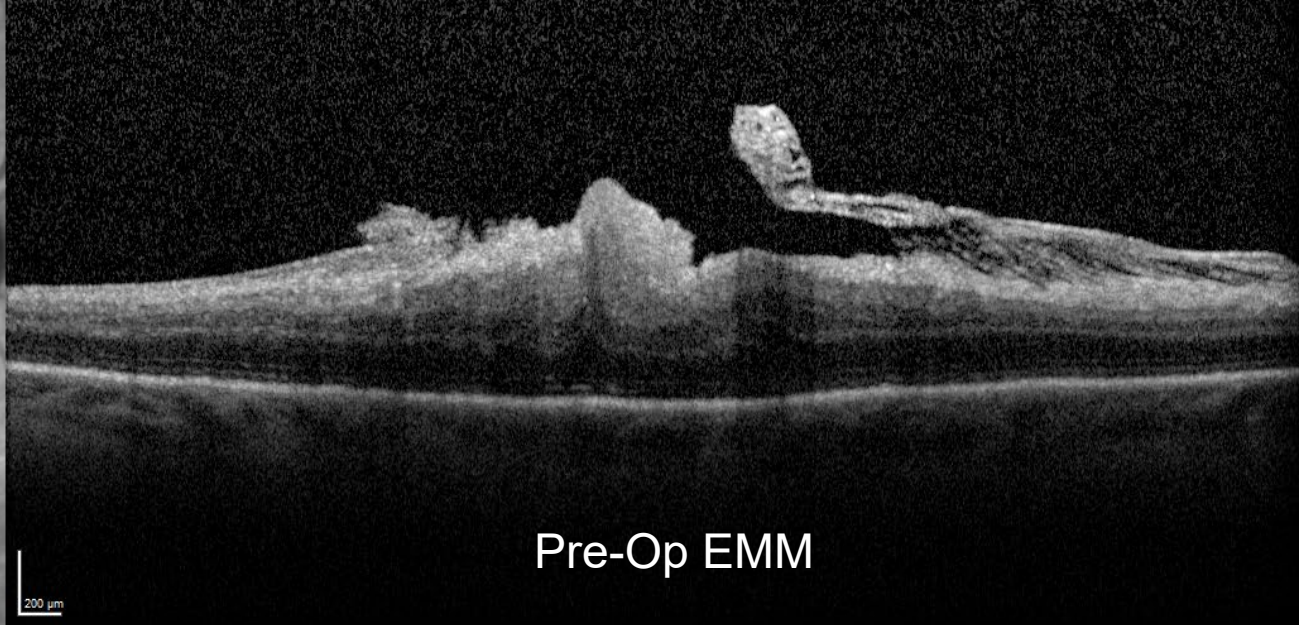
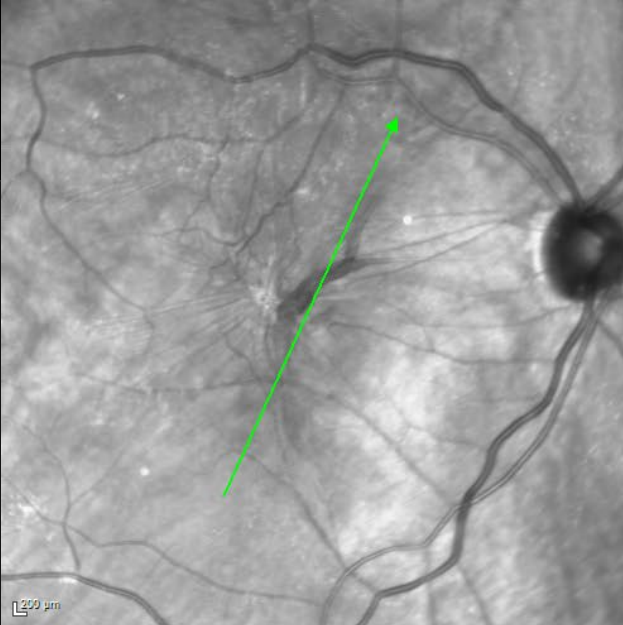


Vitreomacular Surgery

steve charles

Financial Disclosures

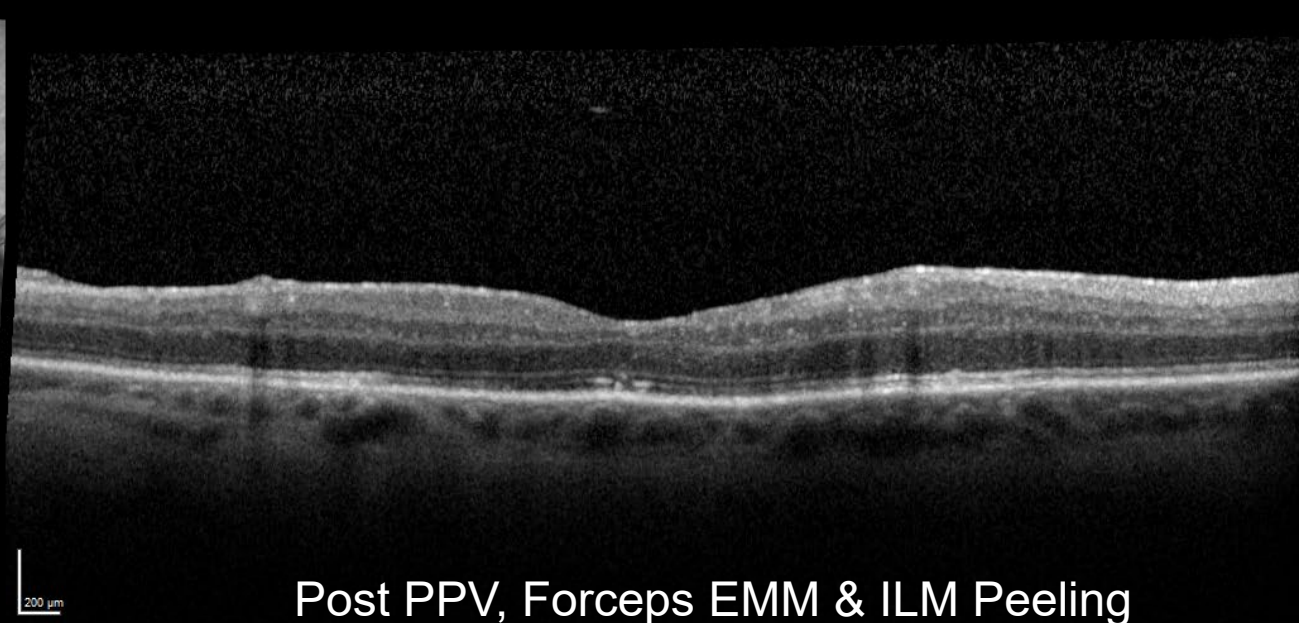
- ◉ Consulting Fee: Alcon Laboratories



Pre-Op EMM

12/8/2011, OD

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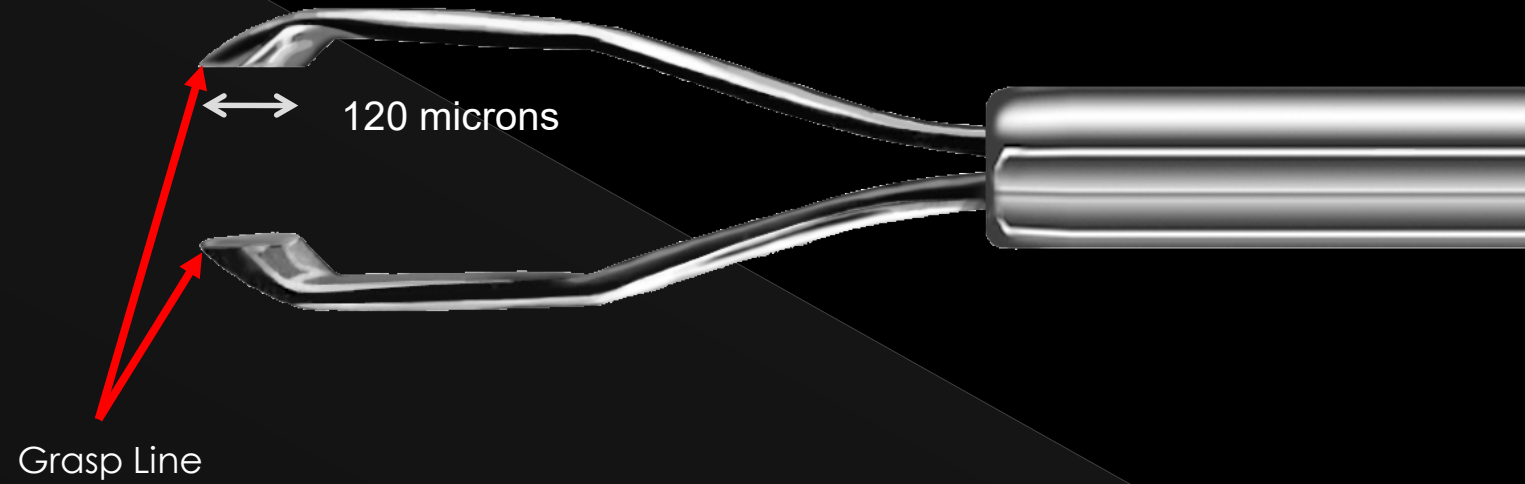
Post PPV, Forceps EMM & ILM Peeling

1/9/2012, OD

IR&OCT 30° IHR| ART(8) Q: 32

My Current EMM Technique

- ◉ 25/27 Gauge, Trans-Conjunctival, Sutureless PPV
- ◉ Inside-Out, End-Grasping Forceps Peeling w/
Alcon 25G End-Grasping DSP ILM Forceps



25G End-Grasping DSP ILM Forceps

Benefits of End-Grasping Forceps Peeling

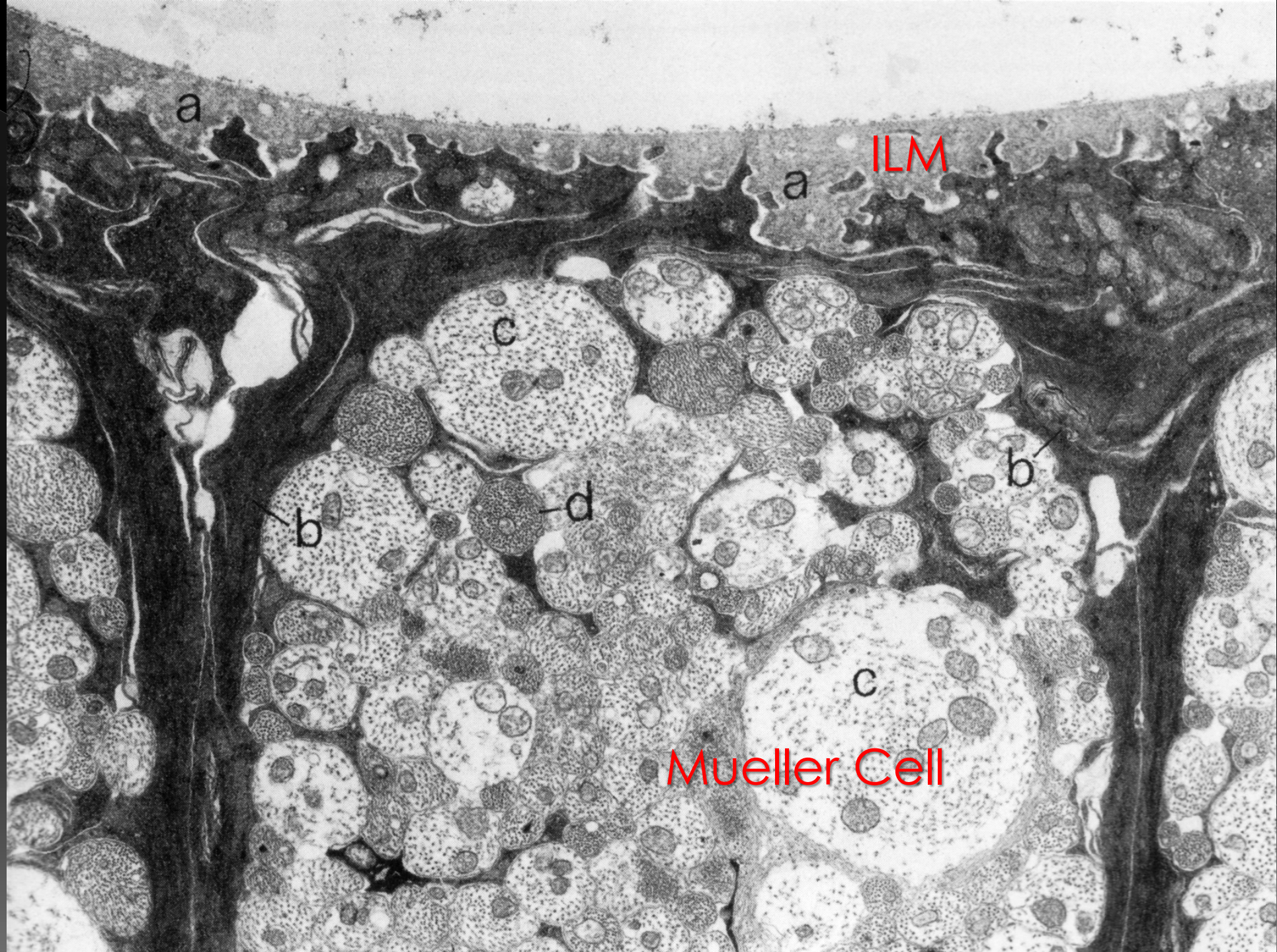
- ◉ Pics, Bent MVR Blades, & Forceps with One Blade Under ERM Are Based on the Outdated Concept of Finding or Creating an “Edge” Which Often Damages the Retinal Surface
- ◉ Inside-Out, End-Grasping Forceps Membrane Peeling is Safer, One-Step Procedure, Eliminates All Other Tools

