



CONTINUING EDUCATION CERTIFICATION
 Homecoming Continuing Education
 October 3, 2015
 Pacific University, Jefferson Hall
COPE EVENT 109798

Saturday, October 3, 2015 6 HOURS TOTAL	Tracy Doll, OD <i>Inside the Medical Lab: Hematology and Serology for Optometry</i> Pages 1 - 29 8:00 – 9:00	46413 SD 1 hour	
	Amiee Ho OD <i>Diabetic Keratopathy</i> Pages 40 - 67 9:00 – 10:00	44449 SD 1 hour	
	David Kading, OD <i>The Future of Dry Eye</i> Pages 68 - 82 10:00 – 12:00	44997 AS 2 hours	
	Tracy Doll, OD <i>Decoding the Omega and Alphas: Selecting the right ocular nutrition for your dry eye patient</i> Pages 83 - 110 12:30 – 1:30	46284 OP 1 hour	
	Tracy Doll, OD <i>Hands On Dry Eye Technology Workshop</i> Pages 111 - 129 1:30 – 2:30	46462 PD 1 hour	

TOTAL HOURS OFFERED: 6

TOTAL HOURS ATTENDED _____

Name _____ License Number _____

Mailing Address _____

City/ST/ZIP _____

Please keep a copy of this form for your records. Be advised that your individual state board makes the final determination of applicable hours. If you have an OE Tracker number, your hours will be added to their database. *OE TRACKER captures and stores continuing education attendance data for optometrists. The information is retained in the secure ARBO database and can be accessed online by you and your licensing board. OE TRACKER can save you time and reduce your paperwork by tracking all your CE credits electronically.*

HOMEcomings CONTINUING EDUCATION SPEAKERS



Dr. Tracy Doll completed both her undergraduate degree and doctor of optometry degree at Pacific University. She then went on to complete a residency in primary care optometry with emphasis in routine management of ocular disease at the Portland Veterans Administration Medical Center. At Pacific, Dr. Doll teaches laboratories and lectures regarding ocular disease and procedural techniques. She is the lead instructor for the elective course, Spanish for the Eye Care Practitioner. You can also find Dr. Doll acting as the attending optometric physician for third- and fourth-year students in the school clinics.

In July Dr. Doll was named the coordinator of Pacific Dry Eye Solutions, the College of Optometry's newest specialty clinic, located at the EyeClinic Beaverton. That clinic offers advanced ocular surface disease diagnosis and treatment.



Dr. Aimee Ho received her Doctor of Optometry degree in 2012 from the University of California, Berkeley, School of Optometry after earning her BS degree in Biochemistry/Cell Biology from the University of California, San Diego.

In 2013, she completed a residency in Geriatrics and Primary Care at West Los Angeles Veterans Administration Medical Center through the Southern California College of Optometry. From 2013 to 2015, Dr. Ho served as an optometrist for the Southern Arizona Veterans Affairs Health Care System at a Community-based Outpatient Clinic in Yuma, Arizona. She joined the Pacific University College of Optometry faculty in July, 2015.



Dr. Dave Kading owns a 4 doctor 2 location practice in Seattle Washington. He graduated from Pacific University College of Optometry where he also completed the Cornea and Contact Lens Residency. Dr. Kading specializes in: complicated contact lens fitting. His referral based dry eye and contact lens clinics are well known for utilizing the latest technology for complex or rudimentary dry eye or contact lens fits.

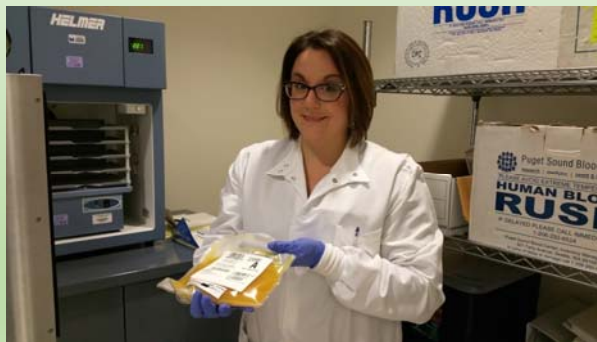
Dr. Kading enjoys conducting clinical research within his practice, he has written over a hundred articles and papers, and has given several hundred lectures in North America, Australia, Europe, and Asia. He works closely with industry, publications, local, state, and national organizations. He has a regular column in *Contact Lens Spectrum*, *Contact Lens Today*, and a digital video series called *Clinical Insights* on Eyetube OD.

Inside the Medical Lab Hematology

Tracy Doll, O.D., F.A.A.O.
Pacific University College of Optometry
Homecoming CE
October 3, 2015

Consultant

- Shelley Hubka, MT, CLS, Legacy Laboratory Services



Common Causes of Blood/Hypoxia in the Eye

- Dot-blot hemorrhages
- Flame hemorrhages
- Cotton wool spots

- Cardiovascular systemic conditions
 - Diabetes
 - HTN
 - Atherosclerosis

Quick Tests to Rule Out Basic Bleeding

- In-office blood glucose
 - Fasting < 100mg/dL
 - Non-fasting < 200mg/dL

- Taking blood pressure
 - < 120/80 mmHg



- What if these values come back as normal?
- Hematological work-up anyone?

Main Hematology test for Optometry

- The Complete Blood Count with Differential
- Erythrocyte Sedimentation Rate



Goals for Hematological Testing

- 1. Get results quickly
- 2. Avoid extra costs for the patient
 - Time
 - \$\$

Beyond Scope of Practice: When to Utilize the PCP

- Some entities will require an medical lab order placement by a PCP
 - Check with your own state regulations and managed care plans
- Save the patient the cost of an extra medical visit via direct communication with the PCP
- Save time, by having the lab testing done prior to PCP visit.
- It helps to have very specific recommendations for the PCP

In Scope of Practice: Ordering on Your Own

- Reliability
 - All labs must pass CLIA certification.
 - Joint Commission Standards for safety has a website where consumers can check to make sure a lab has met safety standards
<http://www.qualitycheck.org/consumer/searchQCR.aspx>
 - Results should be accurate and timely.
- Process
 - You will be supplied with acquisition forms by lab of choice, that need to be filled out completely and with urgency of the test results needed.
- Keep the PCP in the Loop
 - In the event that the results of testing show the need for systemic treatment, it's a good idea to have result sent to PCP.

CBC print-out

Test Name	Accession	Specimen	Physician	Collected	Received	PL
CBC with Differential	H073240390	Blood		11/20/ 16:39	11/20/ 16:40	RO
	Result			Units	Reference	
White Blood Cell Count	4.50			10E3/uL	4.00-11.00	
Red Blood Cell Count	4.25			10E6/uL	3.80-5.20	
Hemoglobin	11.3 L			g/dL	11.6-15.5	
Hematocrit	33.9 L			%	35.0-46.0	
MCV	79.0 L			fL	80.0-100.0	
MCH	26.0 L			pg	27.0-34.0	
MCHC	31.8 L			g/dL	32.0-35.5	
Platelet Count	110 L			10E3/uL	150-400	
RDW CV	11.0			%	11.0-16.0	
Mean Platelet Volume	7.9 L			fL	8.0-13.0	

Red Blood Cell Count (RBC)

- **Number of erythrocytes** per cubic millimeter (mm³ or μ L).
- Low count= anemia
 - Blood loss, iron or vitamin deficiency, or bone marrow dysfunction (i.e.- aplastic anemia)
- High count =polycythemia



Retinal Signs of Anemia and Polycythemia

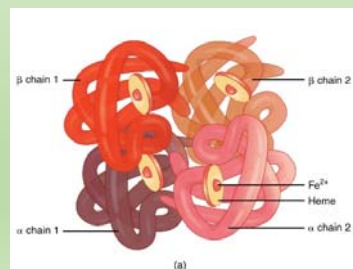
- Cotton-wool spots
- White centered retinal hemorrhages (Roth Spots)
- Posterior pole retinal, mid-peripheral or peripheral retinal hemorrhages



<http://imagebank.asrs.org/file/10840/roth-spot>

Hemoglobin (Hgb)

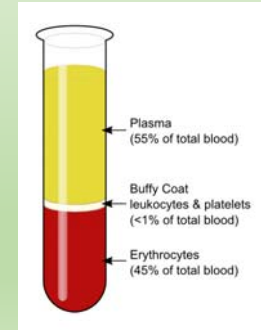
- **Iron-containing protein** that carries oxygen in the bloodstream, as part of the RBC
- Low count= anemia
- High count = polycythemia, lung disease, high altitude, smokers



Hematocrit (HCT)



- The packed cell volume
- The percentage of the **blood volume occupied by red blood cells**
- Low HCT levels = anemia
- Higher HCT is most associated with polycythemia vera



http://en.wikipedia.org/wiki/Buffy_coat

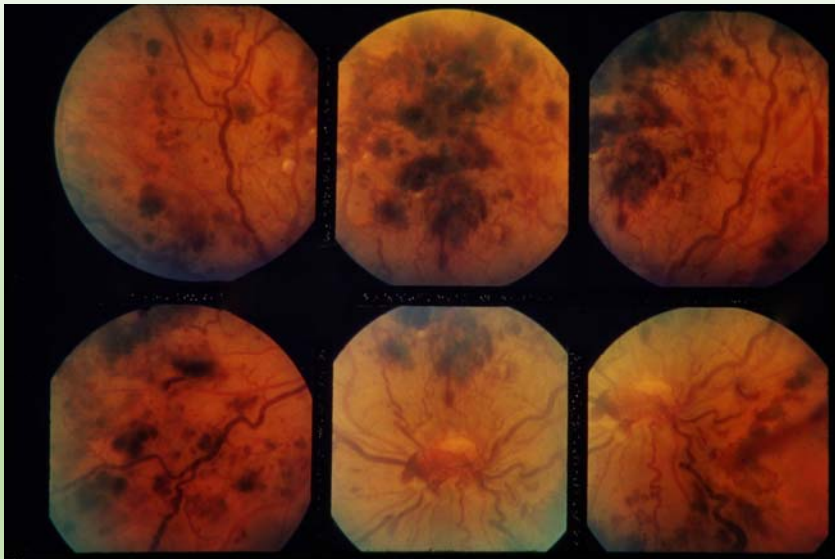
Polycythemia Vera in the Body

- A myeloproliferative disorder causing all of the red blood cell elements in the blood to be over-produced.
 - A rare stem cell defect is the theorized cause of this disorder.
- Demographic:
 - 6th decade of life
 - Most commonly Caucasian females of Jewish descent
- **Eventually 5-10% of patients with polycythemia vera will develop acute leukemia.**

Polycythemia Vera Symptoms

- Systemic symptoms of polycythemia vera:
 - Headache
 - Pruritus (Itching)
 - Exacerbated by heat (showering or exercising) due to the increased amount of histamine found within the red blood cells
 - Fatigue
 - Weight loss

Polycythemia Vera in the Retina

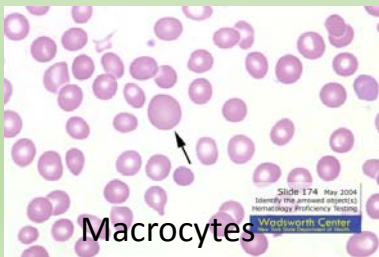


<http://imagebank.asrs.org/file/13877/polycythemia>

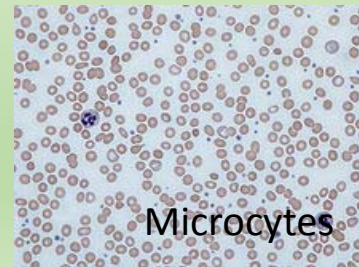
One ocular sign of polycythemia vera is a retinal vein occlusion

Mean Corpuscular Volume (MCV)

- The average **size** of red blood cells is measured by the MCV.
- Low MCV can indicate that the patient has iron deficiency anemia
 - Other causes: recent blood loss, poor bone marrow function
- High MCV indicates macrocytic anemia



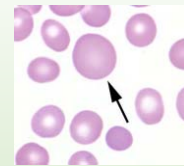
Macrocytes



Microcytes

Macrocytic Anemia

- Folic Acid Deficiency
 - Folic acid is needed for proper DNA synthesis.
 - If absent, RBCs, platelets and WBCs grow too quickly, do not divide when they should and end up too large in size.
- Vitamin B12 Deficiency
 - Vitamin B12 aids folic acid in DNA synthesis
 - Can be dietary (usually found in animal products)
 - Pernicious anemia isn't dietary, but rather results from lack of intrinsic factor in the stomach to absorb the B12
 - autoimmune/ chronic stomach inflammation



Detecting Vitamin B12 Deficiency

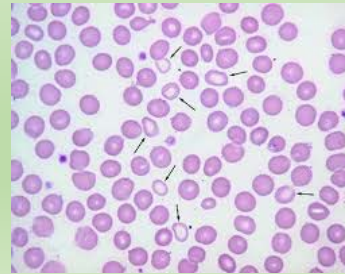
- B12/ folate Levels:
 - Can confirm the cause of anemia as B12 deficiency
- MMA (Methylmalonic acid) test:
 - Early detection/ mild case of Vit B12 deficiency
 - The level of this substance is higher in people with vitamin B-12 deficiency.
 - Might have seen this as a test for newborns to check for a rare metabolic disorder (heel-stick)

Testing for Pernicious Anemia

- Antibody testing:
 - Antibodies to intrinsic factor, which would indicate pernicious anemia.
 - Antibodies to parietal cells, which would also indicate pernicious anemia, as parietal cells make intrinsic factor
- Gastrin
 - Increased levels of this hormone that regulates stomach acid production is often seen in pernicious anemia
- Schilling test: no longer available.

