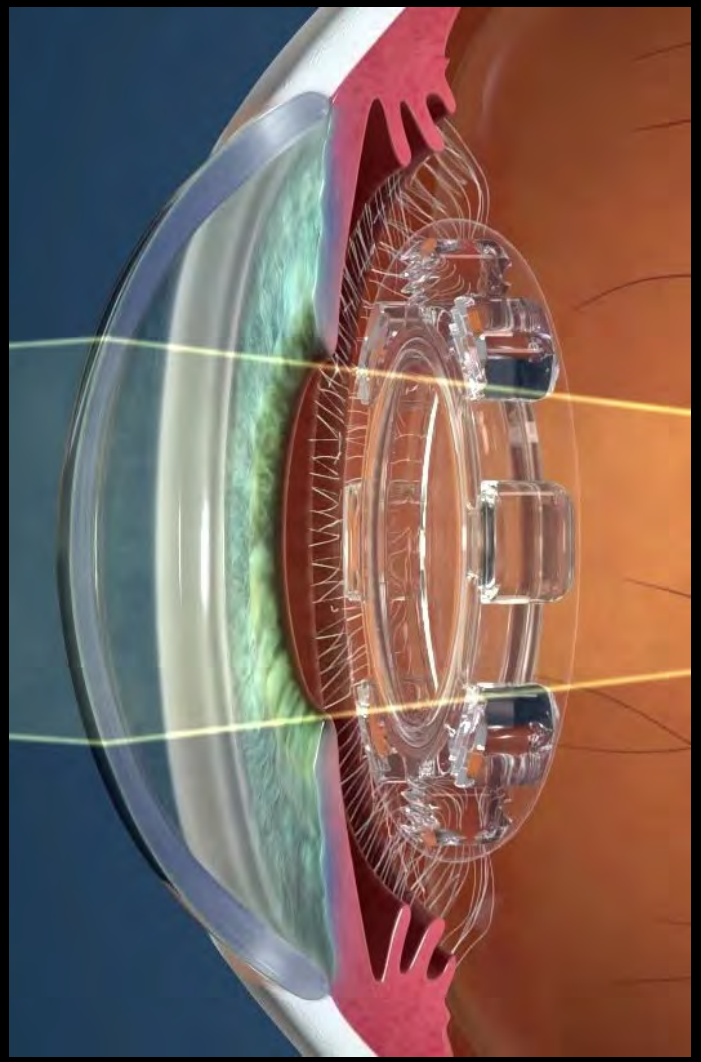
- Juvene (LensGen, Inc)
- Anterior lens held in base by 3 tabs
- Future technology could be placed

Truly Accommodating IOLs

- JelliSee (JelliSee Ophthalmics, Inc)

- Accommodating and astigmatism correcting monofocal IOL
- 7 diopters or more of accommodation
- Requires < 0.2mm diameter change for full range of accommodation
- Foldable

(per their website)



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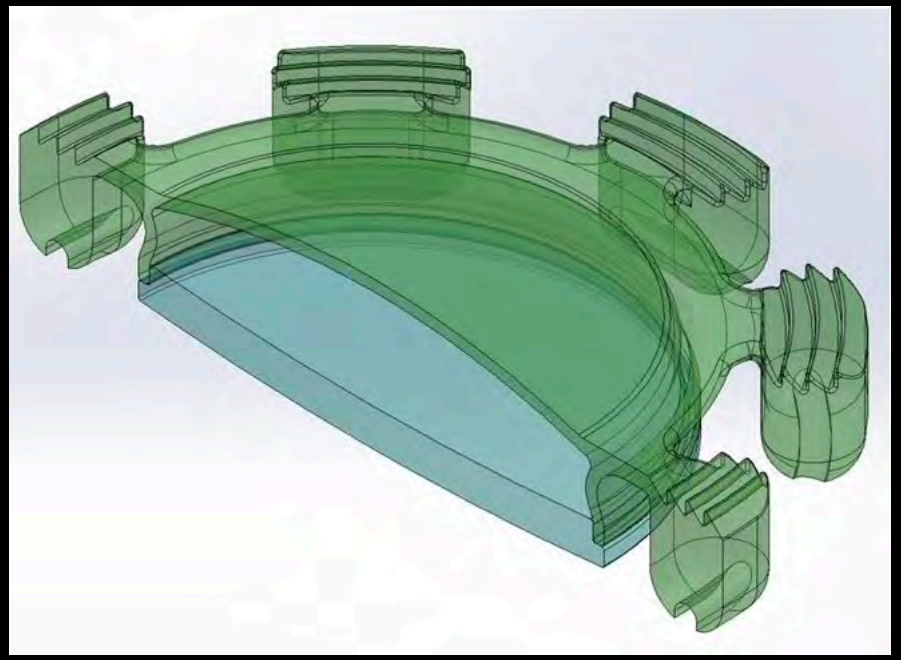
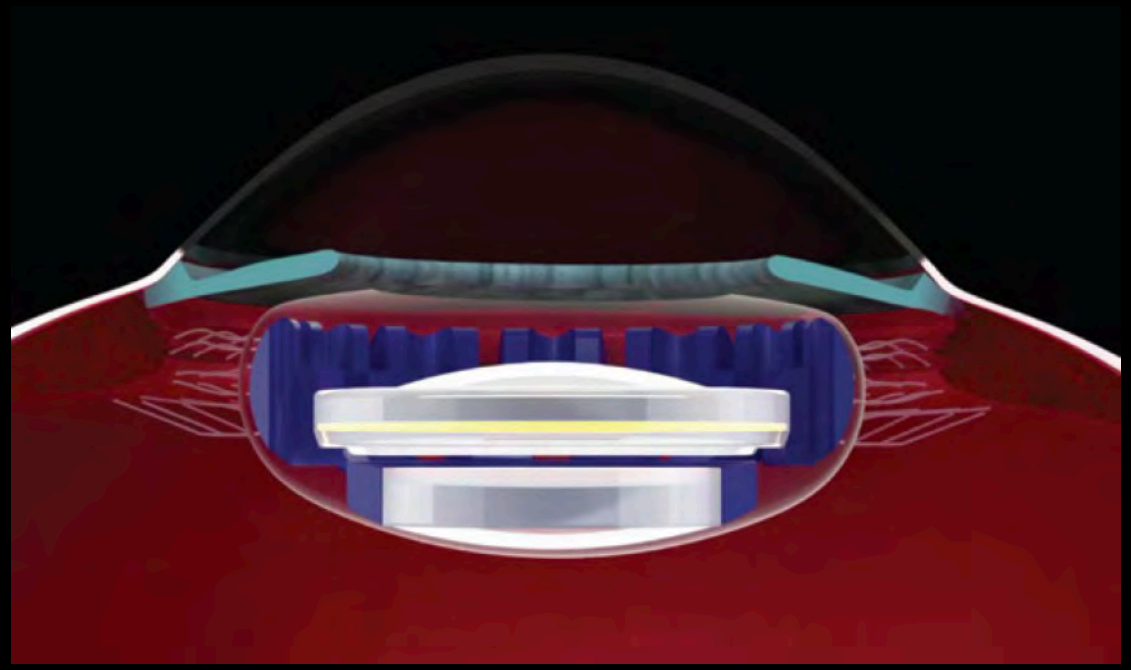
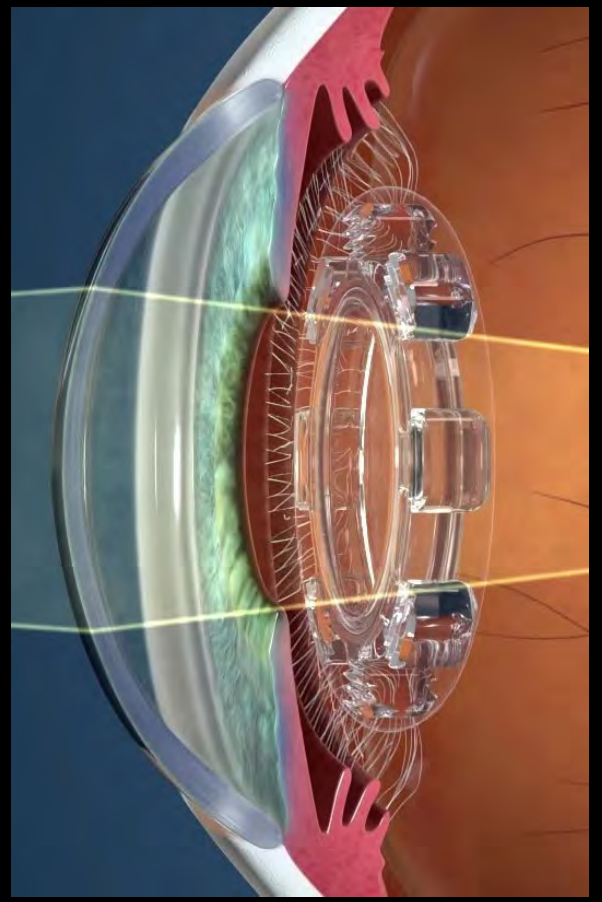