Indications for ILM Peeling

- ◉ All Lamellar and Full Thickness Macular Holes
- ◉ All Epimacular Membranes
- ◉ All Vitreomacular Schisis
- ◉ All Vitreomacular Traction including DME
- ◉ Many Diabetic TRDs
- ◉ Many PVR
- ◉ Hypotony Maculopathy (Jeroni Nadal et al)
- ◉ Iatrogenic macular folds after FAX w/or simultaneous internal drainage of SRF during PPV for RRD

Advantages of ILM Peeling

- ◉ Reduces Recurrence Rates (Anselm Kampnik)
- ◉ Intraoperatively Eliminates Striae, Hastens Visual Recovery and Eliminates Metamorphopsia, Except for Stiles Crawford Effect Which Takes 18 months
- ◉ Guarantees Complete Removal of Epiretinal Membrane and/or Residual Posterior Vitreous Cortex



ILM Staining

- ◉ ICG Toxicity is a Significant Issue
- ◉ Brilliant Blue is the Only Safe, Effective ILM Staining Agent (Maia, Farah et al, Kampik et al)
 - › BBG is Off Label in US, It Must be Obtained from Compounding Pharmacy, BBG is Approved as Brilliant Peel in Europe

Advantages of Brilliant Blue

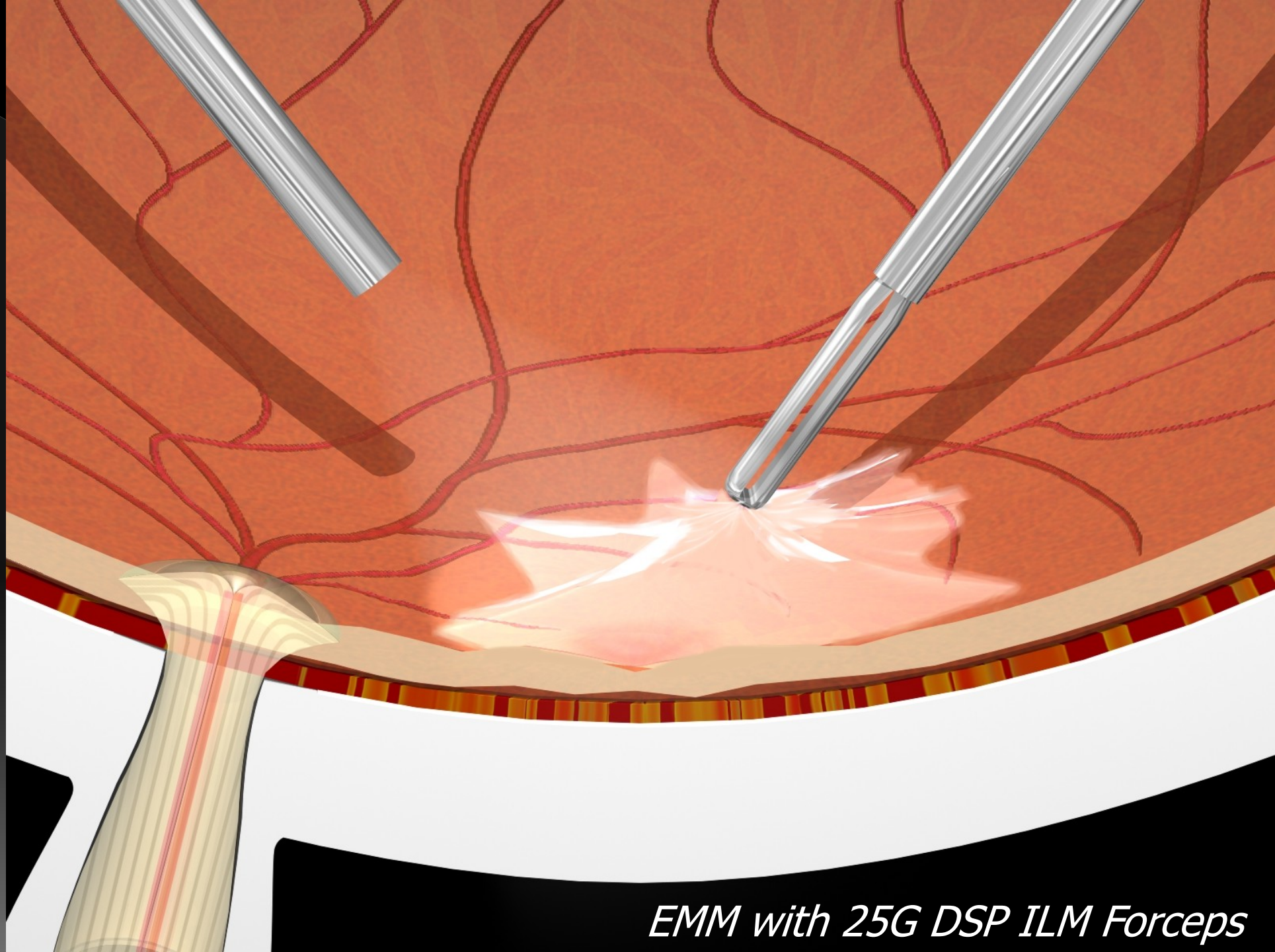
- ◉ Dissolved in BSS, not H₂O like ICG
- ◉ Not Fluorescent So Less Risk of Phototoxicity
- ◉ Stable pH and Osmolarity
- ◉ No Need to Infuse Under Air
- ◉ Can Repeat, 1st ERM then ILM
- ◉ Brilliant Blue is Off Label in the US, approved in Europe

Optimal Viewing for Macular Surgery

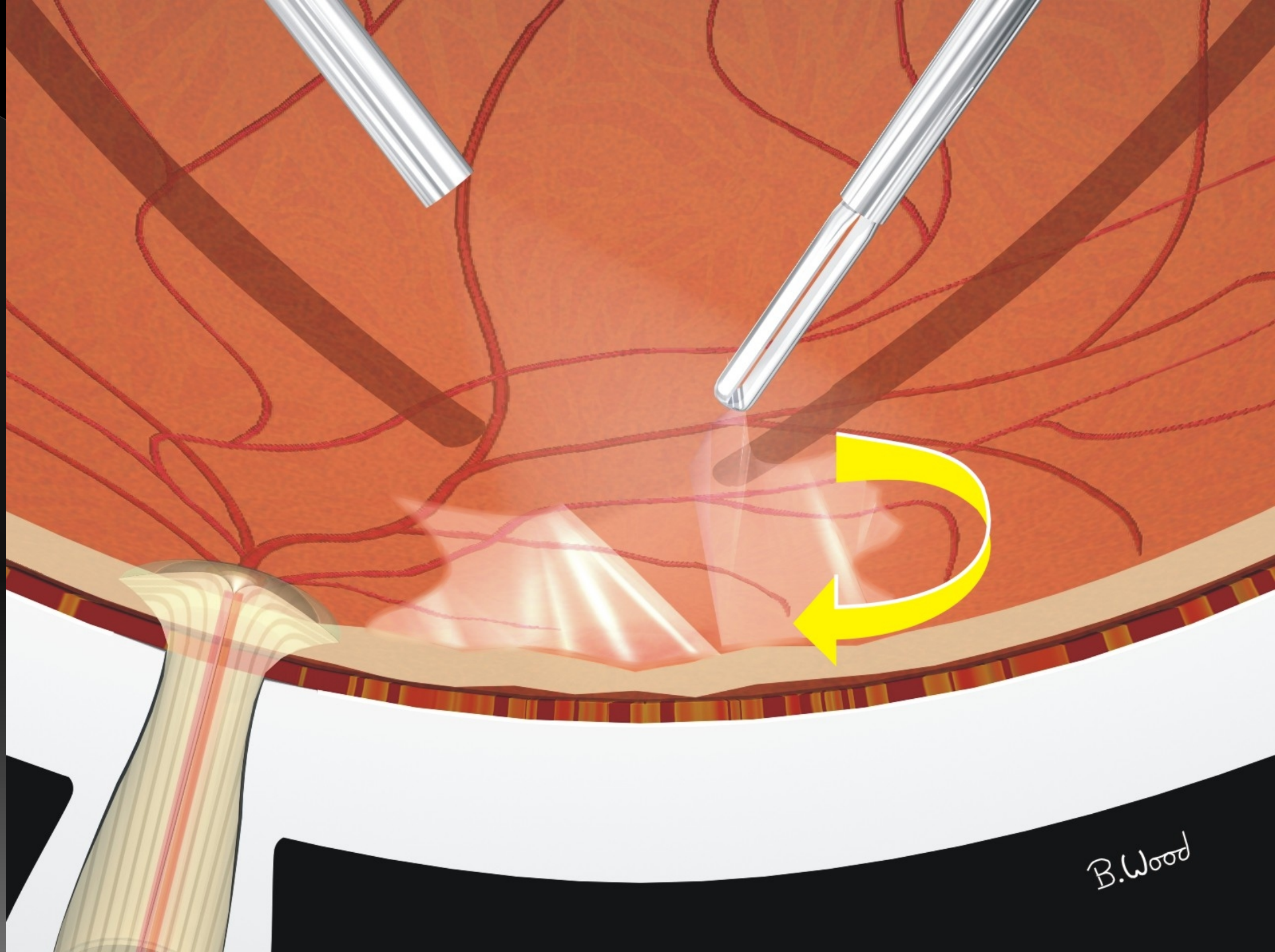
*Plano Contact Lens Provides
Best Resolution, Eliminates
All Corneal Asphericity*