Mean Corpuscular Hemoglobin (MCH)

- The MCH is a test of the **mass of the hemoglobin** present in an average red blood cell.
- Both low (hypochromic) and high (hyperchromic) MCH values can be consistent with anemia.
 - Hyperchromic anemias: folic acid or vitamin B12 deficiency.
 - Hypochromic anemias: iron deficiency and thalassemia



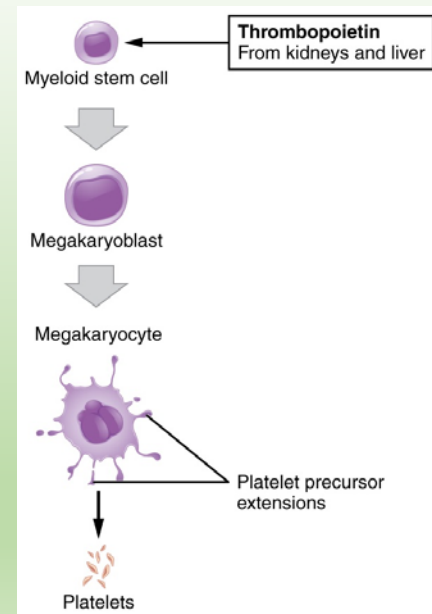
<http://www.lookfordiagnosis.com>

Platelet Count (PLT)

- Platelets are necessary for **blood clotting** and repairing damaged blood vessels.
- High count from: chronic bleeding such as with gastric ulcers, in patients who smoke, or those with leukemia.

Platelet Count cont.

- Low count from:
 - Blood loss
 - Anticoagulant medication, i.e. Warfarin (Coumadin)
 - Autoimmune-thrombocytopenia (destruction of RBCs)
 - Also in: enlarged spleen, septicemia, bone marrow failure due to leukemia, or myelofibrosis



Mean Platelet Volume (MPV)

- The MPV tells the clinician the **average volume of the platelets** in a patient's bloodstream.
- Decreased MPV is consistent with diseases like aplastic anemia.
 - Recent research has shown that a low MPV can also be associated with inflammatory bowel diseases.
- MPV may be an independent risk factor for transient ischemic attack, stroke, and myocardial infarction
 - MPV is always elevated
 - Consider in addition to a carotid duplex ultrasound

Idiopathic thrombocytopenic purpura

- A blood disorder found in young children, two to four years old
 - A more chronic form of this condition can also occur
- Blood clots form in small caliber vessels in the body and use up the **free floating platelets** in the blood stream
- The cause of this disorder is unknown, but many children have a prior viral infection
- Bleeding and bruising are common
- This condition often will spontaneously go into remission

Ocular Thrombocytopenic purpura

- Subconjunctival hemorrhage can be the **first sign** of the condition
- Retinal Findings:
Pre, sub and intra-retinal hemorrhages, cotton wool spots
- In rare cases, central retinal vein occlusions and serous retinal detachments have been reported



Complete Blood Count Component	Normal Adult Value
Red Blood Cell (RBC) Count	Men: 4.7-6.1 million cells/uL Women: 4.2-5.4 million cells/uL
Hemoglobin (Hgb)	Men: 14-18g/dL or 8.7-11.2 mmol/L Women: 12-16 g/dL or 7.4-9.9 mmol/L
Hematocrit (HCT)	Men: 42-52% Women: 37-47 %
Mean Corpuscular Volume (MCV)	80-90 fL (femtoliters/ μ 3)
Mean Corpuscular Hemoglobin (MCH)	27-31 picograms (pg)
Platelet Count (PLT)	150,000- 400,000 platelets/mm3
Mean Platelet Volume (MPV)	7-11 fL (femtoliters)
White Blood Cell (WBC) Count	Men: 5,000-10,000 wbc/mcL3 Women:4,500-11,000 wbc/ mcL3

Example CBC Print-Out

Test Name	Accession	Specimen	Physician	Collected	Received	PL
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	Result			Units	Reference	
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Mean Platelet Volume	7.9 L			fL	8.0-13.0	

How to interpret the Red Cells

- Low RBC/Hgb/HCT suggest anemia
 - The type of anemia can be narrowed down by looking
 - MCV : low= iron, high = folic acid/Vit B12 deficiency
 - MCH: hyperchromic= iron, hypochromic= folic acid/Vit B12 deficiency
- High values of RBC/Hgb/HCT suggest polycythemia vera
- Abnormal platelets can be of concern:
 - Children- think of idiopathic thrombocytopenic purpura
 - Low for adults- check meds and history of inflammatory bowel disease
 - High for adults- look for risks for cardiovascular disease- occlusions could be eminent

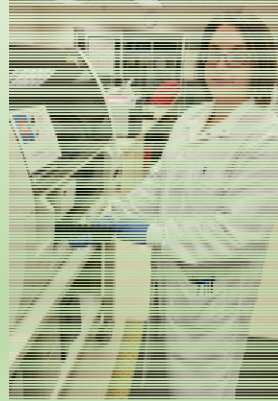
White Blood Cell Count (WBC)

- WBC count is the **number of leukocytes** per cubic millimeter (mm³ or μL).
- A low count = leukopenia
- A high count = Infection, Leukemia (bone cancer)
- Just an overall number isn't very helpful though- we need more

What's the Diff?

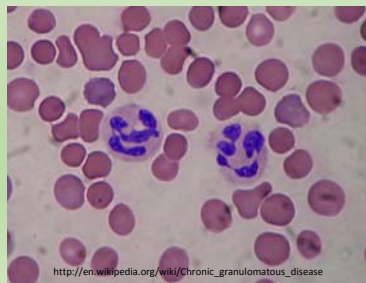
- Differential blood count (Diff) divides white blood cells into five different types. They are (in order of incidence):

1. Neutrophils
2. Lymphocytes
3. Monocytes
4. Eosinophils
5. Basophils



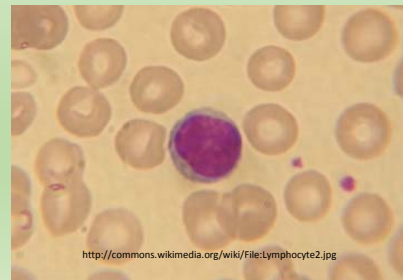
Neutrophils

- “Vacuum cleaner” WBC: by phagocytizing microorganisms or particles
- A higher than normal count = bacterial infection
 - Also from arthritis, surgery, trauma, or myocardial infarction
 - Myeloproliferative disorders are a less likely cause



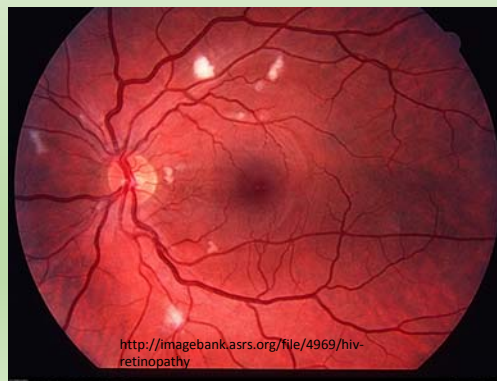
Lymphocytes

- **Help antibodies bind** to pathogens to coordinate the immune response.
- They come in three varieties: Cytotoxic (“Killer”), T-cells and B-cells.
- Expect higher count in: viral infections, active allergies and toxic reactions like food poisoning.



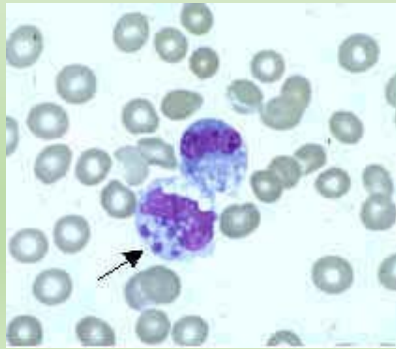
Ocular Signs of HIV

- The lymphocyte count will be depressed in HIV positive patients, as the disease selectively attacks and destroys the Helper T-cells.
 - Isolated retinal cotton wool spots can be seen in HIV infection.



Monocytes

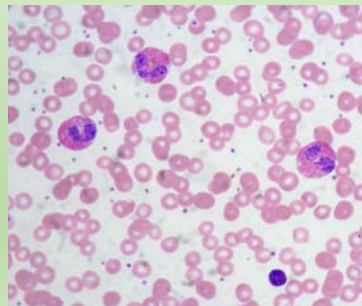
- Fight infection by **phagocytizing dead or damaged cells** and pathogens not fought off by neutrophils or leukocytes.
- A high count can indicate systemic bacteria, as in septicemia or mononucleosis



<http://commons.wikimedia.org/wiki/File:Echaff.jpg>

Eosinophils

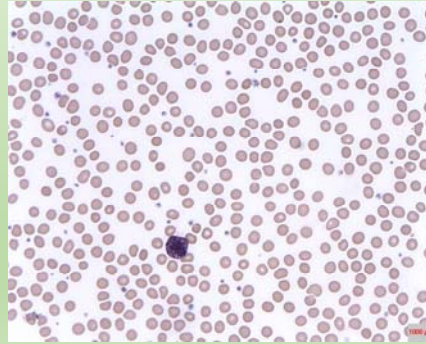
- Seen in response to: parasitic infections, allergies, collagen vascular disease, other extensive skin diseases, as well as Addison's disease.
- An increased in eosinophils is called eosinophilia.








http://commons.wikimedia.org/wiki/File:Eosinophils_in_peripheral_blood.jpg

Basophils

- Brings about **allergic response** to antigens, mainly by releasing histamine to cause inflammation.



http://commons.wikimedia.org/wiki/File:A_type_of_white_cell_%28Basophil%29.jpg

White Blood Cell Type	Normal Values	% of total WBC count	Appearance
Neutrophil	48 -80 ^k / mm ³	40% to 60%	
Lymphocyte	21-47 ^k / mm ³	20% to 40%	
Monocyte	4 -8 ^k / mm ³	2% to 8%	
Eosinophils	0-0.70 ^k / mm ³	1% to 4%	
Basophils	0-0.20 ^k / mm ³	0.5-1%	

How to interpret white cells

- Overall high count indicates infection/ leukemia
1. Neutrophils= bacteria
 2. Lymphocytes= viral
 3. Monocytes= supportive of bacterial or viral
 4. Eosinophils= parasite
 5. Basophils= allergy

Ocular Signs of Leukemia

- White-centered retinal hemorrhages (Roth Spots)
 - Flame hemorrhages
 - Mid-peripheral retinal hemorrhages
-
- What other conditions have similar signs?