Truly Accommodating IOLs

No “truly accommodating IOL” in human trials … that is adjustable





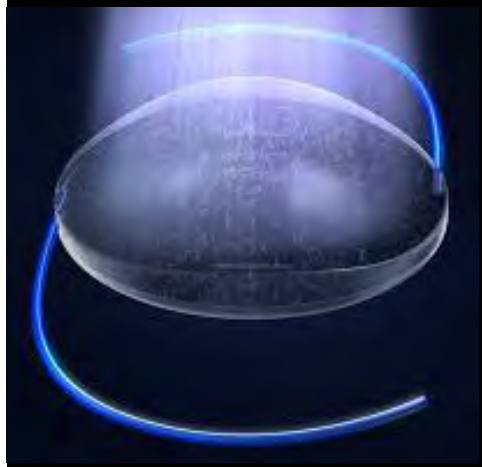
Today's Presbyopic IOL Choices

- 29.7 million cataract surgeries worldwide
- 4.7 million in the US

PanOptix | Odyssey | Vivity | Aphthera | Eyehance | LAL





Diffractive Multifocal IOLs

EDOF IOLs

Today’s Presbyopic IOL Choices

- 29.7 million cataract surgeries worldwide
- 4.7 million in the US

- What lifestyle choices are our patients making?

Today’s Presbyopic IOL Choices

- 29.7 million cataract surgeries worldwide
- 4.7 million in the US

- Incidence of type 2 diabetes

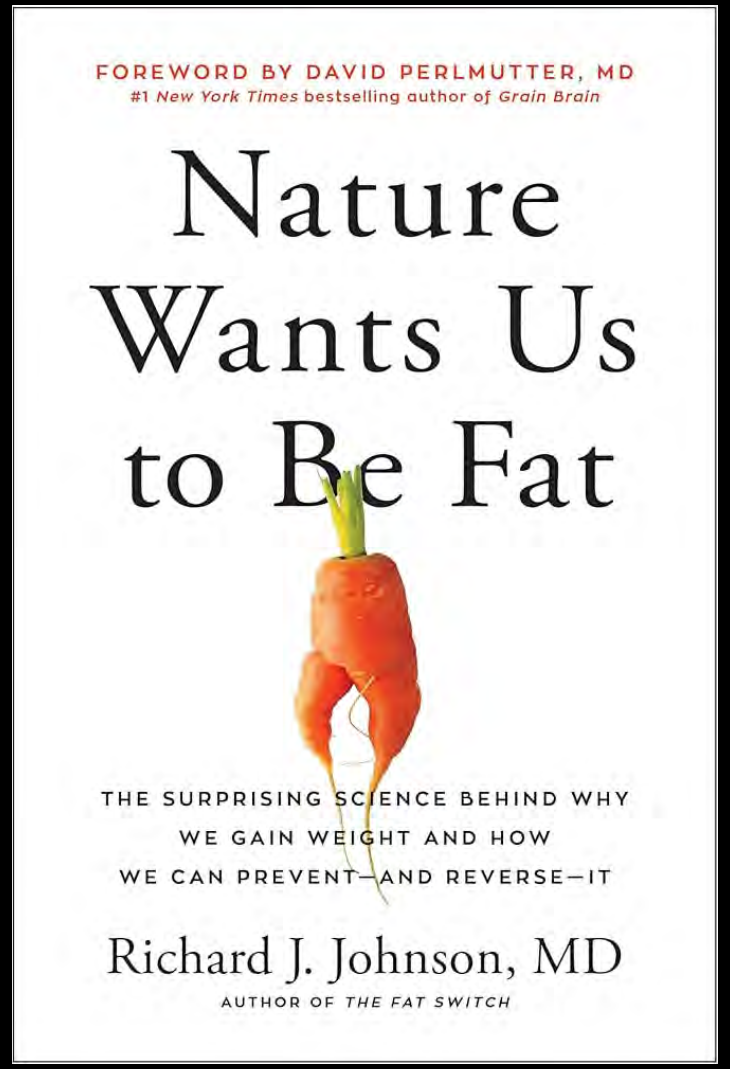
Year	Incidence
1940	1 in 350
1970	1 in 50
Today	1 in 8