*Non-Contact Viewing (BIOM
& EIBOS) Reduce Lateral and
Axial (depth) Resolution*





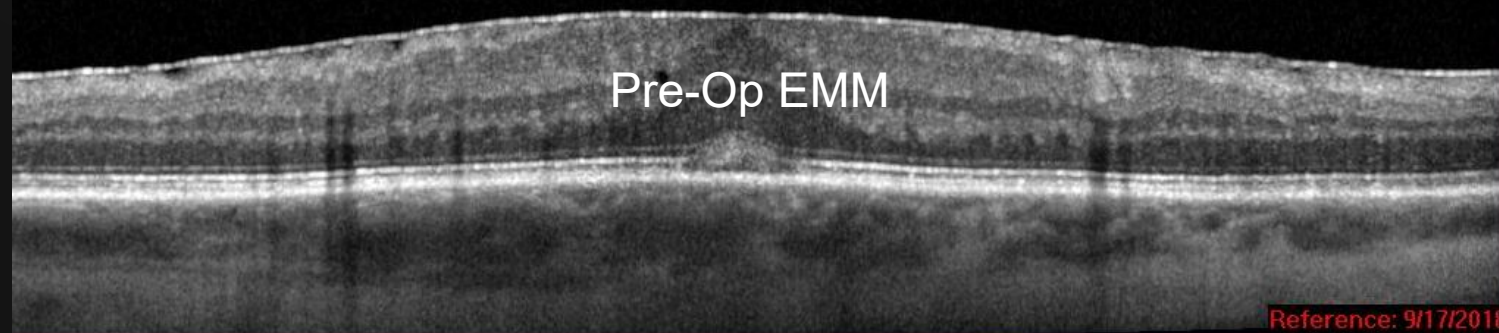
EMM with 25G DSP ILM Forceps



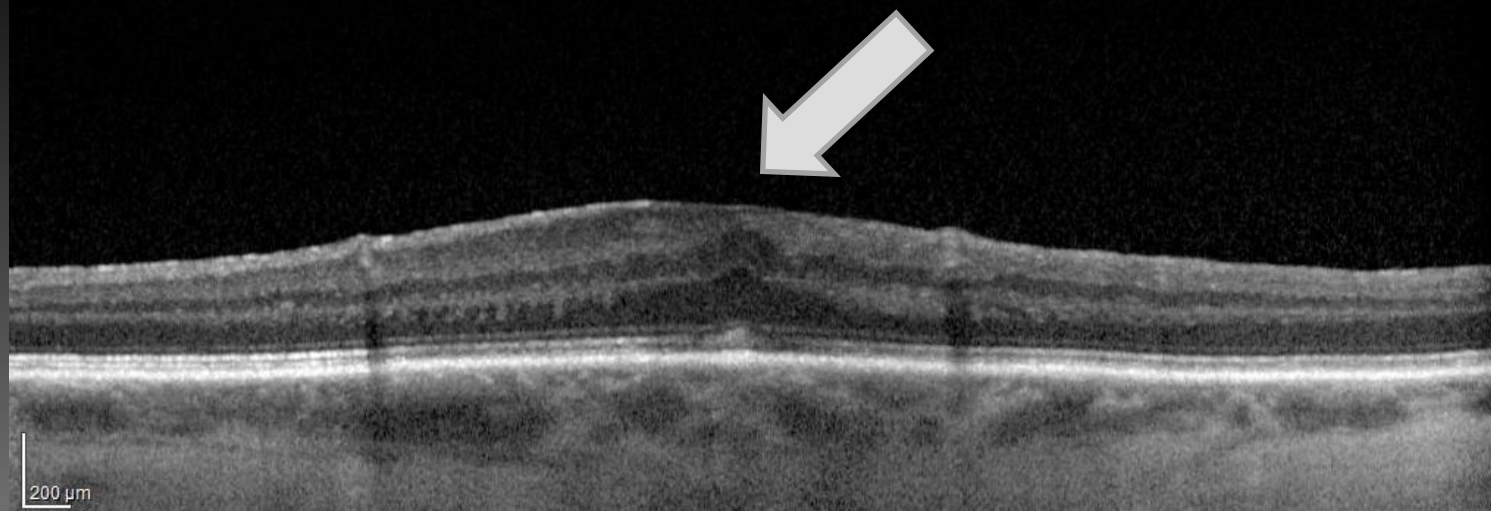
Post-Op Nuclear Sclerosis

- ◉ Nuclear Sclerosis Occurs Only If Pre-Op NS
- ◉ Related to Increased Oxygen Tension in Vitreous Cavity After Vitrectomy (Holekamp, Chang, Steffanson)
- ◉ No Evidence That Infusion Fluid Causes Nuclear Sclerosis Progression
- ◉ Simultaneous PPV-Phaco & IOL Not Indicated for Most Macular Surgery
 - › Intra-Operative Visualization Can Be Worse If Phaco Before PPV & Forceps Membrane Peeling
 - › Refractive Outcomes Worse w/ Phako-Vit (vit/ret surgeons don't use femto, torics, advanced formulas, or intraoperative aberrometry)

PPV, Forceps EMM & ILM Peeling



Foveal Inversion, Not Edema



Over-Diagnosing Edema

- ◉ Foveal Inversion is Structural, Not Edema, Plasticity Will Cause it to Resolve Over Time
- ◉ Intravitreal Steroids Will Not Help But Can Cause Steroid Glaucoma (30-40%) & Cataracts (~100%)
- ◉ OCT Pseudo-color, Thickness Maps, and Foveal Thickness/Volume Measurements Often Cause Misdiagnosis of Edema When Dx is Foveal Inversion, SRF, Macular Schisis, etc

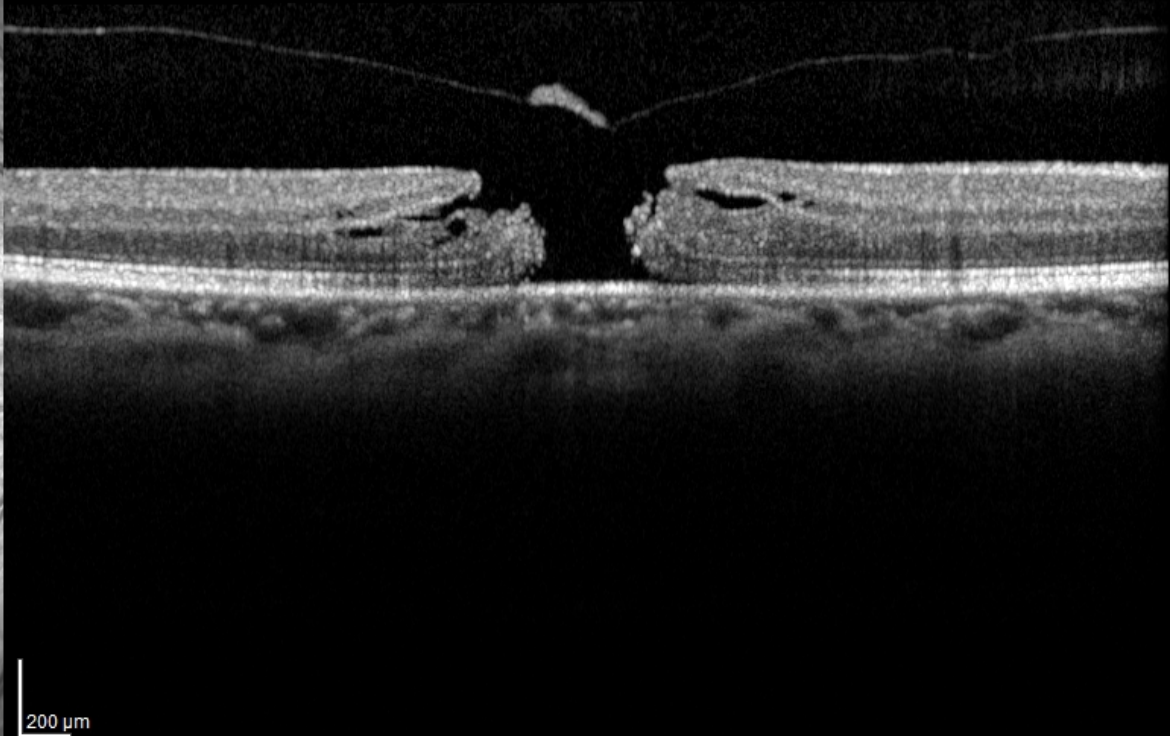
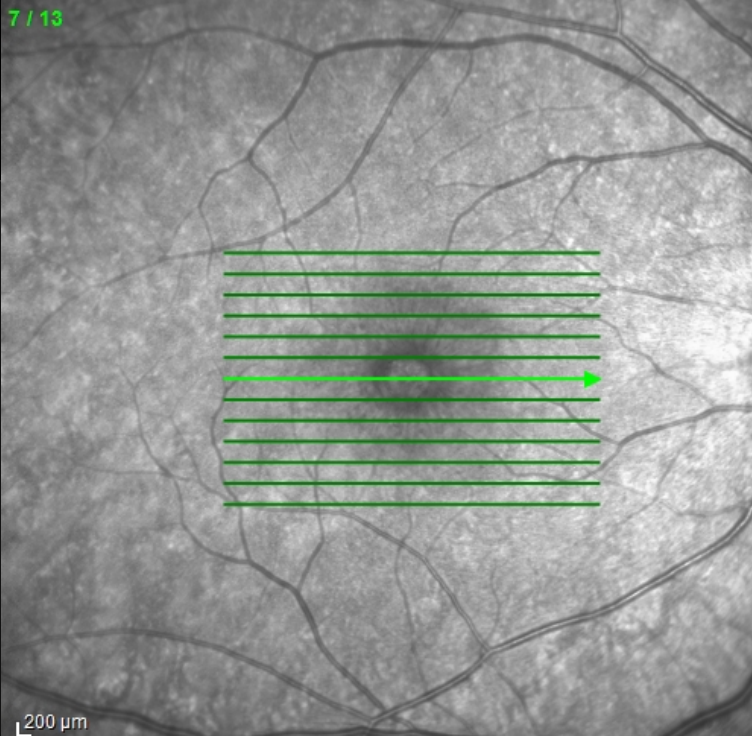
Pathogenesis of Macular Holes

- ◉ Pathogenesis Unknown; Gass Observations & Theories Remain Unproven
- ◉ Possibly from Contraction of the Prefoveal Vitreous Cortex, Hole Enlarges Because of Contraction of Myofibroblasts Attached to Clivus on Internal Limiting Membrane (Gass)
- ◉ Possible Role of Mueller Cells (JDM Gass, Arch Ophthalmol 1999 Jun;117(6):821-3)
- ◉ Apparent Posterior Vitreous Separation (Weiss ring) Does Not Prevent Macular Holes
- ◉ Residual Vitreous Cortex Attached to the Macula is Rarely Contiguous with the Vitreous Cortex Adherent to Optic Nerve
- ◉ Not Avulsed Full Thickness Retina Caused By Adherence Coupled With Saccadic Force
- ◉ Staging is Worthless, Even with OCT Cannot Tell If Residual Vitreous on Retinal Surface