Differential			
Scan Indicates Auto	Perform Manual Diff		
Diff OK			
Neutrophil Percent	30	%	38.0-70.0
Absolute Neutrophil	1.35 L	10E3/uL	1.80-7.00
Count			
Band Percent	3	%	0.0-8.0
Absolute Band Count	0.14	10E3/uL	0.00-0.20
Lymph Percent	44	%	21.0-49.0
Absolute Lymph	1.98	10E3/uL	1.00-3.40
Count			
Atypical Lymph	5	%	0.0-6.0
Percent			
Absolute Atypical	0.23	10E3/uL	0.00-0.66
Lymph Count			
Monocyte Percent	13	%	3.0-11.0
Absolute Monocyte	0.59	10E3/uL	0.00-0.80
Count			
Eosinophil Percent	4	%	0.0-7.0
Absolute Eosinophil	0.18	10E3/uL	0.00-0.50
Count			
Basophil Percent	1	%	0.0-1.0
Absolute Basophil	0.05	10E3/uL	0.00-0.20
Count			
PLT Morphology	Few Large Platelets		Normal
PLT Adequacy	Decreased		Adequate
RBC Morphology	2+ (25-50%) Anisocytosis 2+ (25-50%) Microcytes (1)		Normal
WBC Morphology	Agranulation		Normal
Normalized Cell	100		

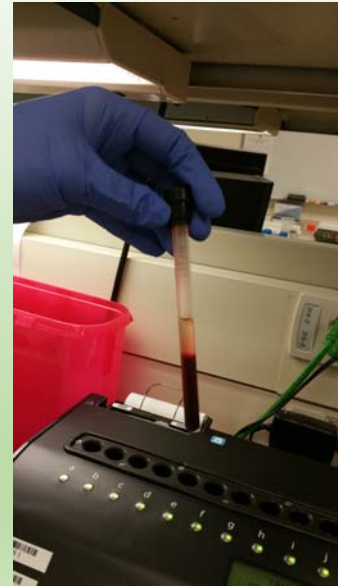
Differential Laboratory Print-Out

Erythrocyte Sedimentation Rate (ESR or sed rate)

- Abnormal blood plasma proteins from inflammatory disease stick to red blood cells and cause them to settle to the bottom of a blood sample more quickly.
- The height of the RBC's, in mm, settled out of plasma per hour
- The ESR test has **excellent sensitivity but low specificity**.
 - Detects even subtle inflammation,
 - Can not tell the clinician *which* disease state is responsible

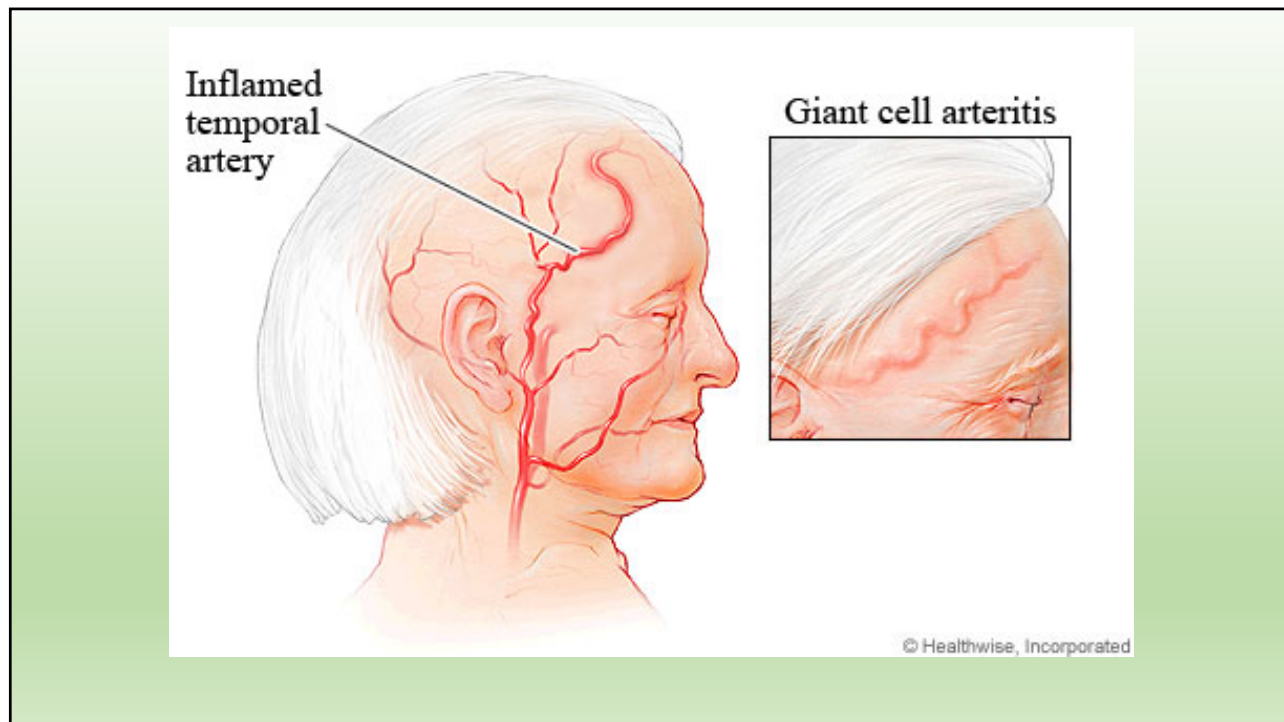
ESR continued

- ESR is elevated in inflammatory conditions:
 - Systemic lupus erythematosus
 - Rheumatoid arthritis
 - Tuberculosis
 - Myocardial infarction
 - Polymyalgia rheumatica
 - Hepatitis C
 - Giant cell arteritis (GCA)



ESR and GCA

- If the patient is a suspect for Giant Cell Arteritis, the first blood test the clinician usually orders is an ESR
- Signs and symptoms of GCA include: optic neuritis, positive afferent pupillary defect, vision loss, temporal headache, jaw claudication (muscular pain when chewing) and scalp tenderness.
- A temporal artery biopsy should also be immediately ordered if temporal arteritis is suspected. The biopsy may be ordered while lab results are being processed.

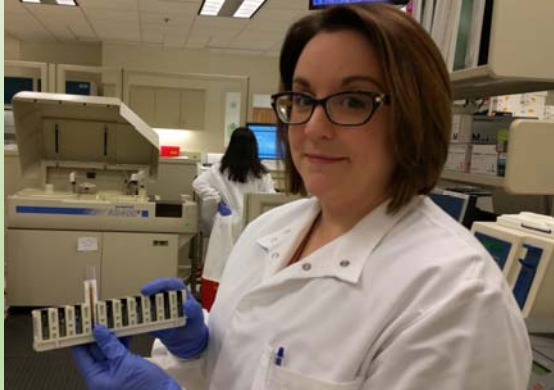


ESR Interpretation

- The maximum normal ESR for men = patient's age/2
- The normal maximum ESR for women = $(\text{age} + 10)/2$
- A sedimentation rate greater than 50 mm/hr is suggestive of inflammation.
- **Always order a CBC with an ESR**
 - Anemia can falsely increase the ESR

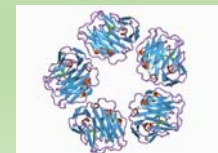
Non- hematologic studies to order alongside the ESR

- CRP
- Lp-PLA₂



C- Reactive Protein (CRP)

- A plasma protein rises dramatically in systemic inflammation
- Also elevated in: stress, trauma, surgery, secondary infections from neoplastic conditions, or myocardial infarction
- Used to check for inflammatory flare-ups, or to monitor the effectivity of a specific treatment regimen
 - Note that the CRP level is not always elevated by inflammation, thus this test has some false negatives
- *It's faster than an ESR!*



http://en.wikipedia.org/wiki/C-reactive_protein

High-Sensitivity CRP (hs-CRP)

- Elevated CRP levels have been associated with increased risk for diabetes, hypertension and cardiovascular disease
- A particular sub-category, hs-CRP, is used to determine this risk for cardiovascular disease. It measures lower levels of CRP
 - hs-CRP levels of less than 1mg/L are considered low risk
 - hs-CRP levels of greater than 3mg/L are considered high risk

High-Sensitivity CRP (hs-CRP)

- The role of CRP in coronary artery disease is still being investigated. It is possible that the CRP is not merely a marker of inflammation, but also plays an active role in inflammatory disease
- This test is usually ordered in conjunction with cholesterol, diabetic testing, and blood pressure measurements, as it is one small piece of the cardiovascular picture.

Lipoprotein-associated Phospholipase A₂ (Lp-PLA₂)

- A newer test, Lipoprotein-associated Phospholipase A₂ (Lp-PLA₂) is an inflammatory marker **specific to cardiovascular disease**.
- It's an enzyme that has been identified in the inflammation of blood vessels.
- In cases where CRP would be elevated due to a chronic inflammatory condition, such as arthritis, Lp-PLA₂ could be incredibly useful to determine the true risk of cardiovascular disease.

Lipoprotein-associated Phospholipase A₂ (Lp-PLA₂)

- Elevated levels are correlated with increased risk of ischemic stroke and coronary heart disease.
- Ordered alongside lipid panels and blood pressure testing
- Not a test ordered in isolation

Back to GCA

- If you'd order an ESR, also consider
 - CRP (faster)
 - Lp-PLA₂ (specific to blood vessels)

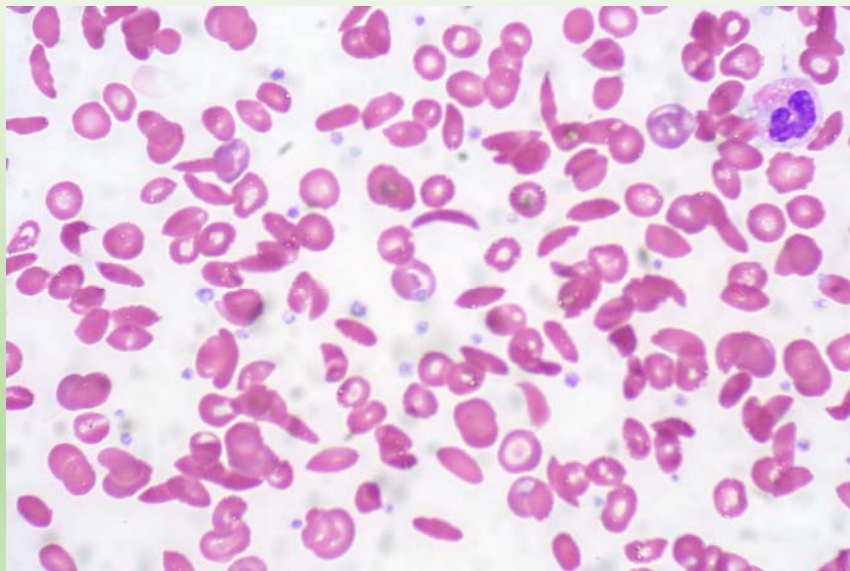
The One Condition that has it all...

- Sickle Cell Anemia
- Genetic conditions resulting in an abnormal hemoglobin molecule (HbS and/or HbC).
- Named "sickle cell" due to the abnormal sickle shape to the RBC.

Sickle Cell Anemia

- Sickle Cell will reflect in the entire CBC:
 - Hgb and HCT level is decreased
 - Platelet count is increased
 - Total leukocyte count is elevated with a predominance of neutrophils
 - ESR is low
- Peripheral blood smears demonstrate irregular red cell morphology

Sickle Cell Blood Smear/Morphology

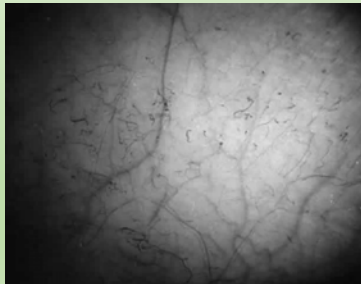


Sickle Cell Review

- Approximately 8% of African-Americans are heterozygous for the gene for Hb S, known as **sickle cell** trait (Hb AS).
- Systemic findings include:
 - Anemia
 - Organ infarcts in the lungs, spleen, kidney and liver
 - Severe pain in the limbs and trunk termed a pain “crisis”

Anterior Chamber findings of Sickle Cell

- Conjunctival sign: dilated, truncated and interrupted vascular segments
- Iris: atrophy or neovascularization
- Anterior chamber: hyphema more common with ocular trauma

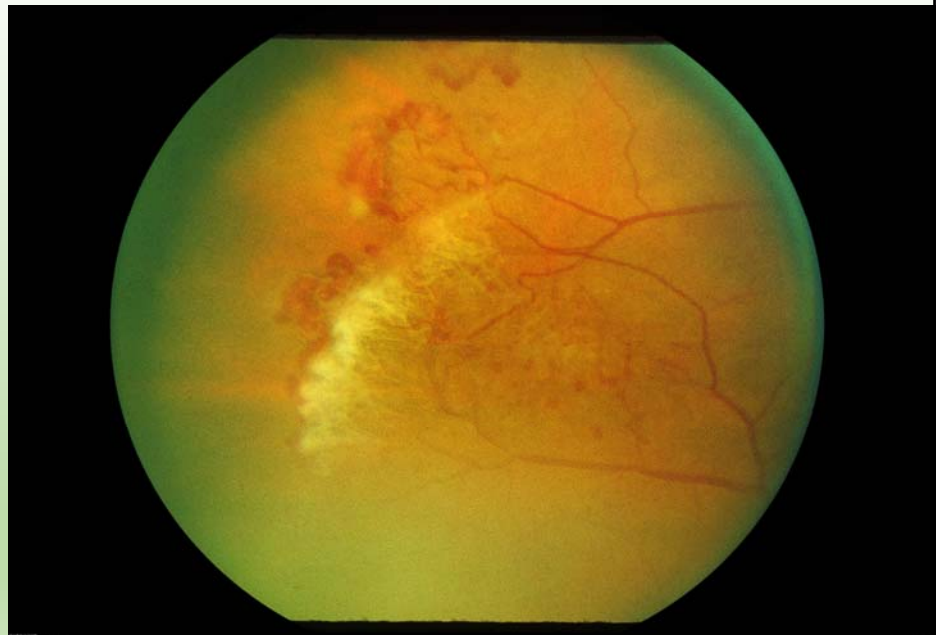


<http://www.eyecalcs.com/DWAN/pages/v3/ch017/001f.html>

Posterior Chamber Sickle Cell

- Optic nerve: multiple comma-shaped vascular segments at the disc
- Retinal Vasculature: tortuosity, artery/vein occlusions
- Retina/Macula: angioid streaks, ERM, larger FAZ, MA-like dots, salmon-patch hemorrhages, retinal breaks/detachments
- Sea-fan anastomosis: Occlusion of the terminal arterioles redirects the blood to the nearest venules. These anastomoses form between the perfused and non-perfused retina.
 - Dilated pre-existing capillaries vs. neo, since they do not leak on fluorescein angiography

Sickle Cell Sea Fan



<http://imagebank.asrs.org/file/18293/sickle-cell-sea-fan-retinopathy>

Case Example 1

- 24 yowf presents with a the cc of needing a renewed CL Rx
 - Happy with current Rx, no dryness, in daily contact lenses
- POHx: mild myopia (-2.00 DS)
- FOHx: MGM glaucoma
- PMHx:
 - Tension HA controlled with ibuprofen PRN
 - Oral contraceptive
 - Very fatigued lately, but did start a new job
 - Vegan diet

Case 1 Exam Findings

- BCVA= 20/20 OD, OS
- EOM, CVF= normal
- Pupils: PERRL (-)APD
- Ant seg: trace conjunctival injection 360[^], ghost vessels at 3:00 OD
- Posterior Segment
 - OD: 6 White centered hemorrhages in the posterior pole
 - OS: 7 White centered hemorrhages in the posterior pole

Case 1
Example
Image



Case 1 in-office testing

- Blood pressure= 120/86mmHg RAS
- Blood sugar= 90mg/dL

Medical Laboratory Testing

- Which tests should I order?