Our Insatiable Desire for Food

- Liquid fructose (1970s)
- Fructose/day was 6g (fruits) and today is 33g

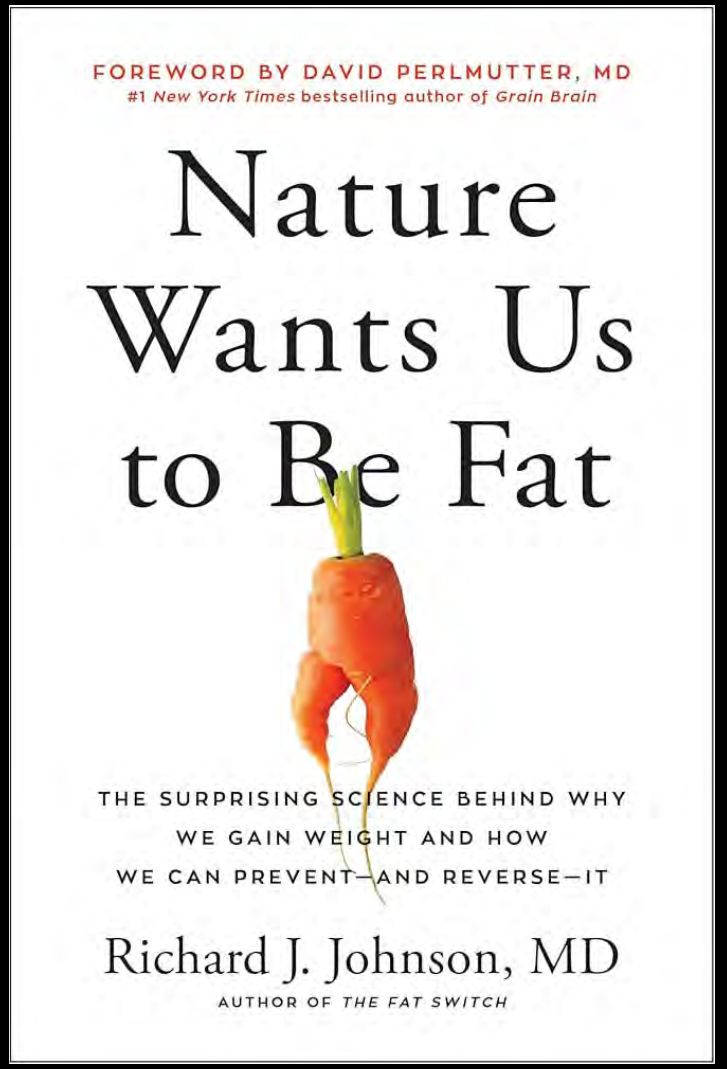
Our Insatiable Desire for Food

- Animals gorge on ripe, fructose-rich fruit in fall
- Food foraging for winter = life or death for animals



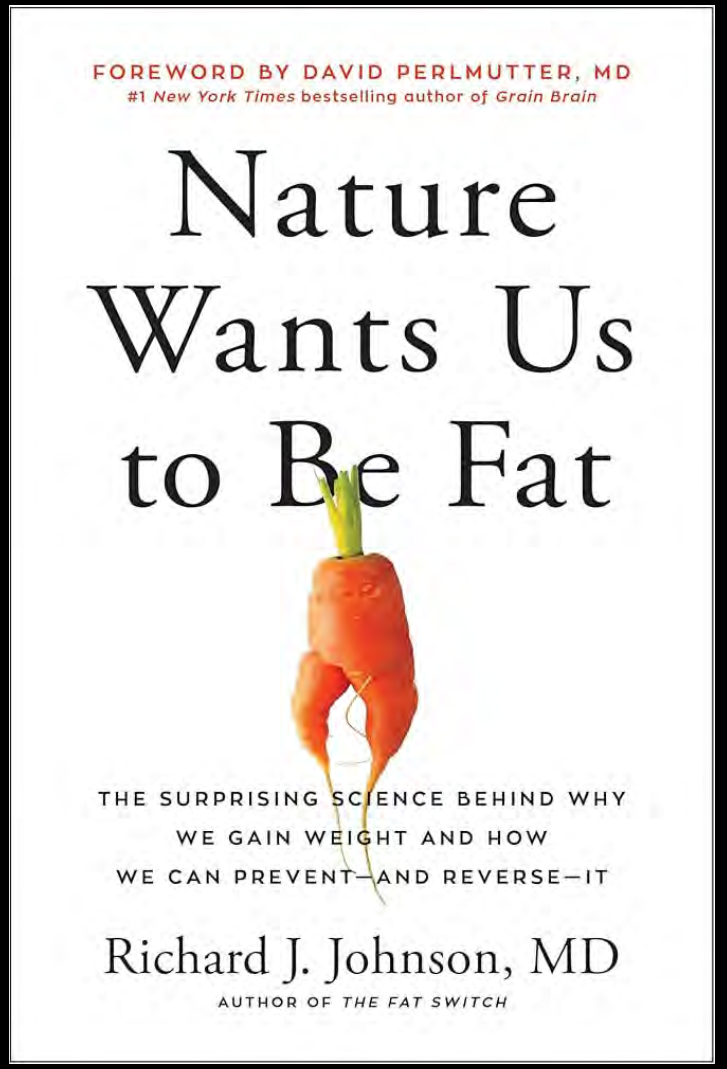
Our Insatiable Desire for Food

- Fructose depletes cellular ATP
- Signals cellular starvation ⟶ intense appetite
  food-seeking behaviors



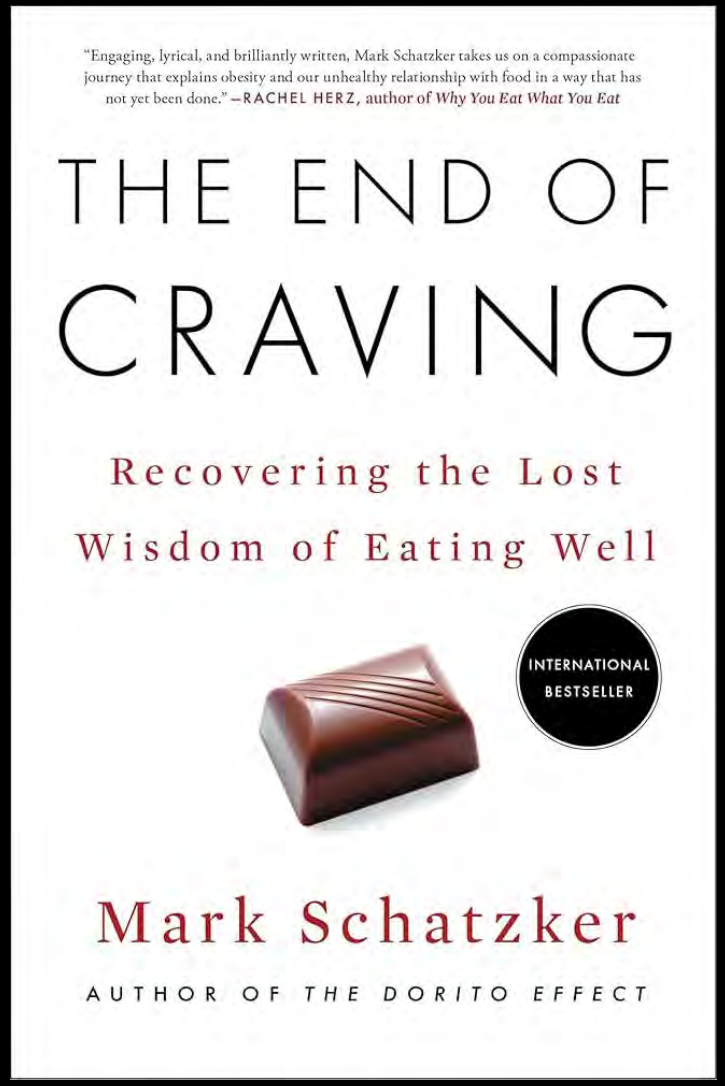
Our Insatiable Desire for Food

- Our survival switch has been used against us
- We are now aggressive food-seeking addicts preparing for a hibernation that never comes