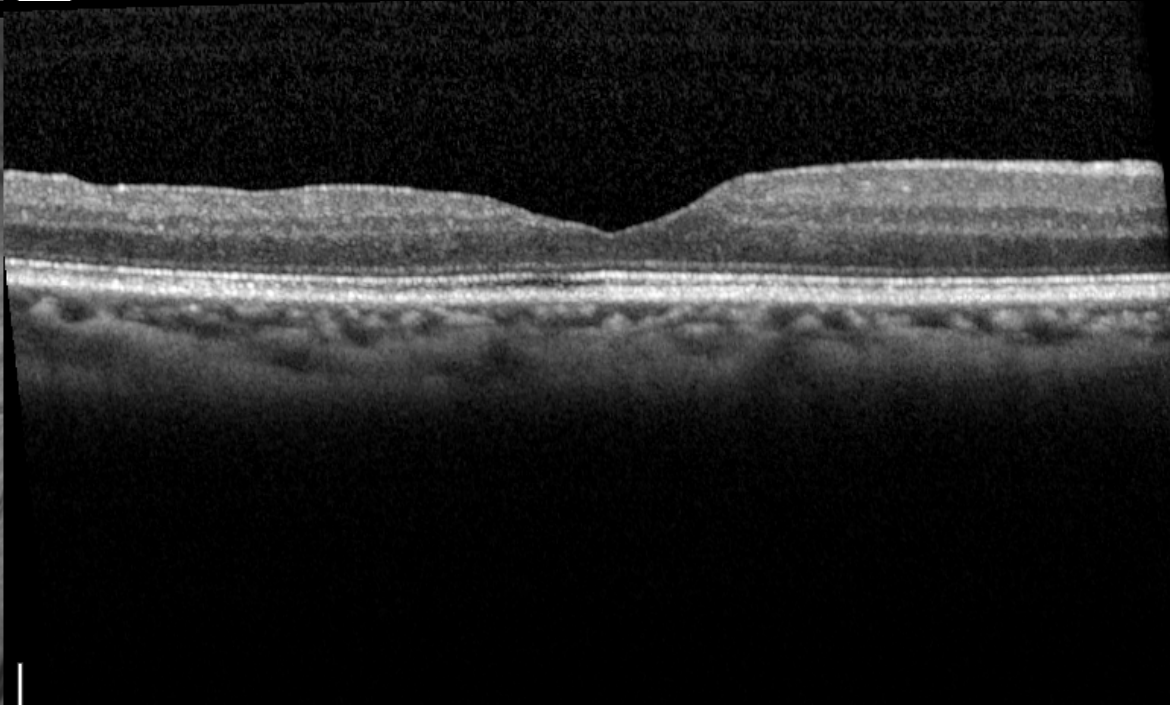
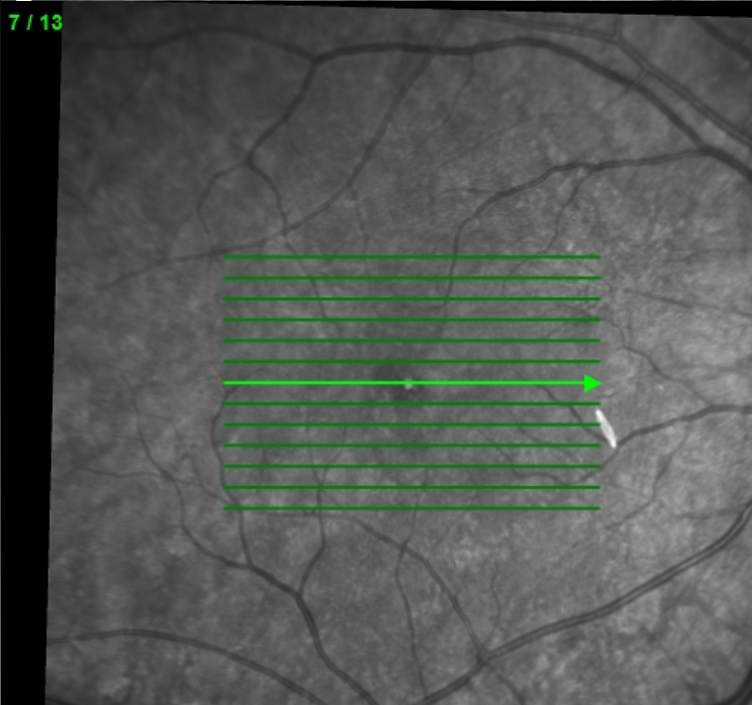
Surgery Indications for Partial Thickness (lamellar) Macular Hole

- ◉ Symptomatic Metamorphopsia
- ◉ Structural Damage: Schisis, Subretinal Fluid, Intraretinal Fluid
- ◉ Not to Prevent Progression to Full Thickness Hole Which is Not Predictable
- ◉ Must Use ILM Peeling with ILM Staining & SF₆ (not air) to Restore Near-Normal Foveal Anatomy

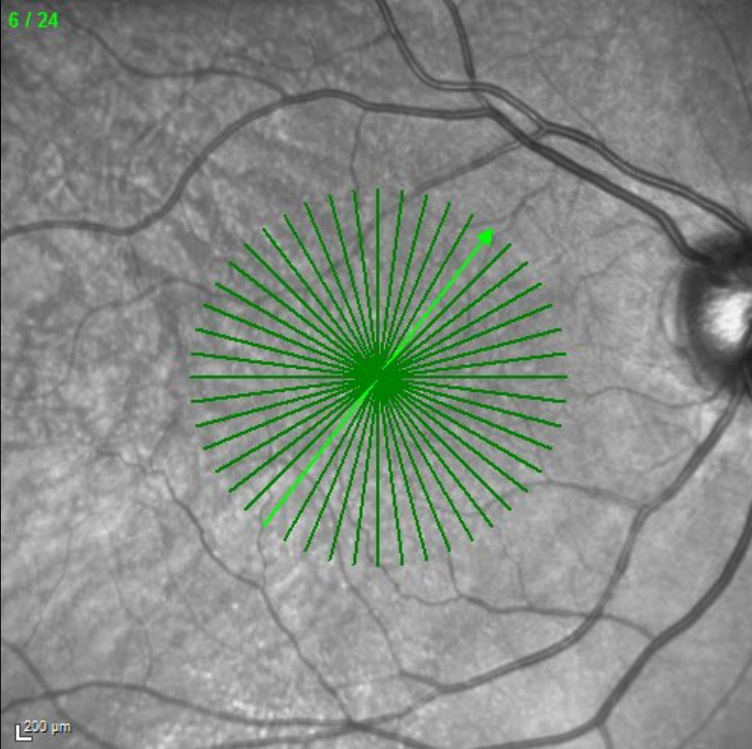
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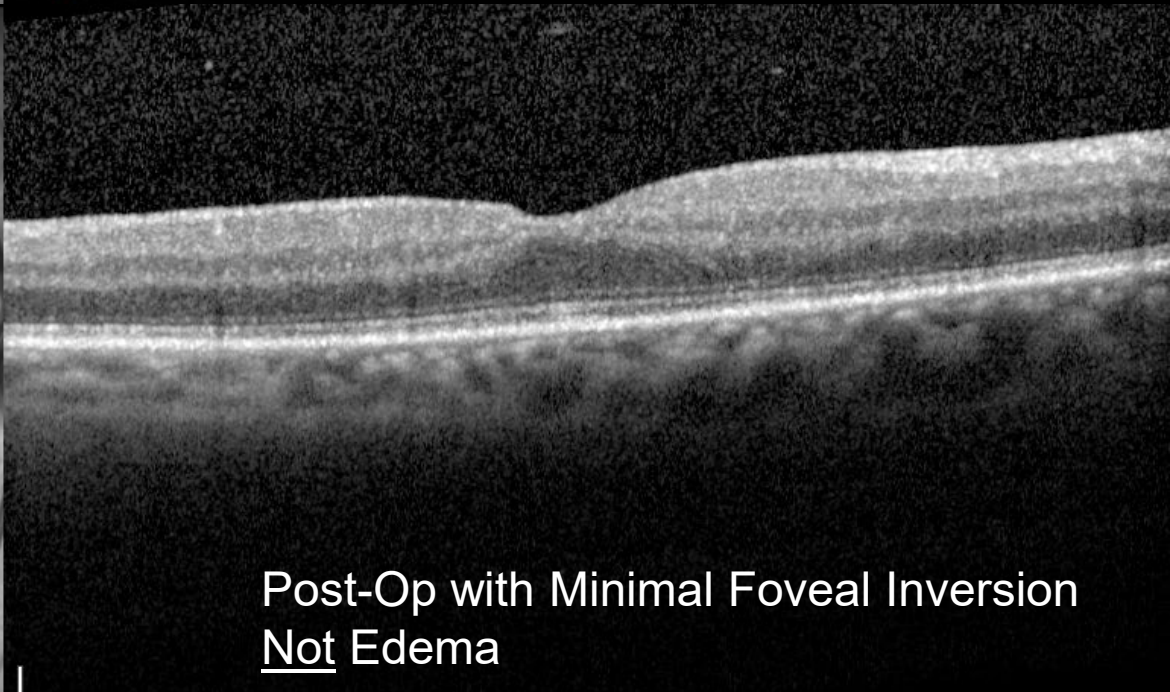
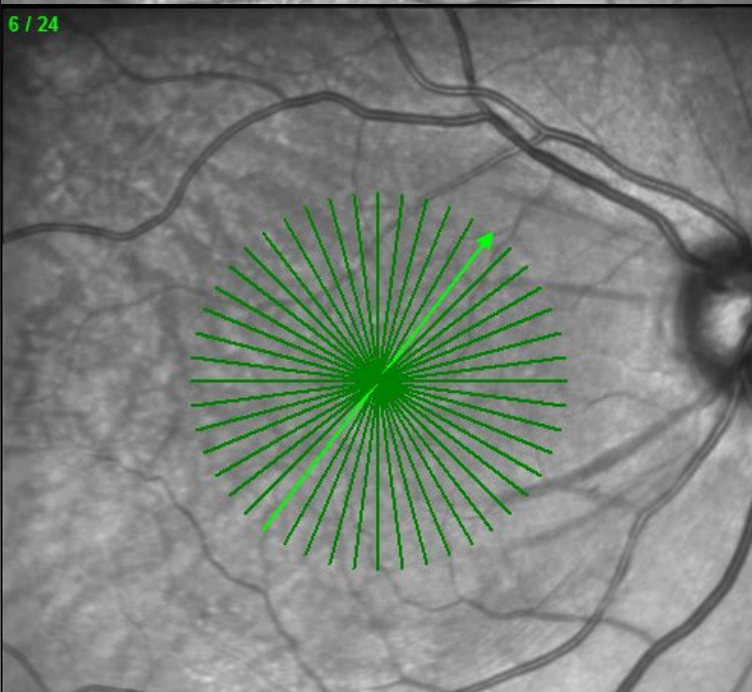


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Pre-Op LMH with Macular Schisis

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Post-Op with Minimal Foveal Inversion
Not Edema

MH Closure Mechanisms

- ◉ Phase 1. Immediate: ILM peel to insure PVC/ERM traction gone and to increase retinal compliance and gas for surface tension effect to cause edge-to-edge apposition
- ◉ Phase 2. Hours: Gas to prevent trans-hole flow and trans-retinal flow to eliminate retinal edema
- ◉ Phase 3. Days: Mueller cell derived reactive gliosis stimulated by ILM peeling and bubble mediated drying heal hole closed by surface tension

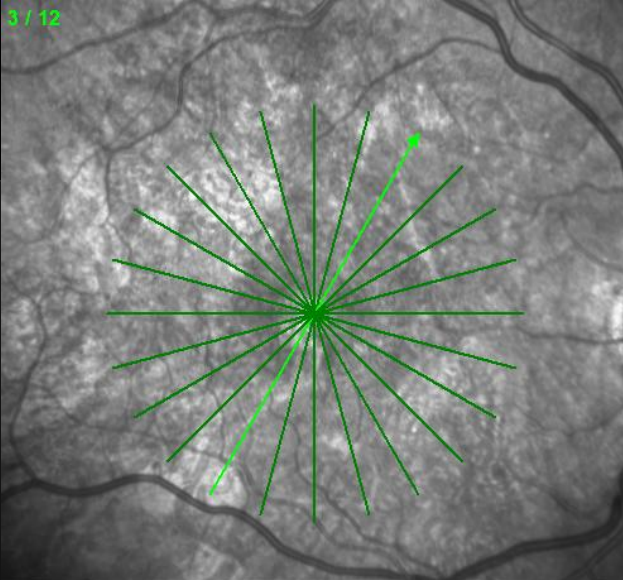
ILM Elasticity

- ◉ Wollensak et al: Less force required to elongate retina without ILM compared to retina with ILM. *Mean force on the central retina was reduced significantly by 53.6% and the ultimate elongation by 27.03% after ILM removal by excimer laser.*