Complete Blood Count Component	Patent Values		Normal Adult Value
Red Blood Cell (RBC) Count	3.0 million cells/uL	L	Women: 4.2-5.4 million cells/uL
Hemoglobin (Hgb)	10 g/dL	L	Women: 12-16 g/dL or 7.4-9.9 mmol/L
Hematocrit (HCT)	30%	L	Women: 37-47 %
Mean Corpuscular Volume (MCV)	100 fL	H	80-90 fL (femtoliters/ μ 3)
Mean Corpuscular Hemoglobin (MCH)	35 pg	H	27-31 picograms (pg)
Platelet Count (PLT)	100,000 platelets/mm ³	L	150,000- 400,000 platelets/mm ³
White Blood Cell (WBC) Count	3,500 wbc/mcL3	L	Women:4,500-11,000 wbc/ mcL3

The Results

- The lower levels of RBC, Hgb, HCT point to **anemia**
- The elevated MCV and MCH show a macrocytic, hyperchromic type
- This vegan patient has a **dietary Vit B12 deficiency**
- This was confirmed with lower serum B12 levels, but no antibodies to intrinsic factor/parietal cells

A more serious Case

Complete Blood Count Component	Patent Values		Normal Adult Value
Red Blood Cell (RBC) Count	1.33 million cells/uL	L	Women: 4.2-5.4 million cells/uL
Hemoglobin (Hgb)	5.5 g/dL	L	Women: 12-16 g/dL or 7.4-9.9 mmol/L
Hematocrit (HCT)	16.5%	L	Women: 37-47 %
Mean Corpuscular Volume (MCV)	80 fL		80-90 fL (femtoliters/ μ 3)
Mean Corpuscular Hemoglobin (MCH)	28 pg		27-31 picograms (pg)
Platelet Count (PLT)	90,000 platelets/mm ³	L	150,000- 400,000 platelets/mm ³
White Blood Cell (WBC) Count	80,000 wbc/mcL3	H	Women: 4,500-11,000 wbc/ mcL3
Neutrophil	45 ^k / mm ³	L	48 -80 ^k / mm ³

The Results

- The abnormally **high** values of the **WBC** count are telling.
- This patient has **AML (Acute Myelogenous Leukemia)**
- That would also account for the anemic WBC profile and neutropenia

Hematology and the Eye Reminders

- Unexplained hemorrhages in the eye could point to hematological disorder
- A CBC should always be ordered with a differential
- Anemia can have a variety of causes including vitamin deficiency
- ESR is no longer used alone for testing for generalized inflammation: CRP, hsCRP and Lp-PLA₂ can give lend an over-all better picture

New Medical Laboratory Testing in the OD Office for Ocular Surface Disease

Tracy Doll, O.D., F.A.A.O.
Pacific University College of Optometry
Pacific Dry Eye Solutions Coordinator

No More Paper and String

- Tear Lab
- InflammADry
- Sjo Test

- Great tests to run in the event that the cause of ocular dryness symptoms is suspected to be from causes other than evaporative/ MGD based or the etiology isn't clear

Tear Lab

- Higher levels of osmolarity in the tear-film and/or unequal osmolarity between eyes has been correlated with dry eye symptoms
 - >308mOsm/L and/or
 - >8mOsm/L between eyes



- Need CLIA certification
- Covered by Medicare and most insurances- a billable diagnostic test for dry eye
- Recommended in conjunction with other testing



InflammDry

- Picks up the presence of the inflammatory marker MMP-9
- MMP-9 is specific to the ocular surface only eye only
- Is diagnostic of **inflammatory**-related dry-eye
- Does not vary with tear-film level
 - Can be done at any time during exam
- Covered by most insurances
- Must obtain CLIA certification for this test
- Recommended as a partner to TearLab



Sjo Test

- Blood test to check for markers in the blood that are correlated with Sjogrens Syndrome
 - Will also pick-up on RA...
- No CLIA certification needed
- Depending on insurance the patient will either have the test done:
 - In a centralized lab (LabCorp)
 - The OD can perform the test in-office
 - Bill in-office medical visit code
 - Medical Lab bills patient directly



Sjo Test

- 89% cumulative sensitivity and 78.2% specificity
- New proprietary markers aimed at early disease detection
 - Salivary Protein-1 (SP-1)
 - Carbonic Anhydrase-6, (CA-6)
 - Parotid Secretory Protein (PSP)
- Includes the classic biomarker of ANA, as ANA itself will test positive in 70% of patients



Source: <http://www.monstermarketplace.com/chemical-lab-equipment-and-accessories/arrayit-whatman-ge-healthcare-903-protein-saver-cards>

Questions?

By Amiee Ho, O.D.
Homecoming CE
Pacific University
10/03/15

Outline

- Introduction
- Impact of diabetes on the cornea
- Treatment
- Risk factors
- Differential diagnosis
- Complications
- Summary

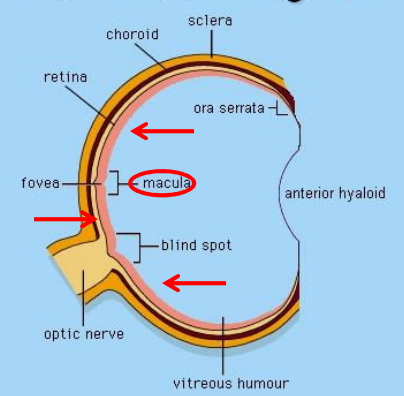
Outline

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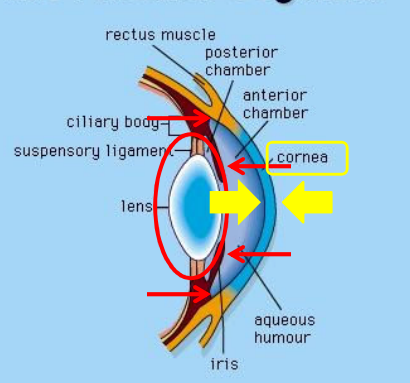
3

Diabetes and The Eyes

The Posterior Segment



The Anterior Segment



4

We need to pay attention to cornea for DM patients because.....



Diabetes can lead to corneal disease or Diabetic Keratopathy!!

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History of DK

•Published: "Diabetic Keratopathy"

1858
Francois

- Cornea/anterior segment abnormalities
- Delayed wound healing
- ↑ risk of infection

1981
Richard Schultz

1850 **1900** **1950** **2000**

•Published: comprehensive review on DK
•Focus: pathopneumonic forms of DK used for early diagnosis

1967
Collier

6

Epidemiology of DK

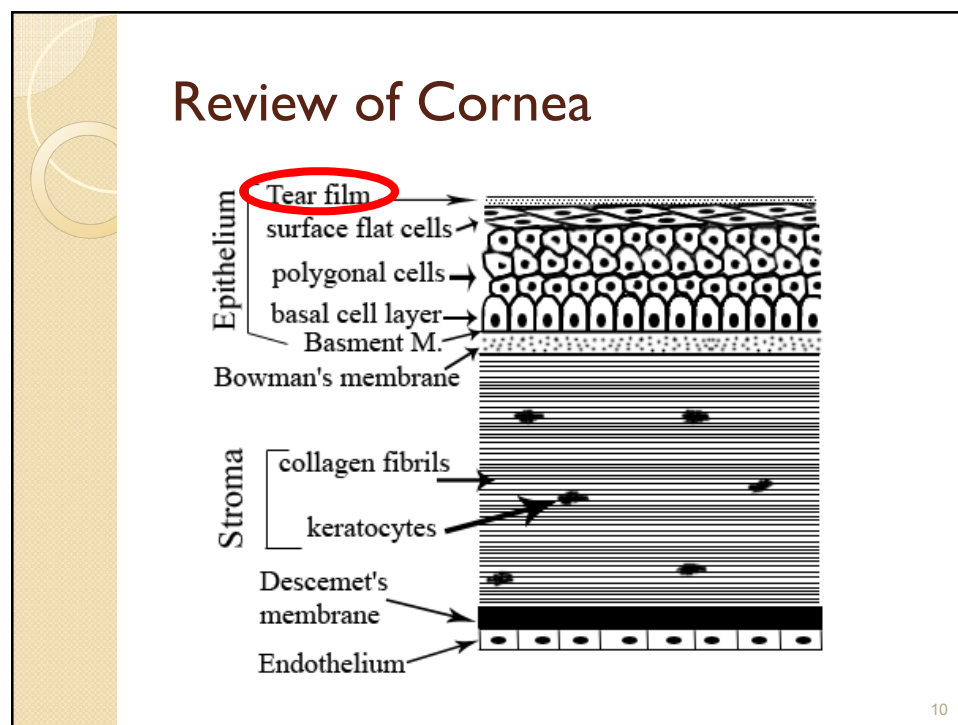
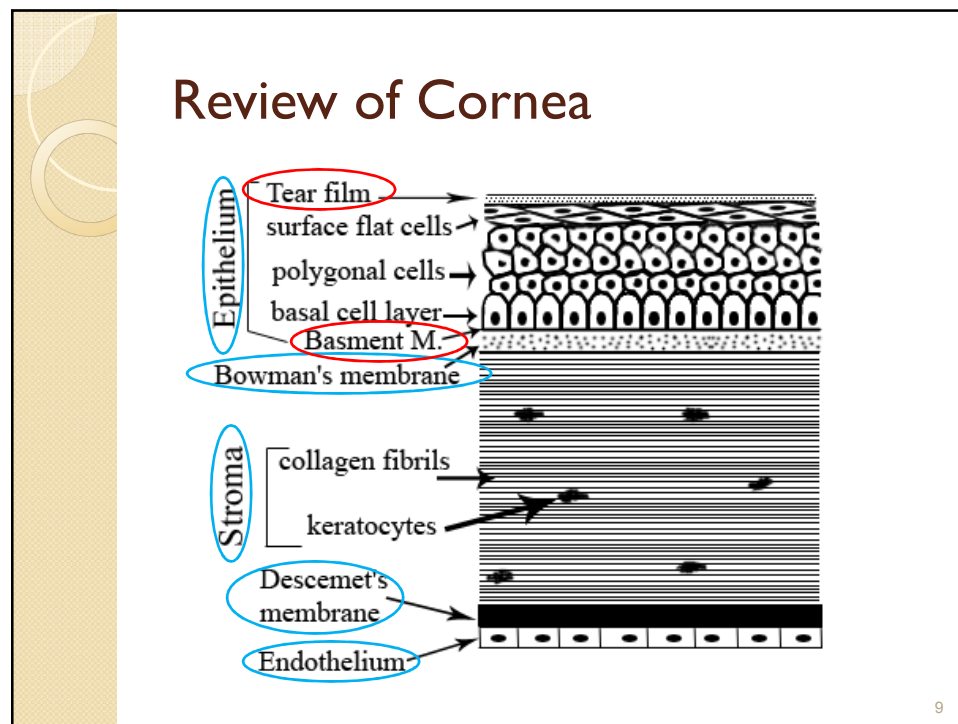
- DK Prevalence estimations:
 - ~1/3 of patients with DM (Rao, Ioli)
 - ~47-64% (Schultz, 1981)
 - Epithelial lesions: ~2/3 (Rao)
- DK is believed to have **high incidence**:
 - Rarely diagnosed (Wylegala)
 - Underreported (Kaji)
 - Overlooked
 - Not considered serious or pathological (Kaji)
 - Difficult confirming changes are only due to DM


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Outline

- Introduction
- Impact of diabetes on the cornea
 - Pre-corneal tear film
 - Epithelium (& basement membrane)
 - Stroma
 - Endothelium
 - Corneal nerves
- Treatment
- Risk factors
- Differential diagnosis
- Complications
- Summary

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FrillyCulias.com

Oops!