Our Insatiable Desire for Food

- Ultraprocessed foods convince us to eat more
  - Unique feature called “variable reward”
  - Create an insatiable desire for more food
  - Nutritional gamble, unsure of the outcome, rendering us to keep seeking and eating



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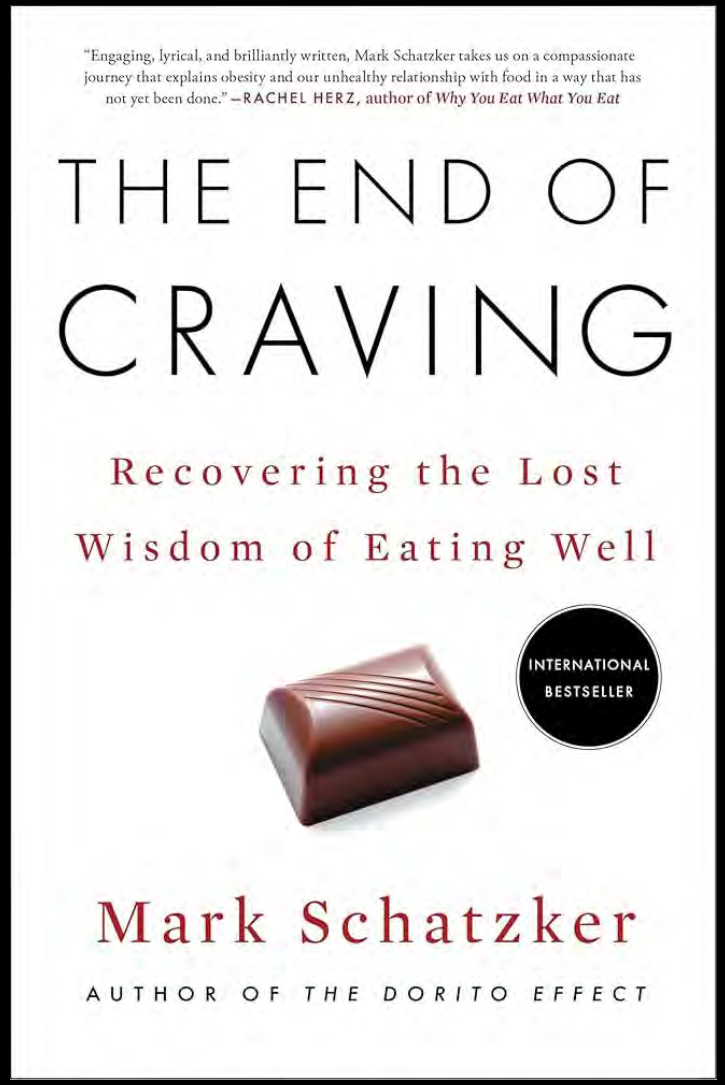


Our Insatiable Desire for Food

- *Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain*
  20 adults unable to leave NIH research facility (Cell, Kevin Hall, 2021)
- First 2 weeks: Unlimited ultra-processed foods

Our Insatiable Desire for Food

- *Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain*
  20 adults unable to leave NIH research facility (Cell, Kevin Hall, 2021)
- First 2 weeks: Unlimited ultra-processed foods
  - Cheerios, croissants, Yoplait yogurt, blueberry muffins, margarine, packaged beef ravioli, diet lemonade, oatmeal raisin cookies, white break, store-bought gravy, canned corn, low-fat chocolate milk, deli turkey, tortillas, Heinz pickle relish/ketchup, Hellmann's mayonnaise, shortbread cookies, Fig Newtons, orange juice, Tater Tots, French fries, cheese-burgers with American cheese, turkey bacon, English muffins, chicken nuggets, hoagie rolls, crackers, hot dogs, burritos, tortilla chips

Our Insatiable Desire for Food

- *Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain*
  20 adults unable to leave NIH research facility (Cell, Kevin Hall, 2021)
- Second 2 weeks: Unlimited unprocessed foods

Our Insatiable Desire for Food

- *Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain*
  20 adults unable to leave NIH research facility (Cell, Kevin Hall, 2021)
- Second 2 weeks: Unlimited unprocessed foods
  - Shrimp, salmon, chicken breast, beef roast, fresh egg scrambles and omelets, steamed and roasted vegetables, rice, nuts, fruits, oatmeal with berries and raw almonds, salads with chicken, apples, homemade dressing, sweet potato hash, bakes sweet potatoes, unsweetened Greek yogurt with fruit