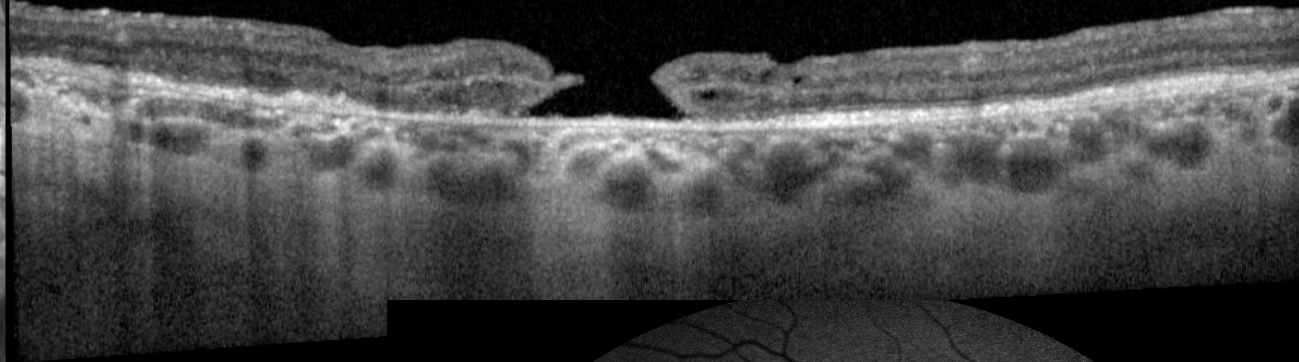
ILM Staining

- ◉ ICG Toxicity Is a Very Significant Issue
- ◉ Brilliant Blue is the Only Safe, Effective ILM Staining Agent (Maia, Farah et al, Kampik et al)

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200 μ m



200 μ m

4/3/2013, OD

#55 IR&OCT 30° ART EDI [HR] ART(8) Q: 32

ICG Toxicity



200 μ m

4/3/2013, OD
#5 AF 55° ART(30)

FAF

Triamcinolone Assisted PPV for Macular Hole Surgery

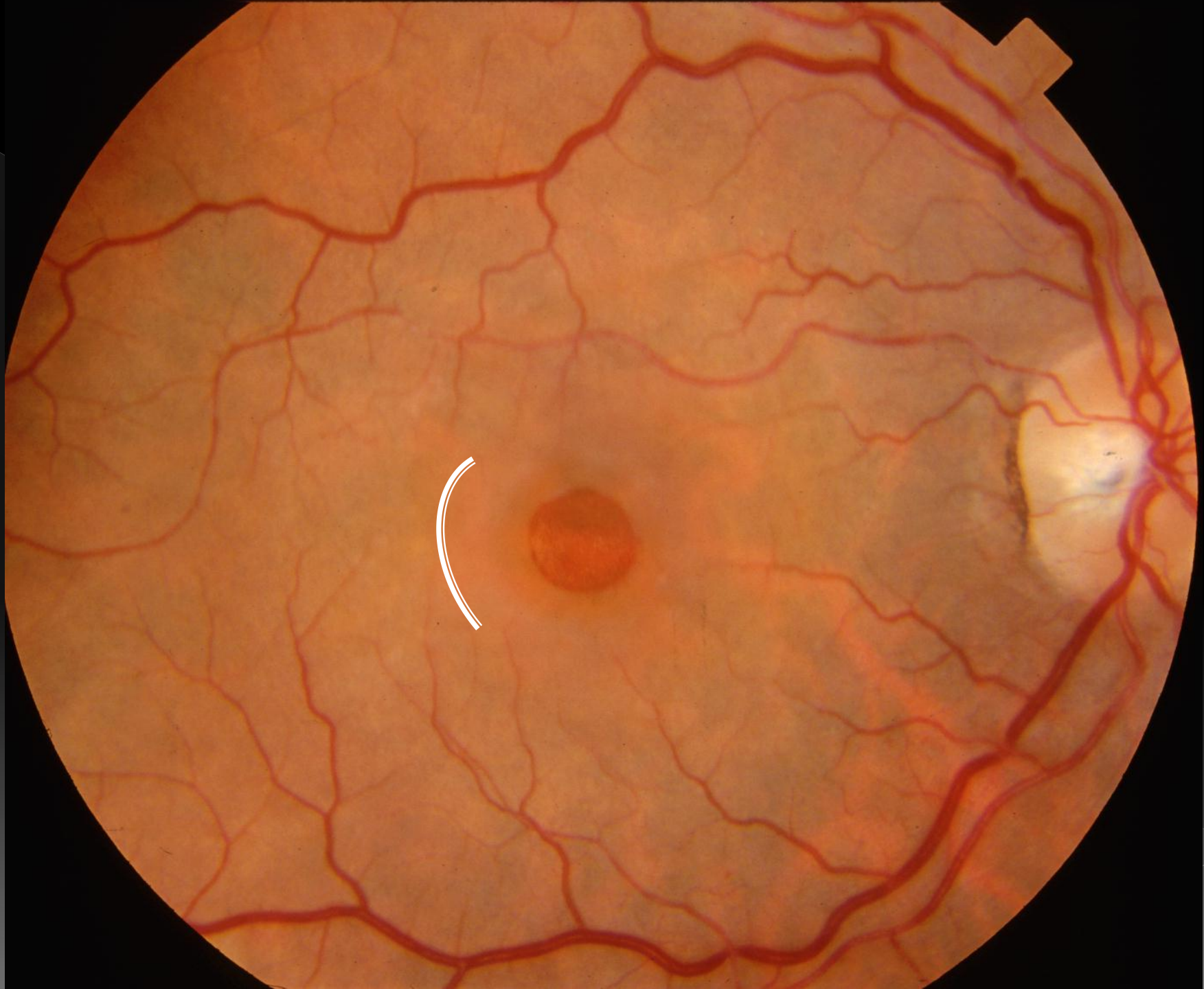
- ◉ Anecdotal Evidence That Triamcinolone Reduces Hole Closure Rates
- ◉ Case Reports of Triamcinolone Incorporated in Closed Hole or Trapped in Subretinal Space
- ◉ Triamcinolone Produces Particulate Marking, Not Staining, and Is Not ILM or ERM Specific

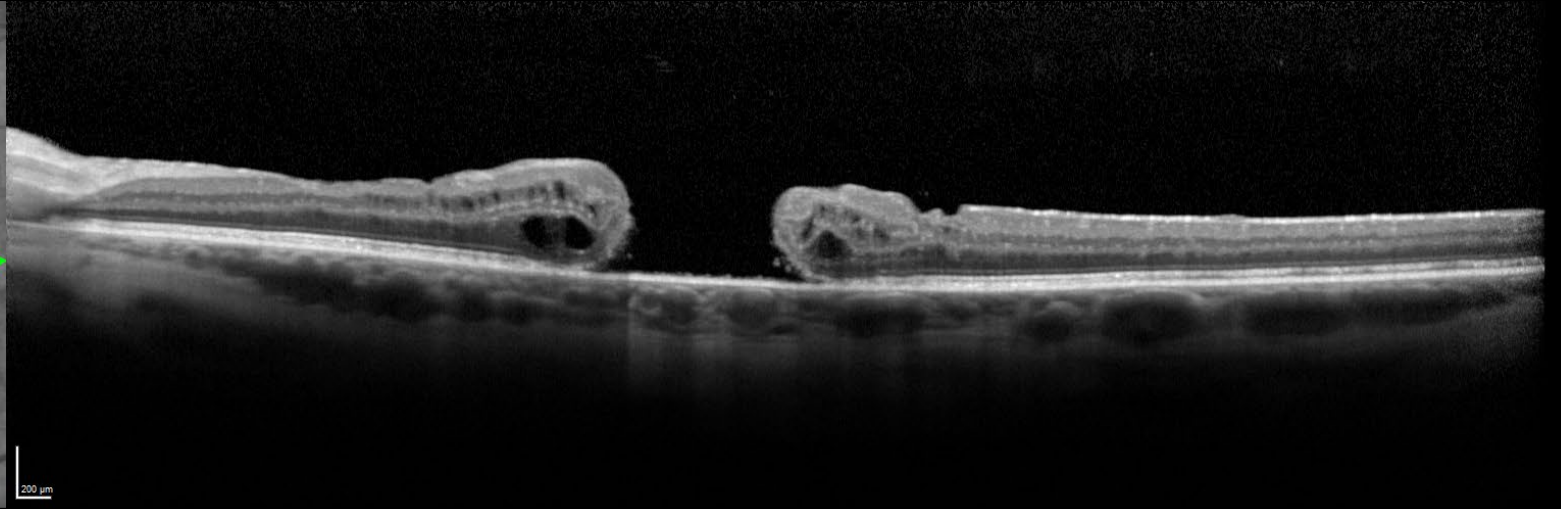
Rationale for Gas

- ◉ Inward Directed Interfacial Surface Tension Forces Cause Near Immediate Closure (Vincent Reppucci, paper at Club Jules Gonin, Capetown, 2006)
- ◉ Surface (interfacial) Tension Effect Prevents Trans-Hole Fluid Flow (also known by the ill-defined term “tamponade”)
- ◉ Drying Effect Signals Mueller Cell Reactive Gliosis to Repair Hole After Surface Tension Edge-To-Edge Closure (Charles)
- ◉ Eliminates Trans-Retinal Flow (uveal-scleral outflow, Charles) and Therefore Reduces Retinal Edema (Tornambe hydration hypothesis)

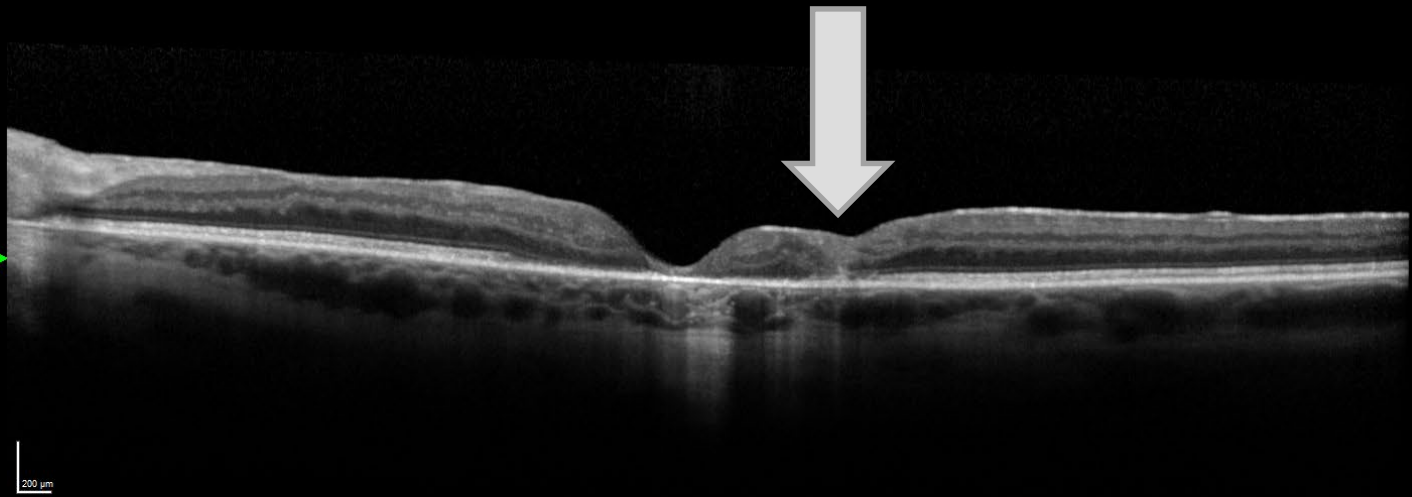
Arcuate Retinotomy for Large, Failed Macular Holes

- ◉ Aneesh Nikhra Suggested Making a Retinotomy Temporal to the Macula for Management of Very Large, Failed Macular Holes
- ◉ Charles Developed Arcuate Retinotomy Using 25G Curved Scissors