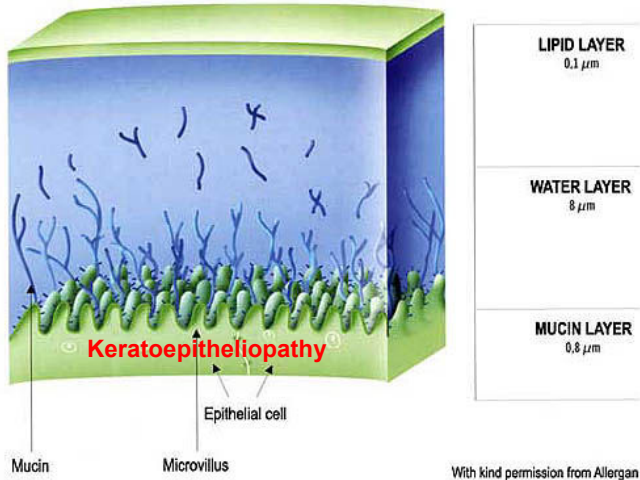
Tear Gas

THE PRE-CORNEAL TEAR FILM

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Tear Film Review

TEAR FILM



LIPID LAYER
0.1 μm

WATER LAYER
8 μm

MUCIN LAYER
0.8 μm

Mucin

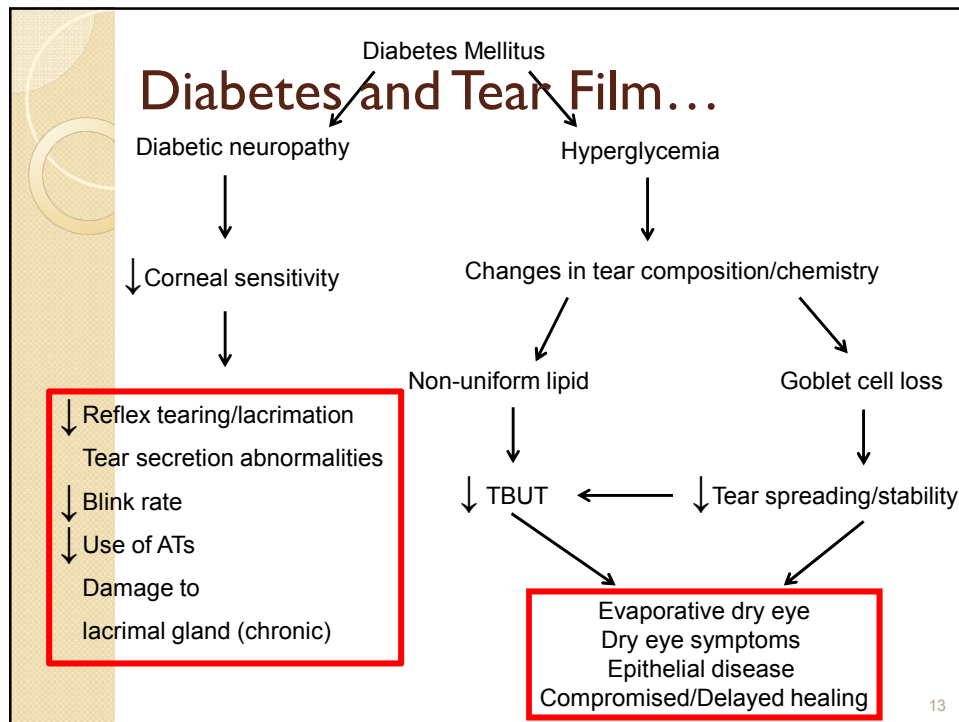
Microvillus

Epithelial cell

Keratoepitheliopathy

With kind permission from Allergan

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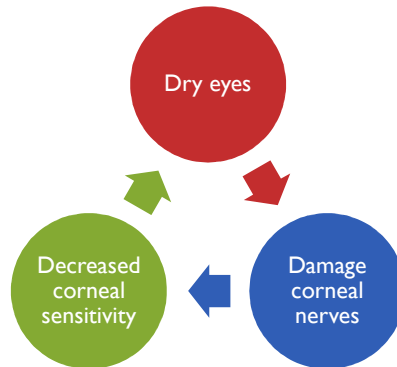
Facts about Diabetes & Tear Film...

- **What some studies are finding!**
- A healthy lipid layer reduces the rate of evaporation by 90-95% (Tasman)
- TBUT “in nearly all diabetics tested was found to be less than 10 seconds, a finding only seen in 5.8% of controls” (Seifart)
- ↓TBUT values correlate with “peripheral neuropathy and poorly controlled disease” (Dogru)

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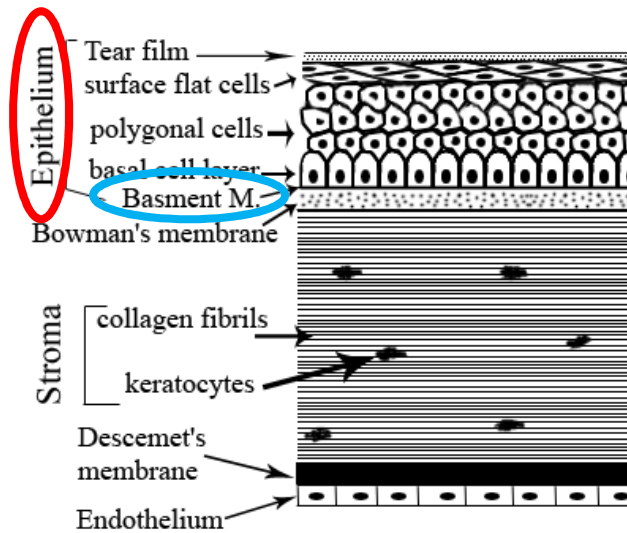
Take home point

- Diabetes can reduce the effectiveness of tear film by altering structure and function causing....

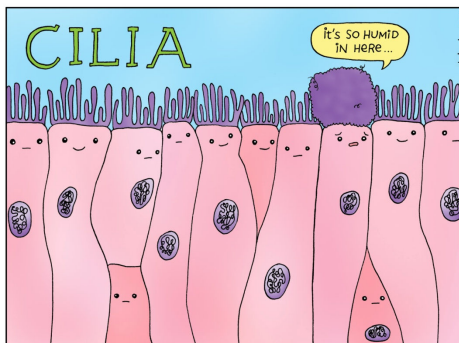


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Review of Cornea



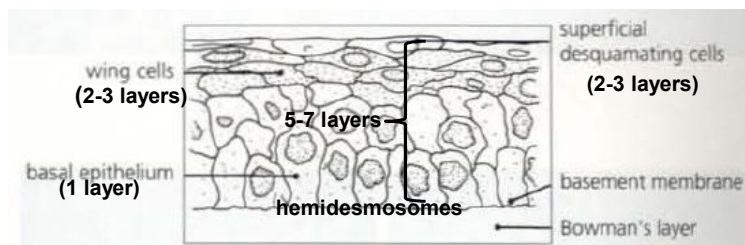
16



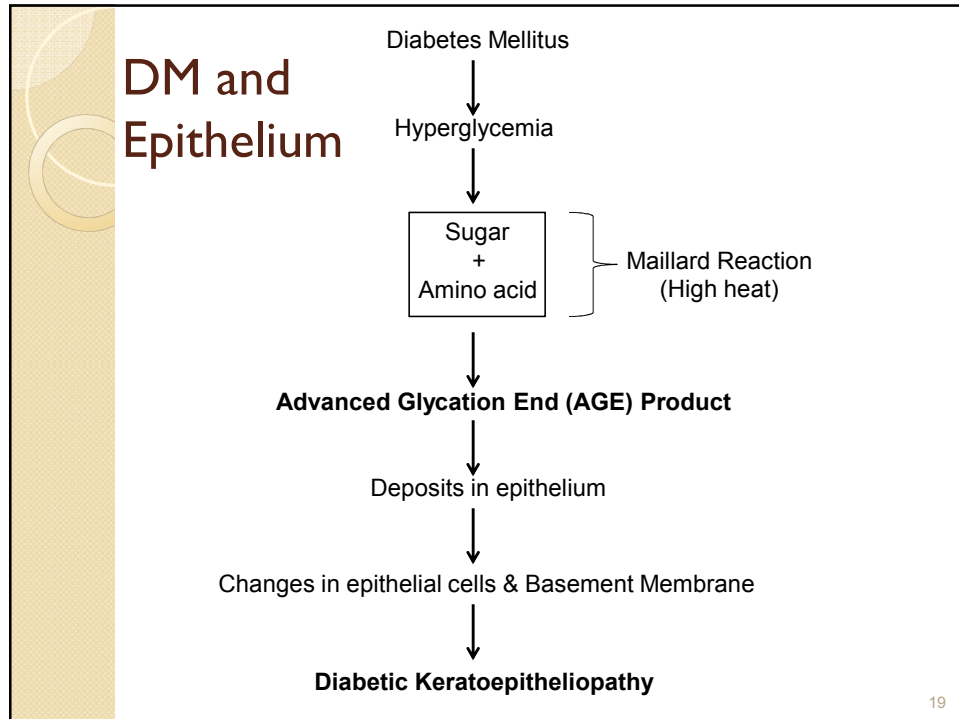
CORNEAL EPITHELIUM & BASEMENT MEMBRANE

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Review of Epithelium



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Diabetic Keratoepitheliopathy

Signs/Symptoms:

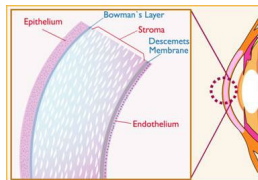
- **Recurrent corneal erosion** (Owen, Perry, Herse, Schultz 1981, 1984, Sato, Abdelkader)
- **Slower wound repair** (Hatchell, Herse, Sato)
- **Delayed reepitheliazation** (Kaji)
- **SPK/Persistent epithelial defects** (Herse, Owen, Schultz 1984)
- **Increased epithelial fragility** (Herse, Abdelkader)
- **↑ risk of infection (i.e. fungal keratitis)**
- **↓ defense properties and barrier functions → edema** (Gobbels, Yokoi, Gekka, Perry, Sato)
 - **5.4x's more permeable to water/ionic substances** (Gobbels)

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Diabetes and Epithelium

- **Is AGE only in epithelium?**

- Gradient of AGE: >epithelium
 - Metabolism is mostly dependent on the aqueous humor (Zou)
- ↑expression of AGE productions, AGE receptors, and transcription factor nuclear factor kappa-B (NF-κB) in the lacrimal glands (Alves)



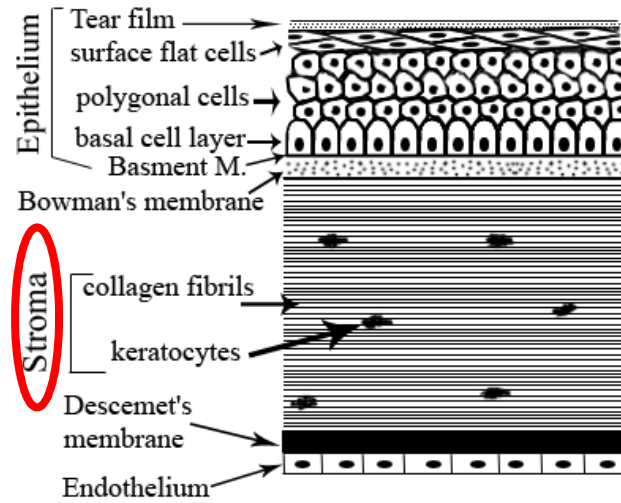
21

Take home point

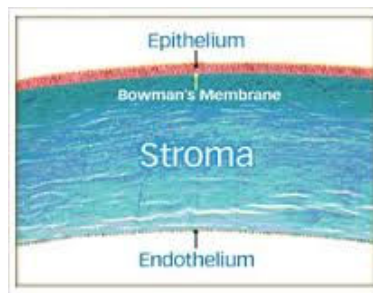
- Diabetes can produce excess AGE products that deposit in the epithelium altering structure and function causing **Diabetic Keratoepitheliopathy**

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Review of Cornea



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Bypass Bowman's Layer and onto...