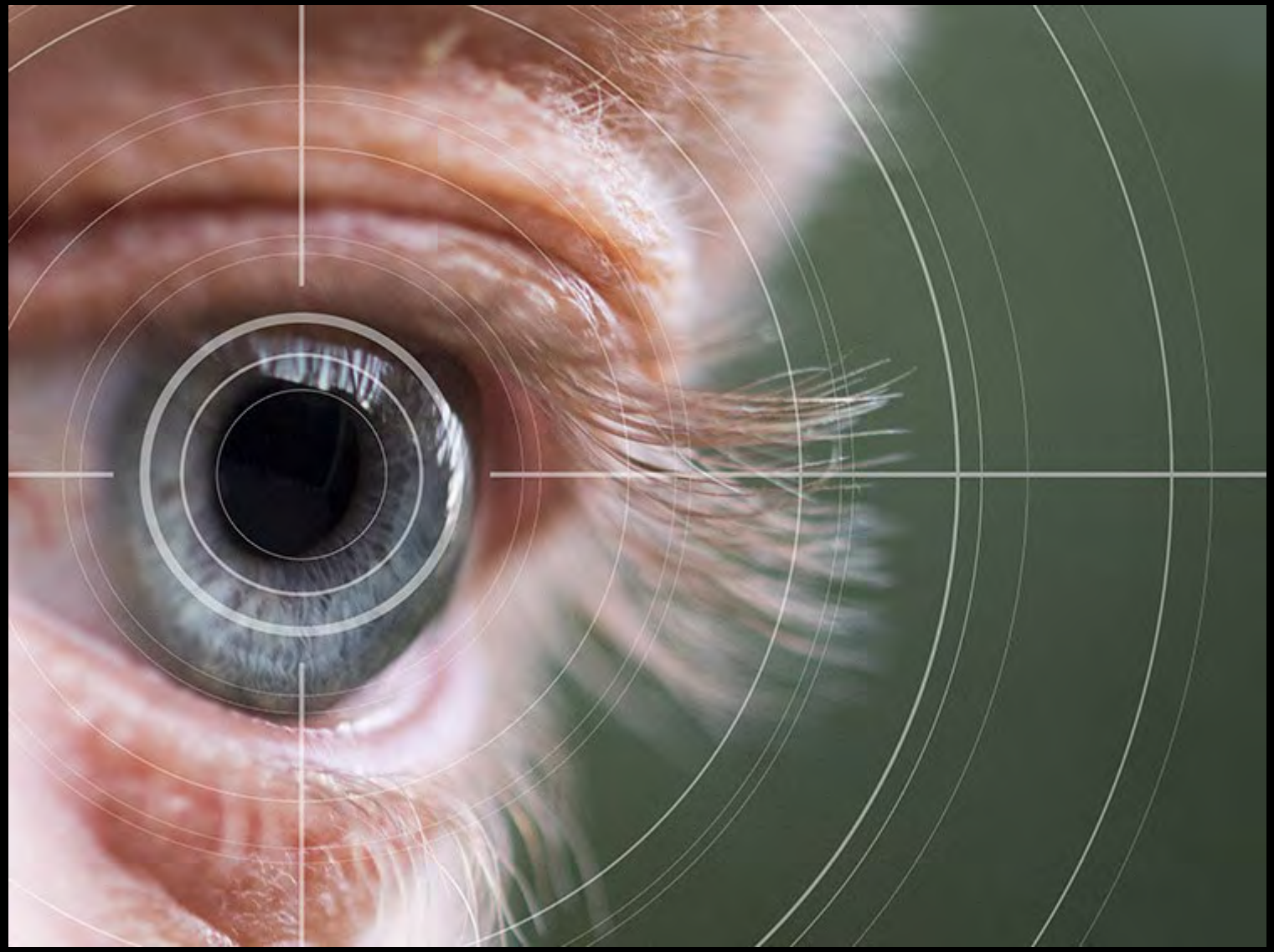
Our Insatiable Desire for Food

- *Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain*

Gained 2 pounds on average
500 more cal/day (7000 calories in 2 wks)