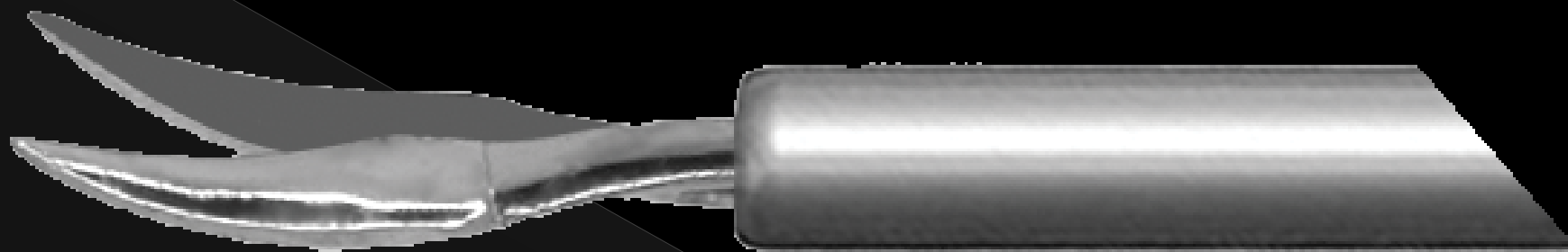




3/26/2012, OS
IR&OCT 30° ART [HR] ART(94) Q: 34



6/11/2012, OS
IR&OCT 30° ART [HR] ART(43) Q: 39



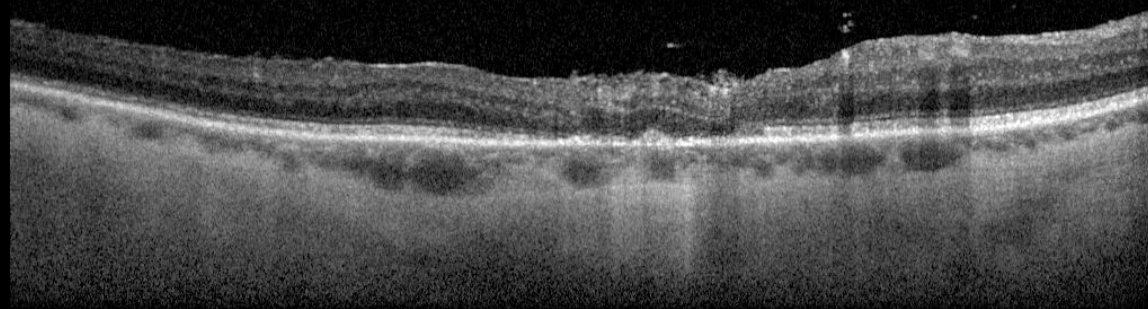
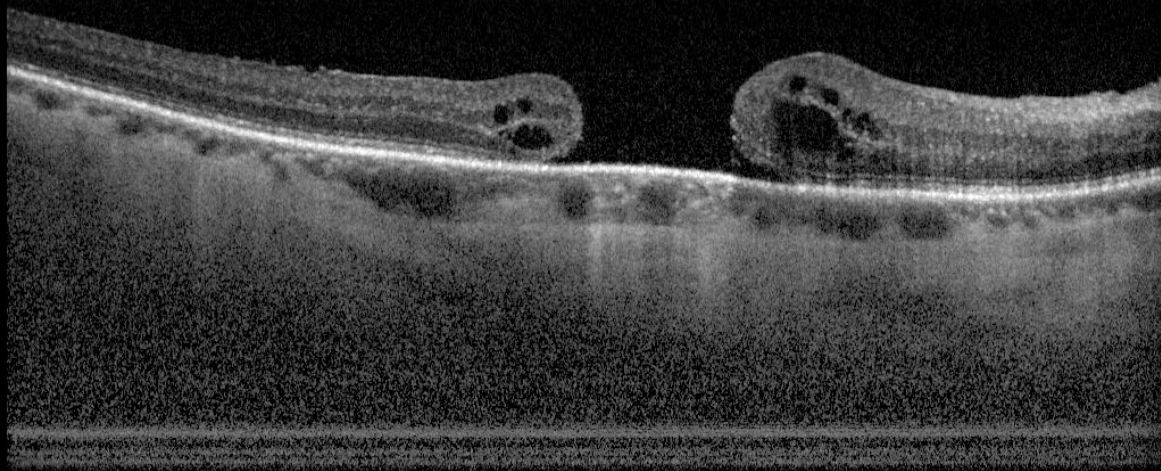
Alcon 25G DSP Curved Scissors

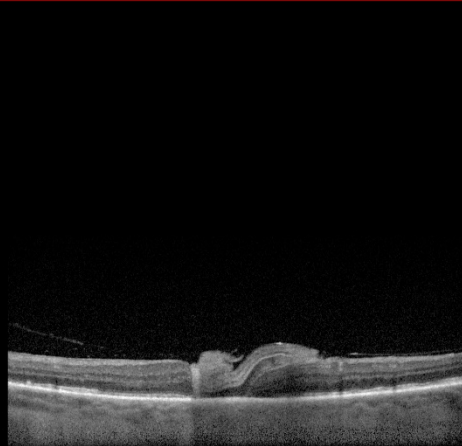
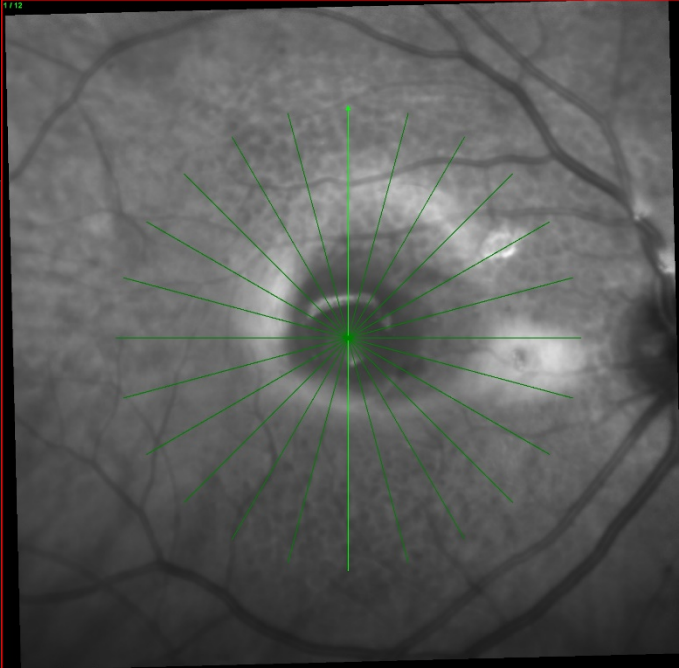
Surgical Approach

- ◉ 25/27G Sutureless PPV
- ◉ PVD Creation At Previous PPV Was Verified in All Cases Using Cutter Over Optic Nerve Head
- ◉ ILM Peeling From Previous PPV was Verified Using DSP ILM Forceps
- ◉ Arcuate Retinotomy Temporal to Macula, Splitting (not cutting) Nerve Fiber Layer
- ◉ Temporal Margin of Hole Displaced Nasally Under Air With Soft-Tip Cannula to Decrease Horizontal Diameter of Hole
- ◉ SF₆ Plus Face Down Positioning for 1-3 Weeks Used in My Series of 16 cases (~60% success)

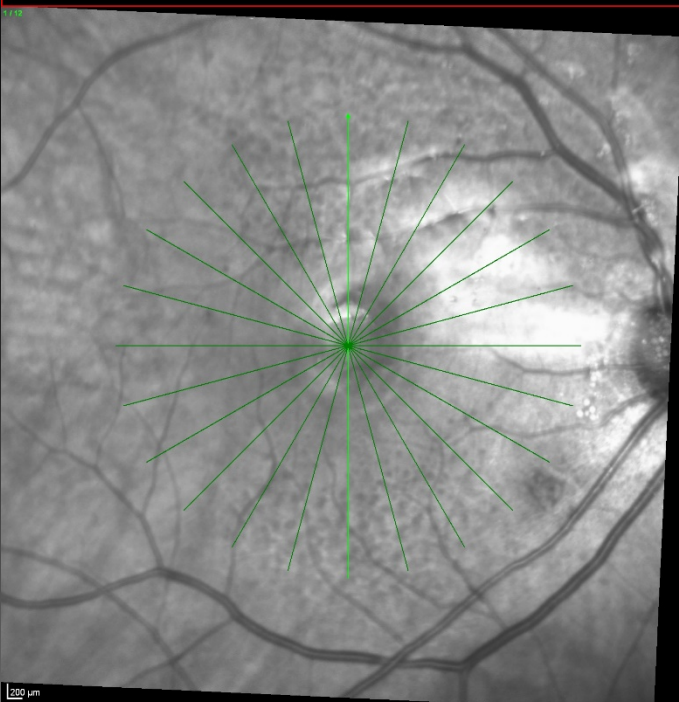
Full Thickness Retinal Patch Graft for Large Macular Hole

- ◉ Developed by Tamer Mahmoud MD PhD
- ◉ Steve Charles: 30 cases
- ◉ Donor Site Near Inferotemporal Vessels Treated with Laser After Graft Cut With Scissors and Moved Under PFO to Macula
- ◉ Medium Term PFO for One Week, Not Silicone Oil; PFO Supports Oxygenation