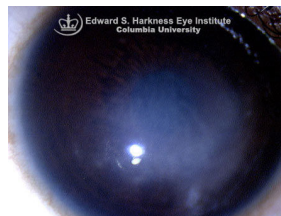
CORNEAL STROMA

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Corneal Stroma

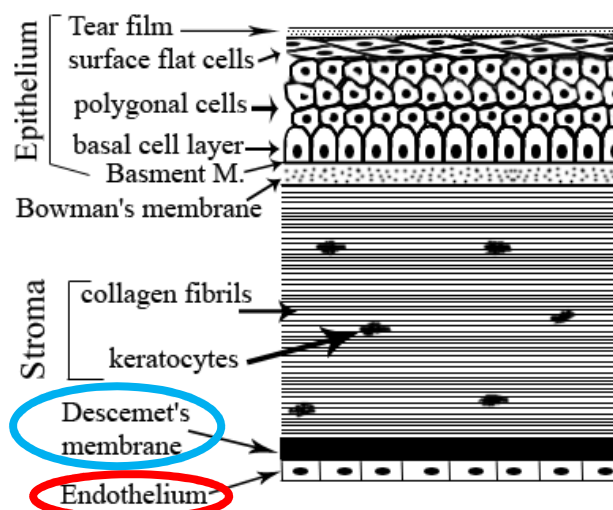
Signs/Symptoms:

- Wide spaced collagen fibril matrix → ↓ transparency (Rehany)
- Transient stromal edema (Herse)
- Corneal lattice degeneration (Herse)
- Various forms of keratitis (Herse)
- Stromal ulceration/melting/perforation (Adbelkader, Lockwood)
- Stromal scarring (Adbelkader, Lockwood)

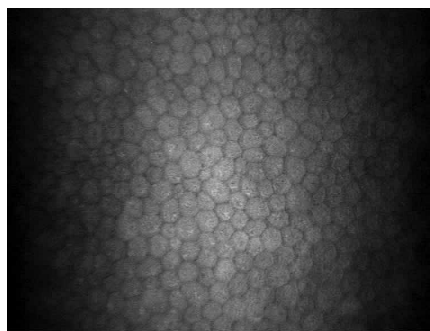


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Review of Cornea



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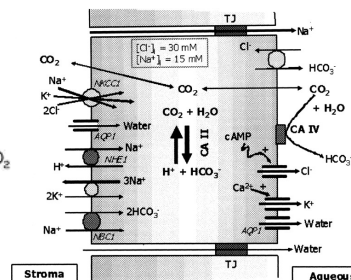
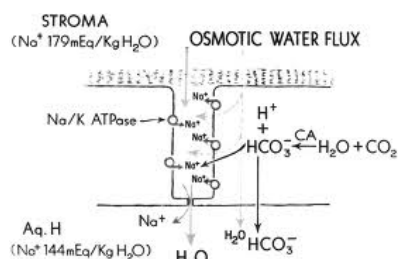
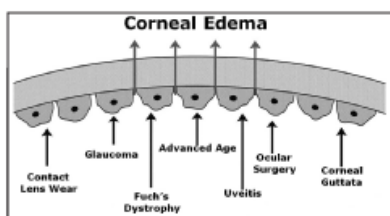


Endothelium

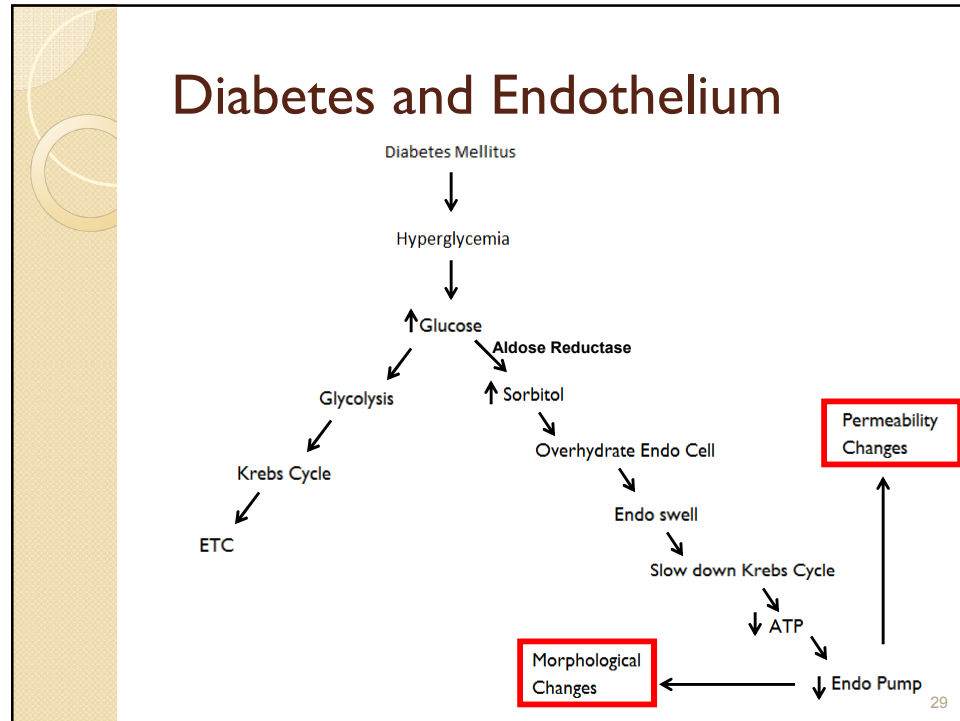
CORNEAL ENDOTHELUM

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Review of Endothelium



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Diabetes and Endothelium

Signs/Symptoms:

- Morphology (Structure)
 - Cell density
 - Pleomorphism (shape)
 - Polymegathism (size)
- Permeability (Function)
 - Pump function → **corneal thickness**
 - “May be one of the **earliest** changes detectable in the diabetic eye” (Busted)
 - Associated with “increased HbA1c and blood glucose levels, and severe retinal complications” (Busted, Su DHW)
- Descemet’s membrane:
 - Wrinkling of descemet’s membrane (Herse, Henkind)
 - Females more prone (Herse)

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Comparing Endothelial Changes

Review of Literature comparing Corneal Endothelial Parameters in Various Published Studies

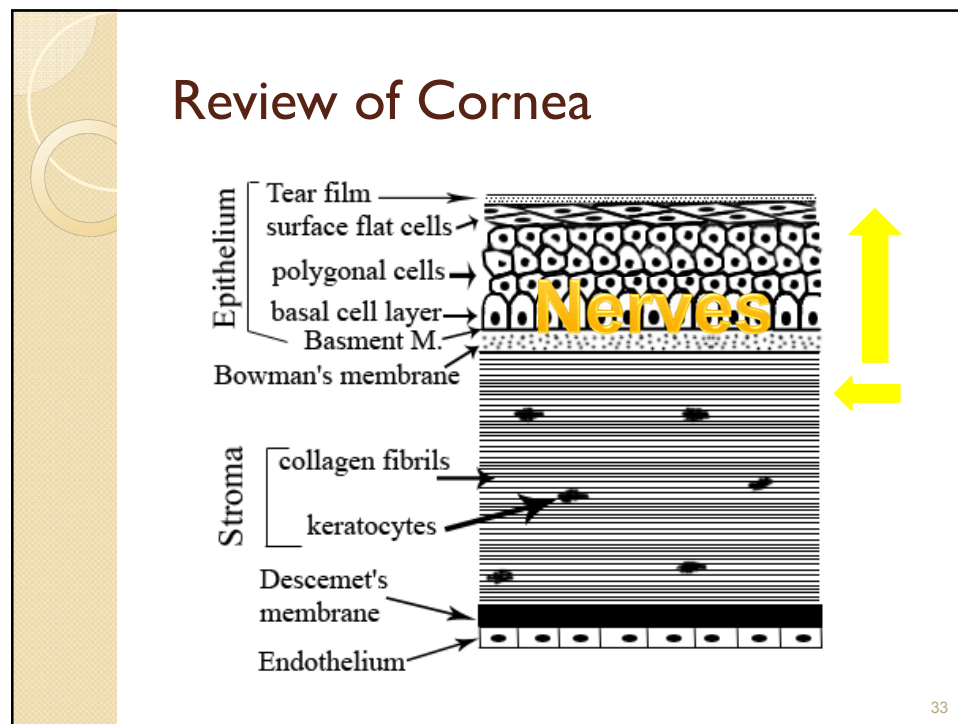
Study	Type of DM	# of subjects Cases/controls	Cell Density	Hexagonality	CV of cell size	Pachymetry
	Type 1	17/23	Decreased	NA	NA	NA
Itoi et al	NA	69/53	No difference	Decreased	Increased	NA
Matsuda et al	Type 2	70/30	No difference	Decreased	Increased	NA
Larsson et al	Type 2	49/31	No difference	No difference	No difference	Increased
	Type 1	60/31	No difference	No difference	No difference	Increased
Roszkowska et al	Type 1 & 2	75/62	Decreased	Decreased	Increased	NA
Inoue et al	Type 2	99/97	Decreased	No difference	Increased	No difference
Shenoy et al	Type 2	110/110	Decreased	Decreased	Increased	NA
Sudhir et al	Type 2	1191/120	Decreased	No difference	No difference	No difference

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Take home point

- Endothelium is the “**powerhouse**” of the cornea
- Diabetes can cause **irreversible, detrimental** changes to the structure and function of endo cells
- **Corneal thickness**
 - May be **earliest** indicator of diabetes affecting eyes
 - Associated with glucose fluctuations & severe retinal complications

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CORNEAL NERVES AND SENSITIVITY

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Review of Corneal Nerves

Epithelium
Bowman's layer
Stroma

Long posterior ciliary + anterior ciliary nerve
Ophthalmic division of trigeminal nerve

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Diabetes and Corneal Neuropathy

Diabetes Affects the Nerves

Blood vessel — Nerve

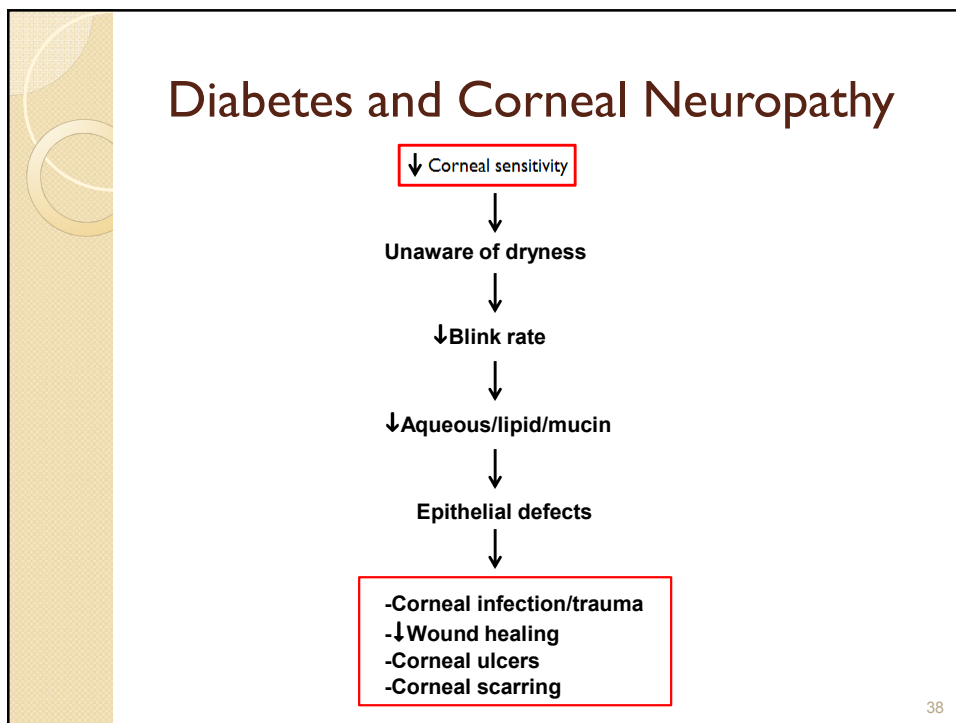
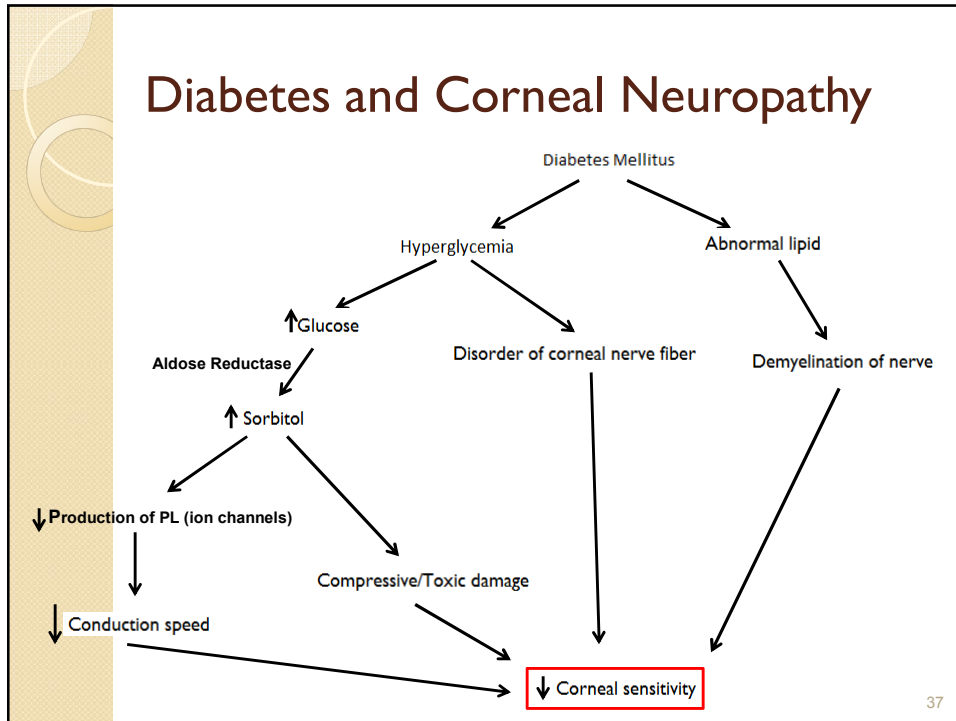
Normal

Diseased blood vessels

Nerves shrivel when blood vessels disappear

- ↓ Corneal sensation + severe retinopathy & longer disease duration (Schwartz, Saito)

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Stages of Diabetic Corneal Neuropathy

Stage 1

- Superficial/epithelial



Stage 2

- Epithelial breakdown



Stage 3

- Stromal involvement
- Ulcer/melting/perforation

(Adbelkader, Lockwood)

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Clinical advice: DK & Nerves

Course of nerve changes...