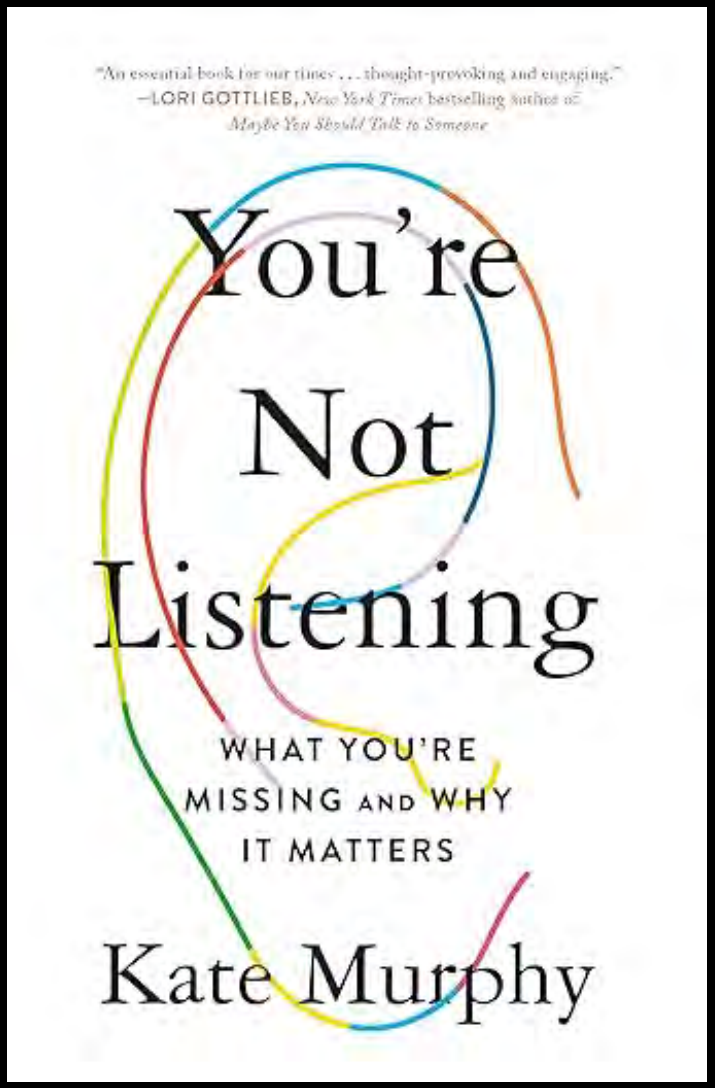
Lost 2 pounds on average

Choosing the Best Presbyopia IOL



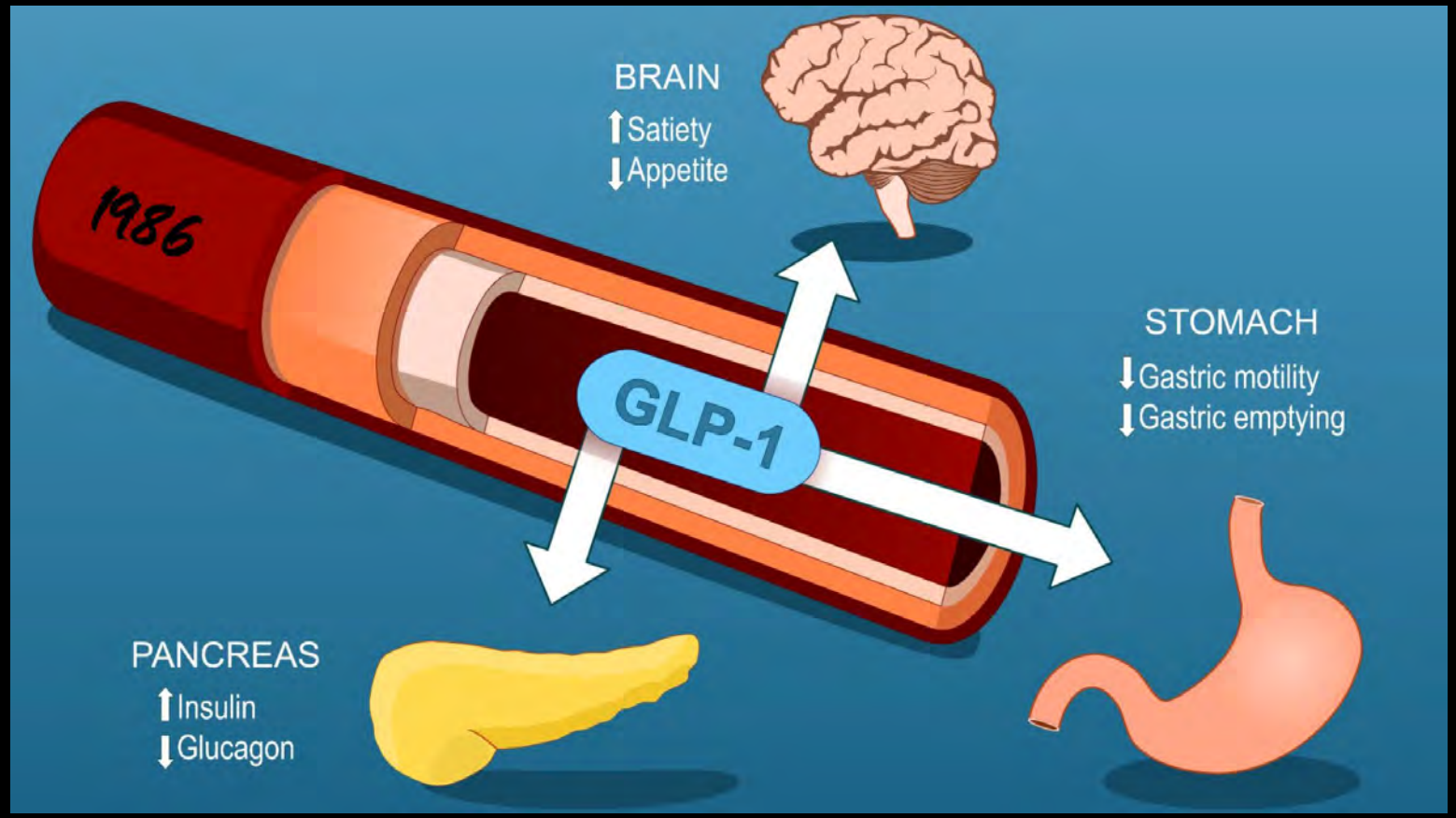
Choosing the Best Presbyopia IOL

- Active, engaged listener with each patient
- Pay attention to verbal / non-verbal cues



Choosing the Best Presbyopia IOL

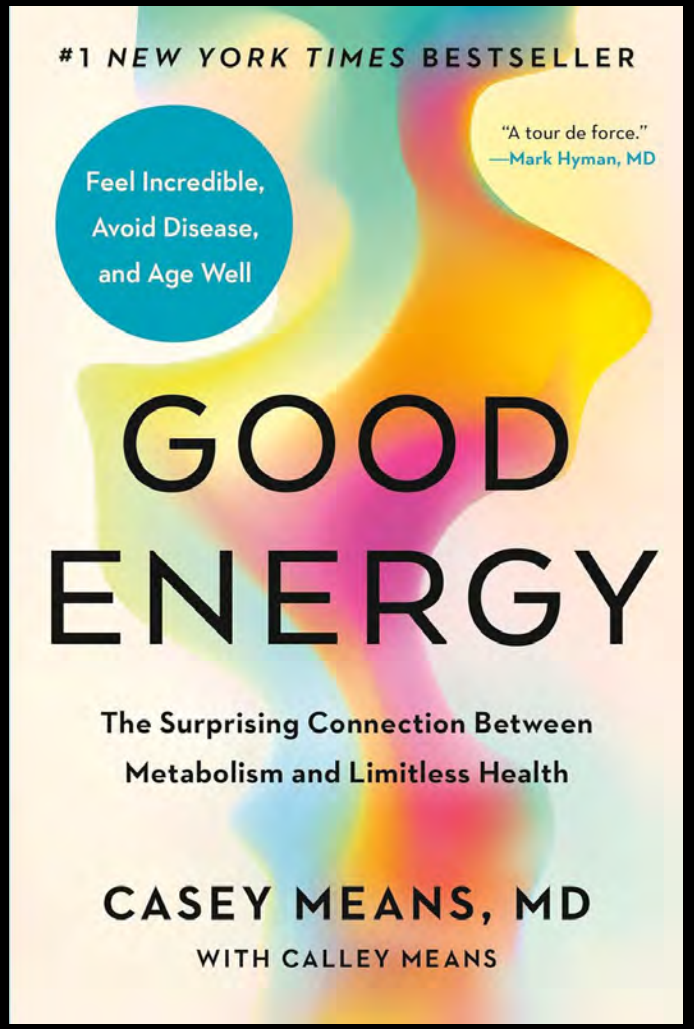
- US: 60% of adult, 67% of childhood calories = ultra-processed foods
- "Aggressive food-seeking addicts" → 1 in 8 incidence of type 2 DM