Reference: 10712000



200 μm

10/20/2015 00:00
41 815027 30° EDI (HR) ARTOS Q 30

Reference: 10712000

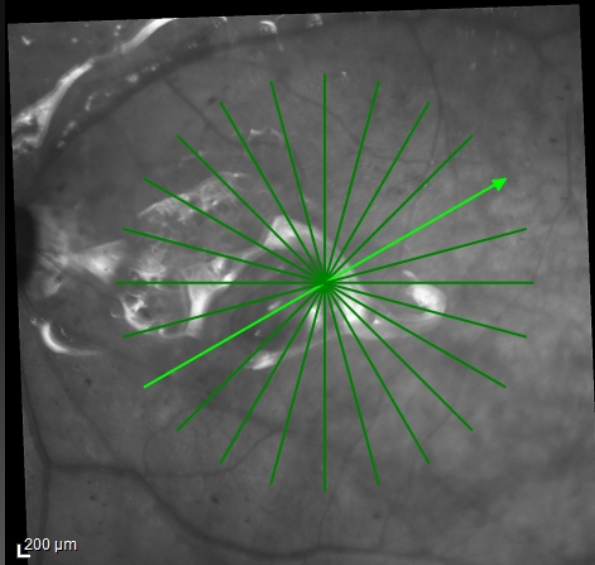


11/30/2016, OD



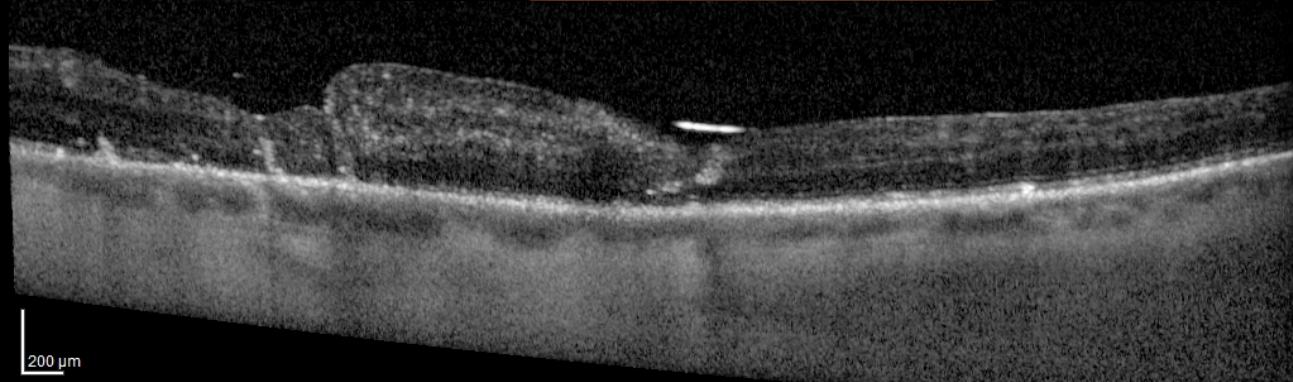
12/14/2016

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12/14/2016, OS

#9 IR&OCT 30° ART EDI [HR] ART(9) Q: 25

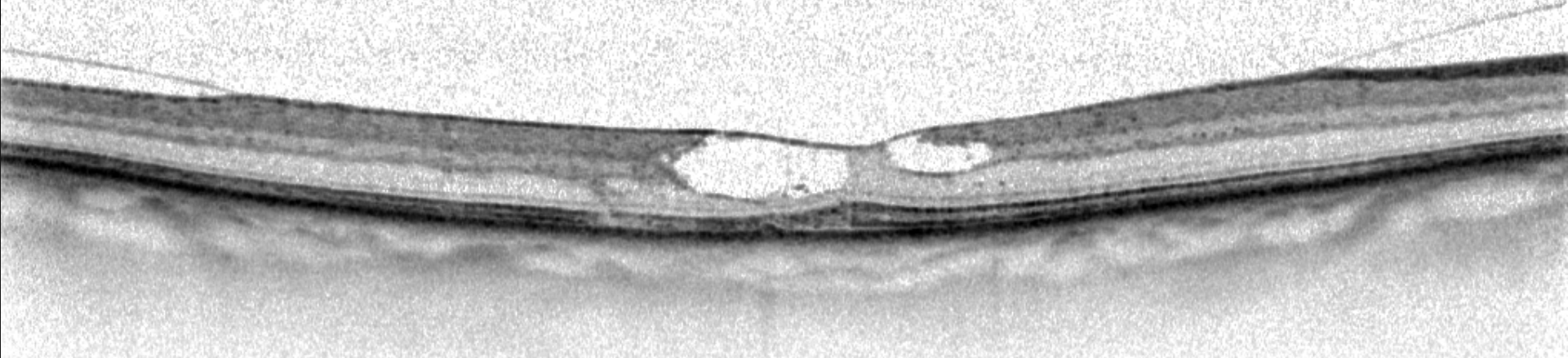




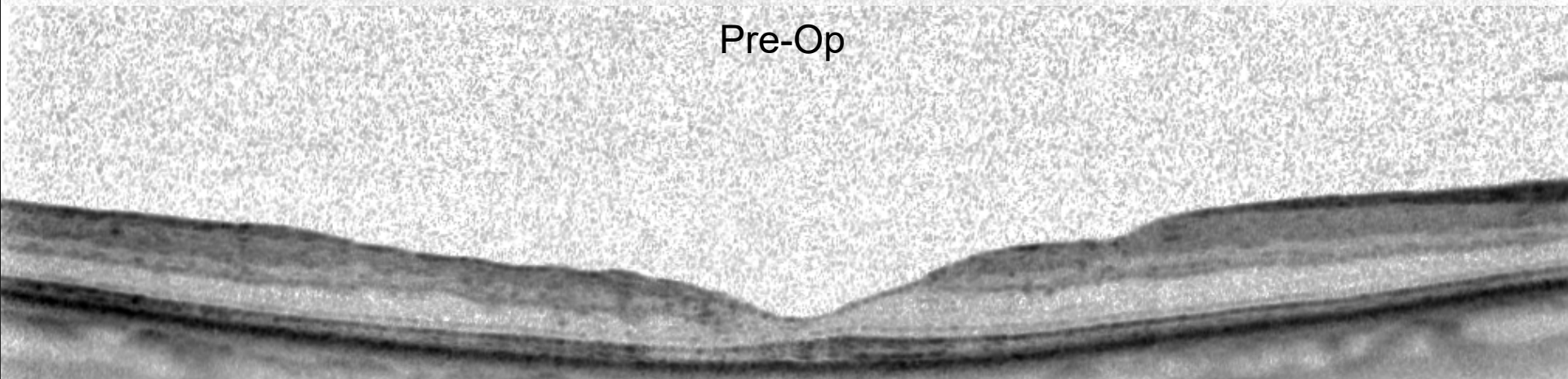
Vitreomacular Traction Syndrome

- ◉ Under-Diagnosed Prior to OCT
 - > Impossible to Visualize Clinically, Even with Contact Lens Exam
 - > Often Coexists with Unrelated Disorders Which Must Be Managed Independently
 - VMT Common in Diabetic Retinopathy & AMD
- ◉ High Surgical Success Rate

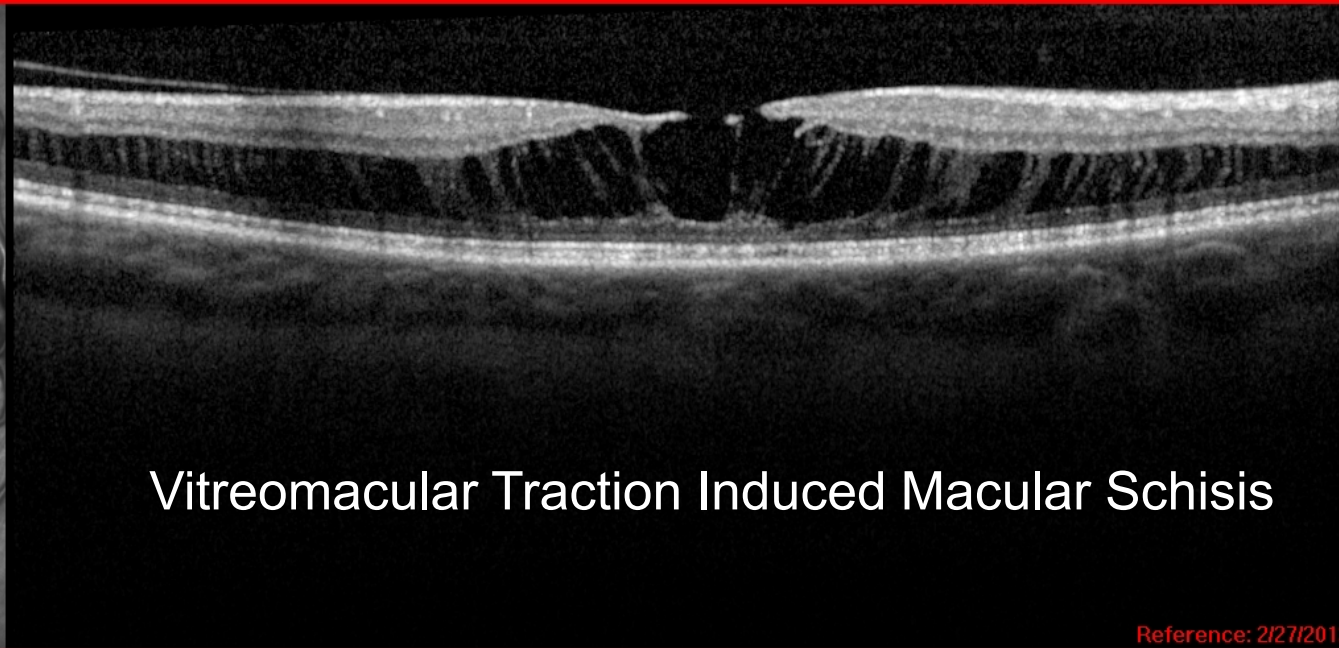
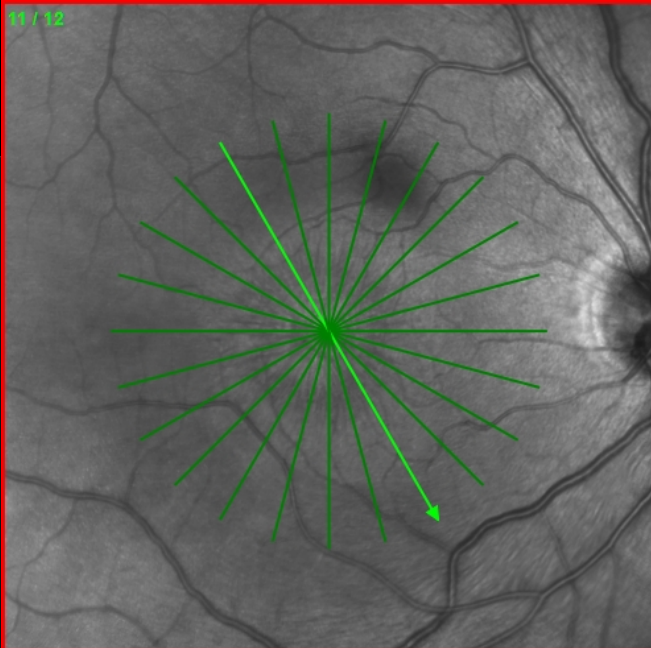
Vitreomacular Traction Induced Macular Schisis



Pre-Op

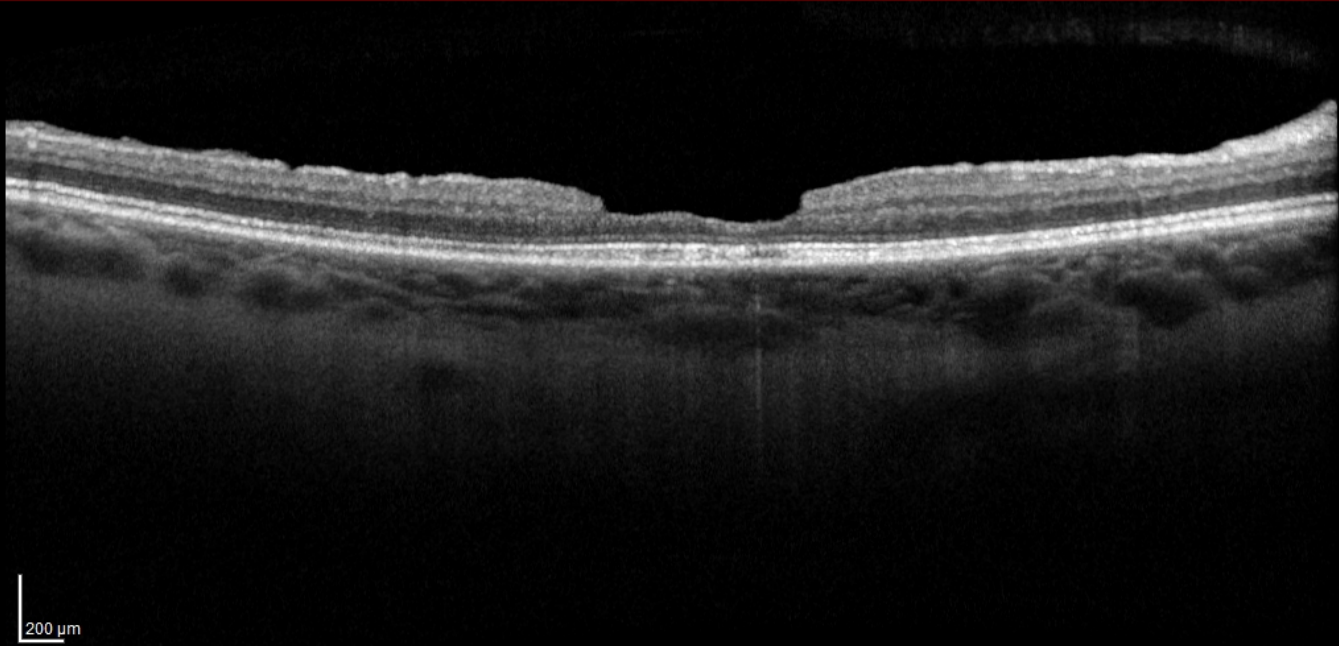
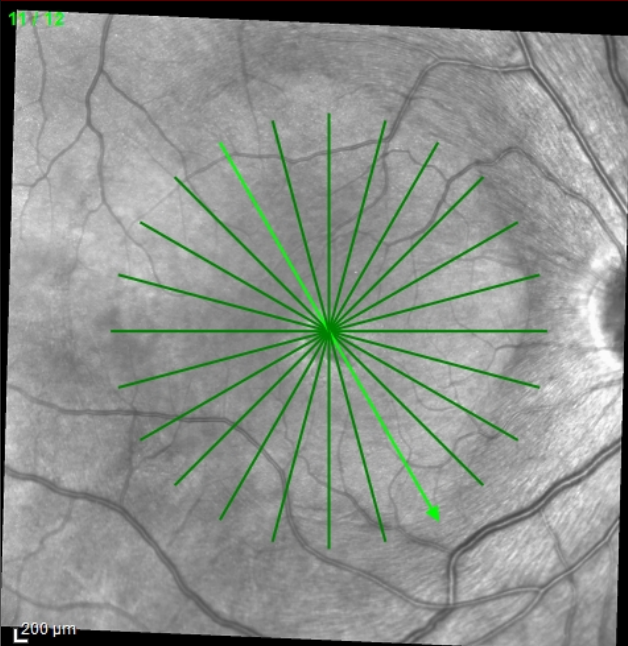