- Mild to moderate neuropathy
 - OBJECTIVE change in long nerve fiber bundles
- Severe neuropathy
 - SUBJECTIVE ↓Corneal sensitivity
- Sensitive instruments! (Rosenberg)

Clinical Pearl:

- Consider **diabetic corneal neuropathy** when pts develop unexplained corneal epithelial disease and ulcer
(Lockwood)

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Outline

- Introduction
- Impact of diabetes on the cornea
- **Treatment**
- Risk factors
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- Summary

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Treatment Options

- **Standard Treatments:**
 - Preservative free topical lubricants
 - Bandage contact lens
 - Patching
 - Tarsorrhaphy
 - Induced ptosis
 - Conjunctival flap
 - Topical antibiotic
 - Topical steroid

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Treatment Options

- **New Treatments:**

- Topical insulin-like growth factor-1 and substance P (E)
- Topical insulin (E) (H)
- Topical nerve growth factor (E) (I) (H) (S)
- Opioid growth factor (E) (S) (T)
- Aldose Reductase Inhibitors (ARI)
- Oral nicergoline (H)
- Oral aminoguanidine (AGE) (A)
- Oral goshajinkigan (ARI)

****KEY****

(A) – improving attachment of epi to basement MB
 (AGE) – inhibiting AGE formation
 (ARI) – Aldose Reductase Inhibitor/Sorbitol
 (E) – epithelial growth/migration
 (H) – epithelial healing
 (I) – ocular inflammation
 (S) – improving sensitivity
 (T) – normalizing tear production

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Risk factors

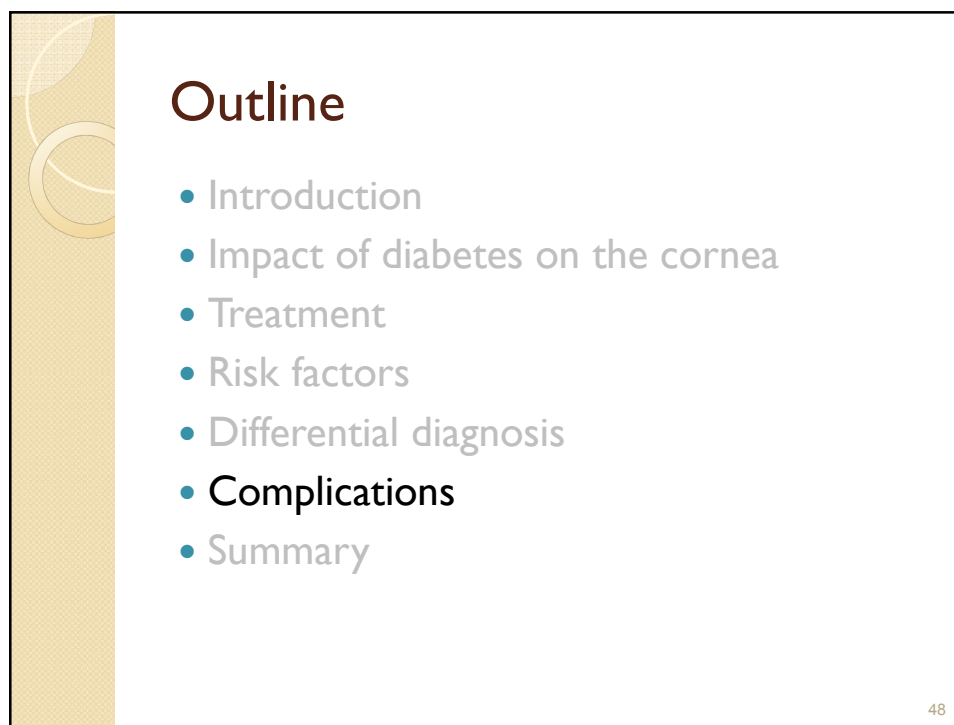
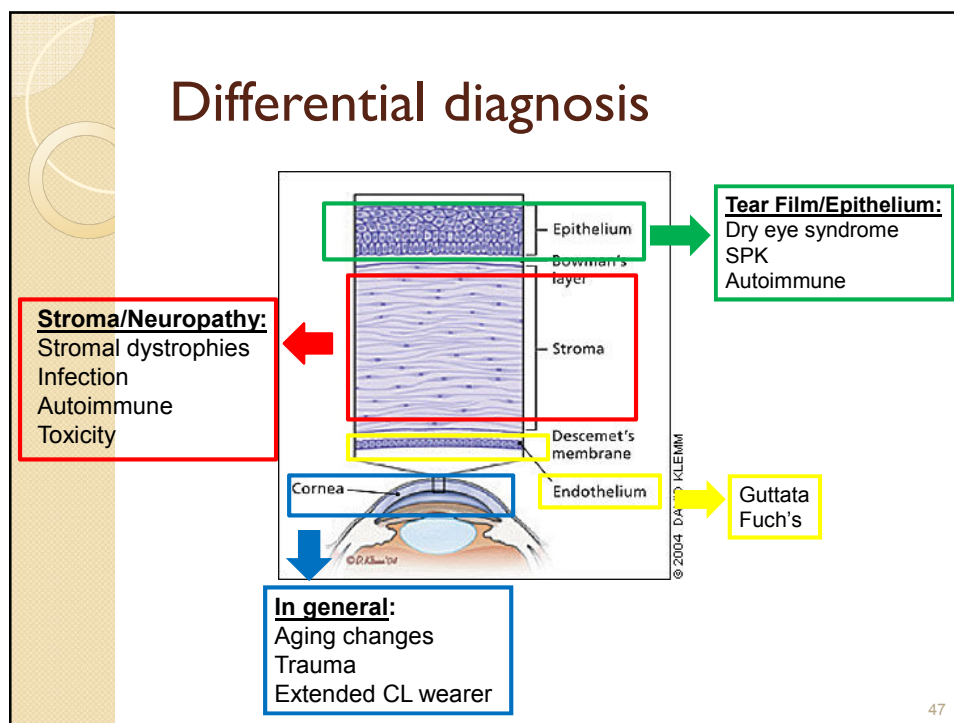
- **Tear**
 - **Stage of DK** is a risk factor for abnormal lipid layer (Yokoi, Inoue 2001)
- **Epithelium**
 - **Stage of DR** is a risk factor for corneal epithelial fragility (Saini)
 - **Stage of DK** is a risk factor for dry eye findings (Yokoi, Inoue 2001)
- **Stroma**
 - **>5 yrs of IDDM** is a risk factor for abnormal stromal nerve architecture (He)
- **Endothelium**
 - **Poor control** of diabetes is a risk factor for abnormal endothelial findings (Herse, Busted, Su, DHW)
 - **Stage of DR** is a risk factor for abnormal corneal thickness, thicker in earlier stages of diabetes (Rosenberg, Busted, Su, DHW)
 - **Duration of disease >10 years** (Lee)
- **Neuropathy/Sensitivity**
 - **DM** is a risk factor for neurotrophic keratopathy (Lockwood, Hyndiuk)
 - **Duration of DM** (Herse), **poor control** of diabetes (Herse) and more advanced **stage of DR** (Saito, Rogell) is a risk factor for abnormal corneal sensitivity
 - **>5years of IDDM** is a risk factor for decreased epithelial nerve density (He)

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Complications

Surgical

- **Cataract Surgery**
 - Delayed/poor healing
 - Corneal edema
 - Cloudy corneal epithelium
 - New/recurrent epithelial erosion
 - Corneal epitheliopathy
 - SPK
 - Persistent clinical corneal changes
 - Severely reduced TBUT
 - Predisposition to bacterial and fungal infection
- **Lasik**
 - Poor refractive outcomes
 - Epithelial complications
 - Epithelial ingrowth
 - Neovascularization of iris and angle
- **Vitrectomy/PRP**
 - Prolong/recurrent epithelial defects

Trauma

- Corneal abrasion
 - Deeper damage
 - Recurrent corneal erosion

Contact Lens

- Microbial keratitis
- Corneal ulcer
- Ocular infection
- Increased lens spooliation
- Resistance to corneal edema
- Non-resolving corneal edema

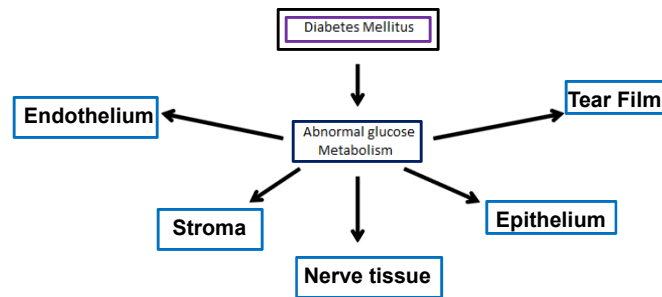
49

Outline

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Summary of DK



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Signs and Symptoms of DK

- Decrease tear break up time (TBUT)
- Symptomatic dry eyes
- Decreased
- Epithelial defects
 - Superficial punctate keratitis
 - Persistent epithelial erosion/defects
- Lacrimal gland damage
- Decreased tear production/lacrimation
 - Decreased reflex tearing
 - Abnormal Schirmer test
- Reduction in blink rate
- Less inclined to use artificial tears
- Decreased corneal healing/wound repair
- Delayed reepithelialization
- Increased epithelial fragility
- Decreased corneal sensitivity
- Epithelial edema
- Stromal edema
- Endothelial edema
- Recurrent corneal erosion
- Increase risk of infection
- Reduction in corneal transparency
- Transient stroma edema
- Corneal lattice degeneration
- Various forms of keratitis
- Stromal ulceration (rare)
- Stromal melting (rare)
- Stromal perforation (rare)
- Stromal scarring (rare)
- Polymegathism
- Pleomorphism
- Wrinkling of descemet's membrane
- Diabetic neurotrophic keratopathy
- Blurry vision

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We need to pay attention to cornea for DM patients because.....



Diabetes can lead to corneal disease or Diabetic Keratopathy!!

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Clinical Insights



Episode 1 - Overview of the Clinical Insights Series

Mile Brujic, OD, and David Kading, OD, discuss the creation of their new Clinical Insight series, which offers timely optometric insights in an efficient way. Drs. Brujic and Kading invite you into their examination rooms to show how they diagnose and treat their patients. The goal of these 3-minute clinical insight videos is to present new ideas and promote discussion on optometric methods.



Episode 2 - Utilizing Fluorescein Dye

Mile Brujic, OD, explores why it might be a good idea to expand the use of fluorescein staining when evaluating the ocular surface. Although fluorescein staining is often reserved for use in symptomatic patients, its use in patients with mild or no symptoms of ocular surface disease may reveal anomalies that are not detectable on clinical examination. Use of the dye as a routine diagnostic adjunct, Dr. Brujic says, may help reveal the cause of unexplained blurred vision, uncomfortable eyes, refractive shift, and corneal compromise, especially in patients with tear film irregularities.



Episode 3 – Lissamine Green

In this episode, the Optometric Insights team discuss how they use lissamine green staining in clinical practice. Although fluorescein staining is crucial for evaluating the cornea, other vital dyes are necessary to assess the conjunctiva and lid margin. According to Drs. Kading and Brujic, lissamine green staining, which may be more comfortable on the eye than rose bengal, is important for detecting difficult to diagnose conditions that would otherwise be missed in the clinical examination.



Episode 4 – Lid Wiper Epitheliopathy

Mile Brujic, OD, and David Kading, OD, discuss the importance of examining the lid wiper region, especially in those with known or suspected dry eye disease. The lid wiper can be examined after lid eversion, but epitheliopathy in this region can only be appreciated with lissamine green or fluorescein staining. In turn, grading of lid wiper epitheliopathy can be used as a marker over time to track disease progression and response to therapy.



Episode 5 – Identifying Evaporative Dry Eye

Mile Brujic, OD, and David Kading, OD, discuss evaporative dry eye disease and share their strategies for evaluating and diagnosing the condition. According to Drs. Brujic and Kading, tear breakup time should improve after treatment.



Episode 6 – Ocular Surface Wellness and Contact Lens Wear

David Kading, OD, and Mile Brujic, OD, focus on the role of ocular surface wellness in optimizing contact lens wear. Drs. Kading and Brujic explain how putting a system in place and assessing the surface of the eye will further improve patients' experience with contact lenses.