Choosing the Best Presbyopia IOL

- 20 million Americans work in the food industry

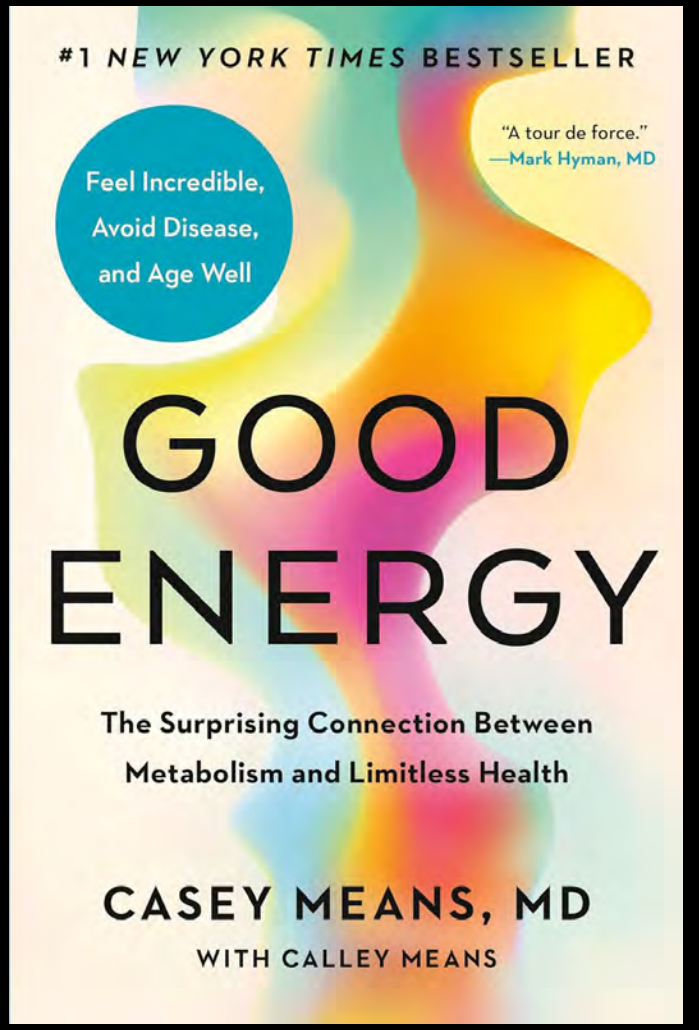
Your cravings → Their livelihood



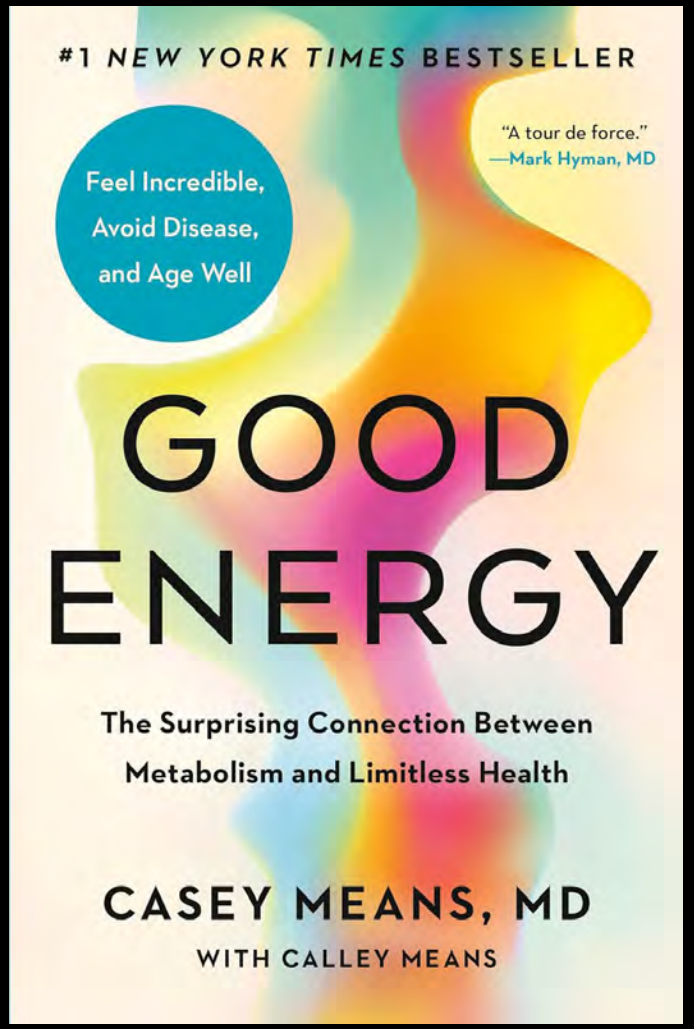
Choosing the Best Presbyopia IOL

- We each consume 70 metric tons of food in lifetime
- Avg distance US produce travels farm to plate = 1500+ miles

- Monocropping, tilling, pesticides = today's fruits and vegetables ~ 40% fewer minerals and vitamins than 70 years ago



Choosing the Best Presbyopia IOL



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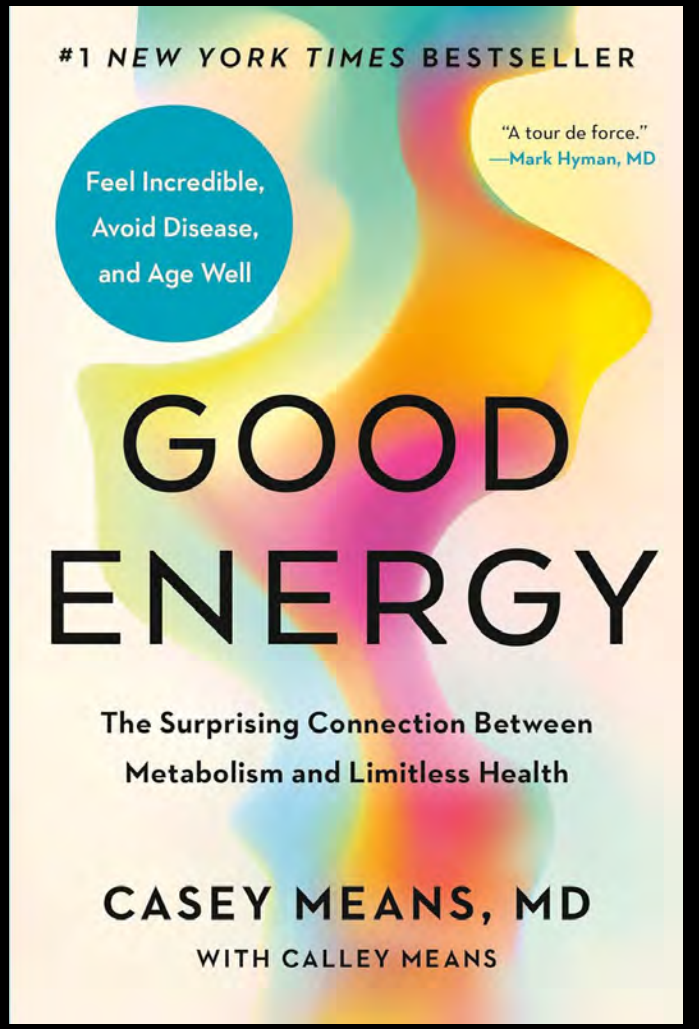
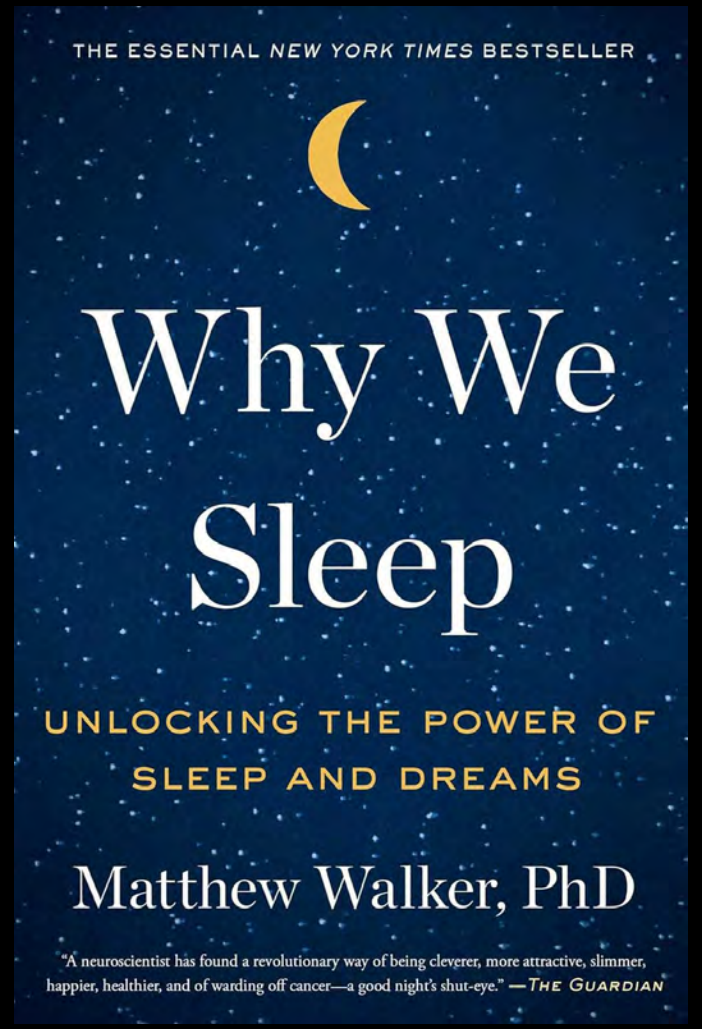