Post-Op



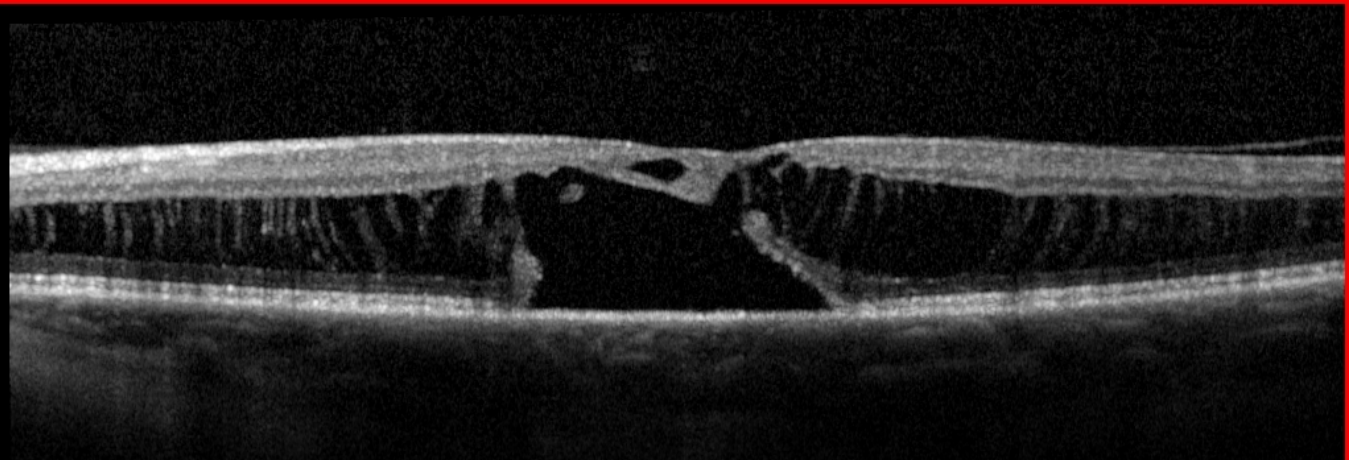
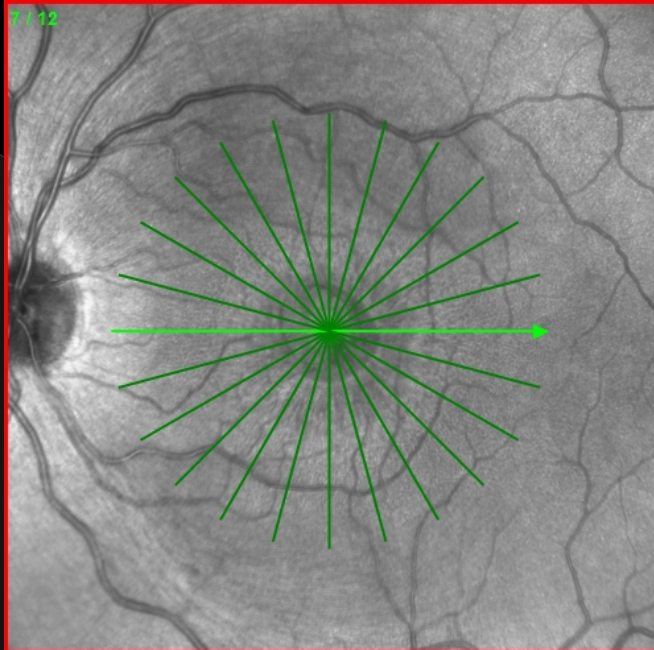
Vitreomacular Traction Induced Macular Schisis

Reference: 2/27/2012



4/9/2018, OD

#21 IR&OCT 30° ART [HR] ART(12) Q: 37

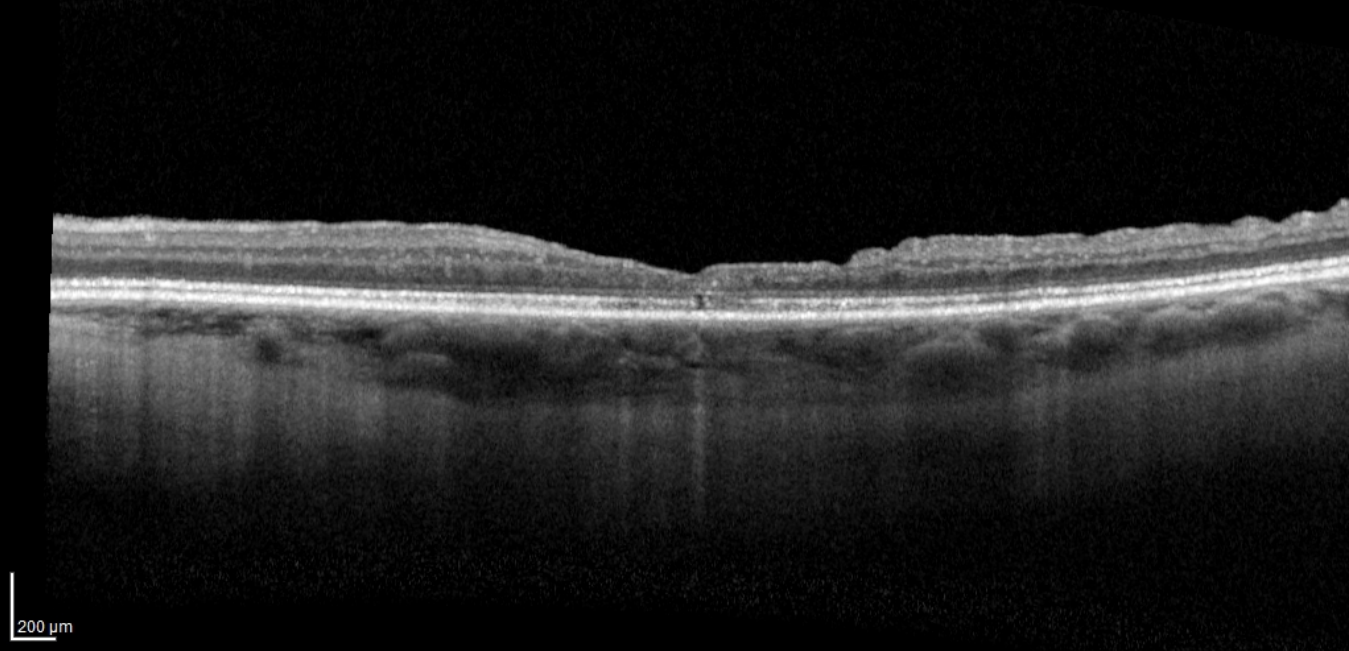


Vitreomacular Traction Induced Macular Schisis

Reference: 2/27/2012



200 μ m

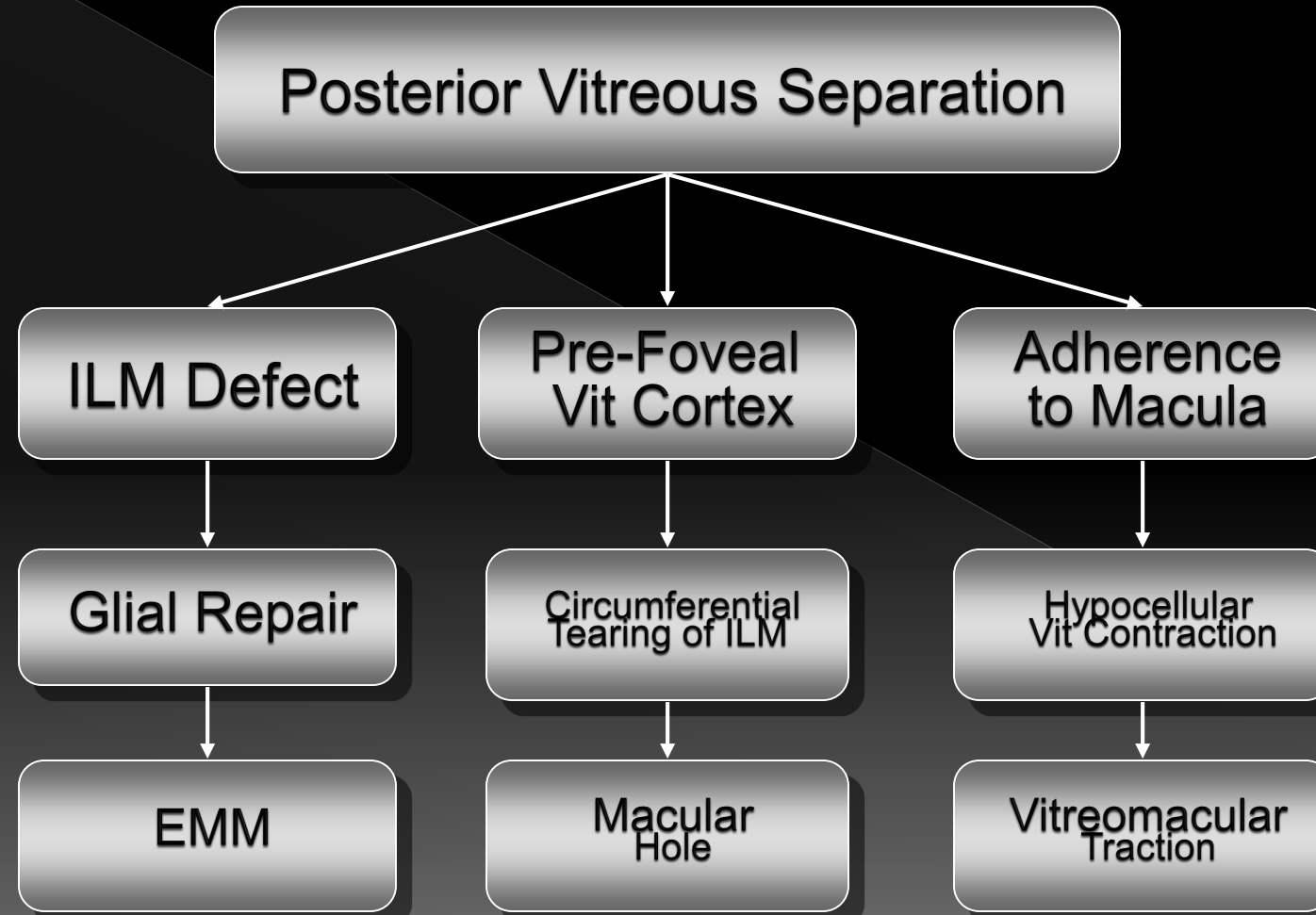


200 μ m

4/9/2018, OS

#75 IR&OCT 30° ART [HR] ART(13) Q: 37

Genesis of Vitreomacular Disorders



PVD; Unanswered Questions

- ◉ Why Do 70%v of Population Develop PVD But Much Smaller Fraction Develop MH, EMM, VMT, or Macular Schisis; All Thought to Be PVD Related
- ◉ Why is Residual Vitreous Often Adherent to ILM After PVDs With Weiss Ring (posterior vitreous cortex has multiple layers)
- ◉ Why Do Some PVDs Evolve Slowly, Over Macula First, Theoretically Linked to Advanced Glycation End Products (AGES)

VMT and AMD

- ◉ Some Investigators Believe That VMT Causes Some Cases of Wet AMD
- ◉ Reality: VMT and AMD are Very Common, Often Coexist, and Both Cause Subretinal and/or Intraretinal Fluid i.e. Increased Macular Thickness on OCT
- ◉ There is No Evidence That VMT & AMD Are Related
- ◉ Treat Wet AMD with Anti-VEGF
- ◉ Treat VMT PPV/ILM Peeling (PPV changes pharmacokinetics)