Choosing the Best Presbyopia IOL Set Your Patients Up for Success

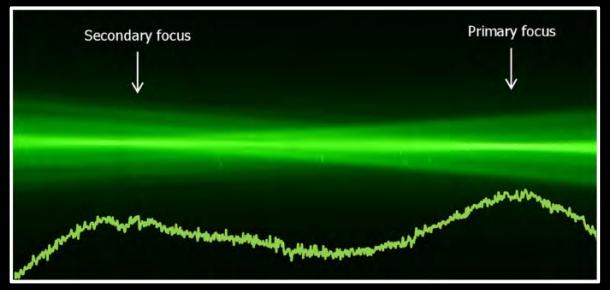
- Consistent sleep duration (aiming for 7-9 hours)
- Avoid screens before bed (blue light disruption)
- Maintain a regular sleep schedule
- Manage stress to promote relaxation
- Exercise regularly (not too close to bedtime)
- Optimizing sleep environment (65 degrees, dark, no pets)

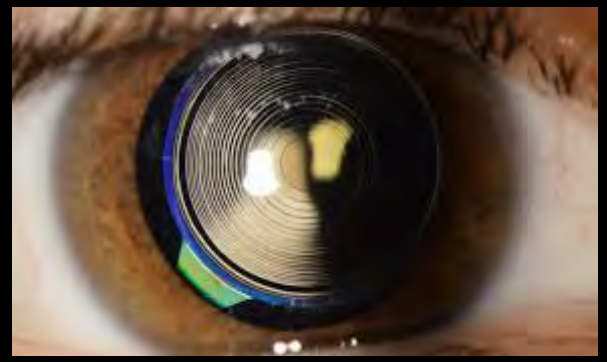


Choosing the Best Presbyopia IOL
Set Your Patients Up for Success

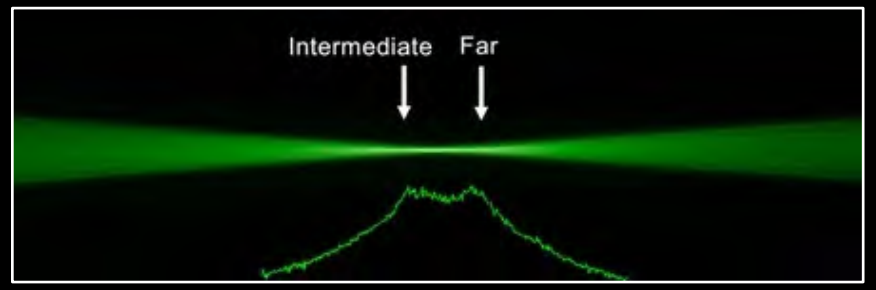
- Variable reward of ultra-processed food → increasing rates DM2
- Most patients likely best served by IOLs that keep 100% light on retina

Multifocal

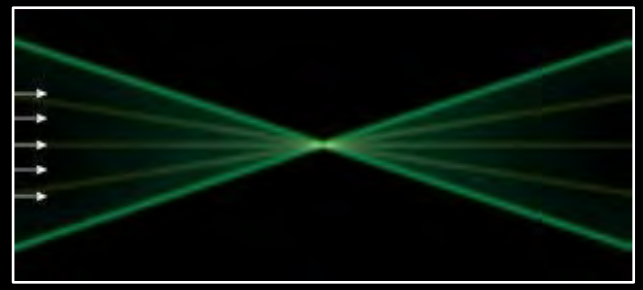


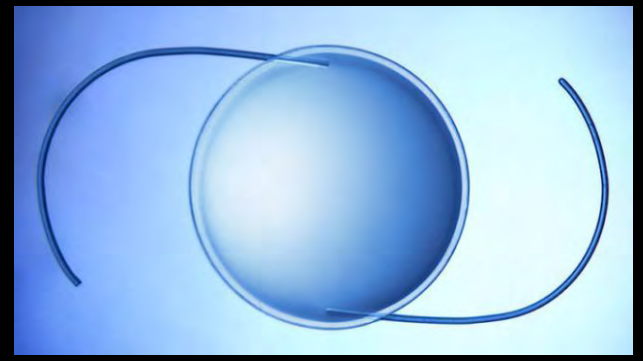


EDOF



LAL





The Future is Bright … But Also a Balance

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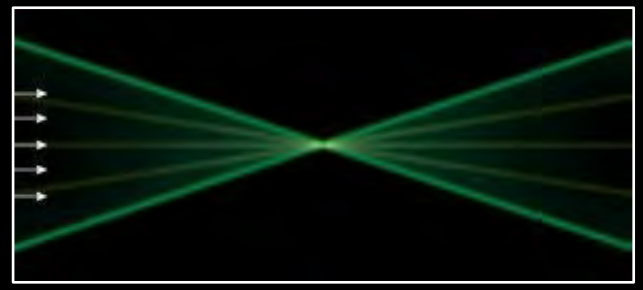
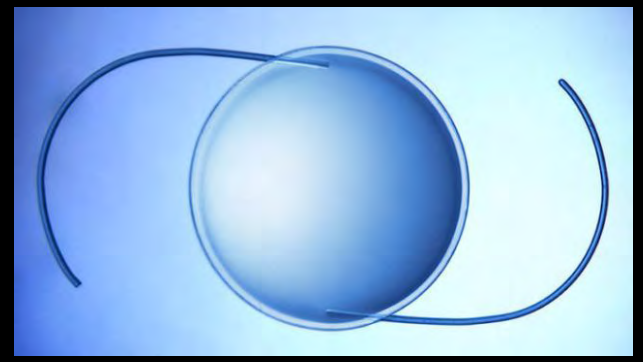
LAL





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