Episode 7 – Contact Lens Care Role in Comfort

Mile Brujic, OD, and David Kading, OD, discuss the challenges of keeping patients comfortable in their contact lenses. They explain that contact lens solutions play a significant role not only in disinfecting lenses, but also in terms of ensuring the lenses are comfortable on the eye.



Episode 8 - The Presbyopic Lens Wearer Part 1 - The Ocular Surface

Mile Brujic, OD, and David Kading, OD, discuss presbyopic patients in relation to wearing contact lenses. They focus on how ocular surface assessment can improve the lens wearing experience. - See more at:
<http://eyetubeod.com/series/clinical-insights/episode-8-the-presbyopic-lens-wearer-part-1-the-ocular-surface--huvebihan#sthash.IIZYUAOx.dpuf>



Episode 9 - The Presbyopic Lens Wearer Part 2 - Contact Lenses

Drs. Kading and Brujic discuss the available options for 1-day multifocal lenses. They hope to see new lens options come on the market and an increase in the utilization of dailies.



Episode 10 - The Presbyopic Lens Wearer Part 3 - Preparing for Success

Mile Brujic, OD, and David Kading, OD, discuss preparing the patient for multifocal lenses. They explain how utilizing the fitting guide, demonstrating success to patients, and giving the lenses adequate time to settle on the eye allows for the best possible results.



Episode 11 - Preoperative Considerations for Cataract Surgery - the Anterior Segment

David Kading, OD, and Mile Brujic, OD, discuss the prevalence of cataracts in Americans today. They explain how to slow the progression of cataracts and prepare patients for cataract surgery. Lastly, they emphasize the importance of checking the lids, lashes, and the ocular surface of every patient.



Episode 12 - Preoperative Considerations for Cataract Surgery

Mile Brujic, OD, and David Kading, OD, discuss the importance of educating cataract patients regarding their options as their cataracts progress. Drs. Brujic and Kading discuss the variety of lens options, in particular toric and multifocal IOLs, and how to ultimately provide the best refractive outcomes.



Episode 13 – Postoperative Cataract Inflammation

David Kading, OD, and Mile Brujic, OD, discuss postoperative inflammation in the setting of cataract surgery. They explain how evaluating the IOP, being aware of the cornea's appearance, and scheduling a follow-up appointment 3 months after surgery will lead to the best postoperative outcomes for the patient.



Episode 14 - The Red Eye

Mile Brujic, OD, and David Kading, OD, explain the importance of understanding the differential diagnosis for a patient presenting with a red eye. They discuss the treatment options for particular types of red eye disease and how point of care tests improve the accuracy of diagnosing the disease.



Episode 15 - Meibomian Glands

In the first episode of this three-part installment on MGD, David Kading, OD, and Mile Brujic, OD, discuss the meibomian glands, diagnosis, and treatment of MGD. They discuss the structure of the meibomian gland and what signs to look for to diagnose dry eye disease. They explain how evaluation of the meibomian gland is a critical aspect of the

dry eye exam and how utilizing instruments that can standardize the amount of pressure used when expressing the glands will ultimately produce the best results for patients.



Episode 16 - MGD Diagnosis

In the second episode of this three-part series on MGD, David Kading, OD, and Mile Brujic, OD, discuss how to identify glands that need treatment. They describe how nonobvious obstructive MGD may be a precursor to traditional MGD. Drs. Kading and Brujic emphasize how applying and maintaining light pressure on the eyelid is crucial for getting the glands to express.



Episode 17 - Treating MGD

In the last episode of this three part series David Kading, OD, and Mile Brujic, OD, discuss treating MGD. Drs. Kading and Brujic explain how plugged glands can be treated with LipiFlow or warm compresses. They suggest avoiding lid massages as it can lead to corneal damage and how changing patients' blinking habits will help them improve their meibum flow.



Episode 18 - Astigmatism Considerations

Mile Brujic, OD, and David Kading, OD, discuss options for correcting astigmatism. Drs. Brujic and Kading select options with effective stabilization and properly identify patients who would benefit from a toric contact lens. They explain how identifying proper candidates is critical and providing opportunity for full visual correction will optimize visual outcomes.



Episode 19 - Pupil Size and Visual Quality

Mile Brujic, OD, and David Kading, OD, discuss the importance of physicians' understanding that higher-order aberrations with pupil dilation is a significant problem for many patients. Drs. Brujic and Kading explain how a low concentration of brimonidine will control pupil dilation effectively in some patients experiencing nighttime vision

issues.



Episode 20 - Is GPC Still an Issue?

Mile Brujic, OD, and David Kading, OD, explain the common causes and treatment strategies for giant papillary conjunctivitis (GPC). Drs. Brujic and Kading focus on the most common cause of GPC, which is contact lens abuse. They discuss how implementing appropriate treatment protocols, such as discontinuing lens wear while treating concurrently with topical corticosteroids, will improve patient outcomes.



Episode 21 - Anterior Uveitis

Mile Brujic, OD, and David Kading, OD, share insights into treating anterior uveitis. Drs. Brujic and Kading discuss their goals for treatment, which include ruling out posterior segment involvement and sequestering inflammation quickly. They explain the importance of monitoring patients' drops, IOPs, and inflammation at the follow-up visit.



Episode 22 - Cataracts and Education

Mile Brujic, OD, and David Kading, OD, review basic knowledge of cataracts and how to address the topic with each patient. Drs. Brujic and Kading explain the prevalence of the three main types of cataracts: nuclear, cortical, and subcapsular. They stress the importance of educating patients in a way that is tailored to the stage of their cataract and encouraging them to ask questions.



Episode 23 - Dry Eye Before Cataract Surgery

Mile Brujic, OD, and David Kading, OD, talk about how common dry eye is in cataract patients. Drs. Brujic and Kading suggest performing a full dry eye workup before patients have cataract surgery. They explain that utilizing treatment methods on the front end can maximize visual outcomes and comfort for each patient after surgery.



Episode 24 - Cataracts and Vision Correction

Mile Brujic, OD, and David Kading, OD, discuss cataract surgery and the individual patient's role in his or her desired outcome. Drs. Brujic and Kading explain how to address this topic by discussing patients' lifestyles, visual needs, and the various IOL options. They stress that positive visual outcomes will ensue if the desires and expectations of each patient are understood as well as the characteristics of the

available implants.



Episode 25 - Anterior Blepharitis

Mile Brujic, OD, and David Kading, OD, discuss how to differentiate between bacterial and *Demodex* blepharitis. Drs. Brujic and Kading suggest performing eyelash rotation to determine if there is an overpopulation of *Demodex*. Regularly applying tea tree oil to the eyelid margin will reduce the *Demodex* and patients' symptoms. Drs. Kading and Brujic stress the importance of following up with

patients to make sure *Demodex* stays controlled.



Episode 26 - Meibomian Gland Dysfunction

Mile Brujic, OD, and David Kading, OD, discuss the prevalence of blepharitis and its occurrence in the setting of other conditions. Drs. Brujic and Kading discuss the preferred term meibomian gland dysfunction (MGD) instead of posterior blepharitis. They explain causes of and current treatments for MGD as well as new treatments entering



Episode 27 - Differentiating Infectious from Noninfectious Infiltrates

Mile Brujic, OD, and David Kading, OD, discuss how to differentiate infectious from noninfectious corneal infiltrates. Drs. Brujic and Kading address key diagnostic differences and identify common signs, symptoms, and causes for both types. They explain that using topical antibiotics for infectious infiltrates and combination antibiotic-steroid agents for noninfectious infiltrates remains the proper treatment protocol.



Episode 28 - Why Is My Eye Itchy?

Mile Brujic, OD, and David Kading, OD, discuss the symptom of itch and what it means in your patients. Before jumping to conclusions, complete the examination. Look at the eyelids, glands, and the palpebral conjunctiva, and be sure to flip the upper lids, especially in contact lens wearers. Because a viral red eye can mimic other

conditions, Drs. Brujic and Kading always perform an in-office diagnostic to rule out adenoviral conjunctivitis. Evaluate patients' tears, the globe, and employ staining. Remember, there are no consistent patterns to patients' redness.



Episode 29 - When to Consider Punctal Occlusion

Mile Brujic, OD, and David Kading, OD, discuss punctal occlusion and when to use it. With the ever-increasing options for treating dry eye disease, it can be more difficult than ever for physicians to determine when to employ punctal plugs. Drs. Brujic and Kading state that their strategy is to reduce inflammation before performing

punctal occlusion to manage dry eyes. The availability of the point-of-care test InflammDry (RPS), which measures the levels of the inflammatory marker MMP-9, allows physicians to assess the severity of and then monitor inflammation. This approach enables a more guided therapeutic plan.



Episode 30 Daily Disposables: Other Uses

Mile Brujic, OD, and David Kading, OD, discuss the multiple purposes of contact lenses. Drs. Brujic and Kading explain the advantages of daily disposable lenses and the type of patient who fits into this regimen. They share their reasons for utilizing daily disposables and the benefits these lenses bring to patients suffering from allergies, ocular surface

disease, or lid wiper epitheliopathy.



Episode 31: Does This Patient Need a Toric?

Mile Brujic, OD, and David Kading, OD, discuss how to determine if a patient needs a toric contact lens. Drs. Brujic and Kading share that utilizing these lenses among low cylinder patients can help improve the stability and clarity of their vision.



Episode 32: Is it Simplex or Zoster?

When evaluating corneal lesions it is important to differentiate between herpes zoster and herpes simplex. The use of dyes is critical, and physicians should be sure to employ both fluorescein and rose bengal. Herpes simplex typically causes dendritic ulcers and is treated with topical antiviral therapy.



Episode 33: Compliance with Contact Lenses: Strategies for Success

Overwear of contact lenses can cause deposits and corneal insult in the short term and inflict serious harm like neovascularization, scarring, and infiltrates in the long term. It is important to decipher the difference between what patients say they do and what they really do. Ask patients to bring their lens care products to their appointment and try to objectify patients' subjective wearing experiences. Finally, take the opportunity to discuss the option of daily disposables to enhance compliance, comfort, and safety.



Episode 34: Success with CLs in Emmetropes

When presbyopia catches up with emmetropes, they become frustrated. We have been very successful offering multifocal contact lenses to emmetropes, however, setting proper expectations is crucial as there will be some level of visual compromise. We perform a swinging lens test with a +2.00 D lens while the patient looks at a distance chart to identify dominance. Other tests that allow us to evaluate visual acuity such as a Multifocal Simulator, can help determine a patient's level of compromise. Unless a patient has demonstrated success with monovision, we typically avoid that strategy

Contact Lens Spectrum 2015



CLS Materials & Design - When Material is Not Enough 1/1/2015

Everyday, we encounter patients who love their contact lenses. But, just as often, it seems that we encounter patients who are struggling with their lens comfort or vision. In fact, a study by Nichols et al (2005) mentioned that as many as 52% of patients encounter dry eye symptoms with their lens wear. Surprisingly, it seems that these statistics have remained unchanged since I graduated from optometry school. That being said, I still think that the quest for the holy grail of contact lens materials continues, even though we are light years ahead of where we were 10 years ago.



CLS New Norm - Is Prescribing Toric Lenses for Low Cylinder the New Norm?

It is commonly known that most of our patients who have astigmatism have cylinder of less than 0.75D. In fact, the majority of those who have astigmatism have less than 1.25D of cylinder (Young et al, 2011).

So we pose this question: Is it normal to put a patient who has low cylinder, such as a prescription of $-4.50 -0.75 \times 180$, in toric lenses? Our guess is that the vast majority of us would initially vertex this patient and prescribe a lens with a spherical equivalent. You could even argue that this would be the best course of action because, indeed, placing a lens with $-0.75D$ of cylinder on this patient would leave him slightly overminused in the cylinder meridian. We could even take this one argument further: why place a toric lens on this patient at all? Toric lenses cost more, take more time to fit, and the patient will not notice the difference.



CLS Materials & Design – Amazing Lathing: A Glimpse into GP Lens Manufacturing 3/1/2015

When we stop to think about how our GP and custom soft contact lenses are made, we can be amazed at the work that goes into creating these wonderful medical devices that give our patients sight. When I sit down to work with one of my patients on a new fit, I tend to overlook the vast complexity that goes into the creation

of a GP lens. Following is a glimpse.



CLS New Norm – Technologies to Improve Contact Lens Success 4/1/2014

We are all aware of the statistics on contact lens dropouts; around 16% (Nichols, 2010) of all contact lens wearers will stop wearing contact lenses this year. Many of them drop out because of discomfort with their contact lenses. But when it comes to making patients comfortable with their lenses, the solution to the problem usually

starts with fixing the ocular surface.



CLS Materials & Design - 3 Mainstream Myths About Multifocals 5/1/2015

If I told you that I tried vegetables once and hated them so I never tried them again, you might think I was crazy. And yet, we often form our perceptions of multifocals after just a few tries and a few mild failures. Multifocal lenses *always* work, we just have to define what success is ahead of time. Many practitioners have justified moving away from multifocal

lenses for one of the following reasons: 1) I tried a multifocal on my patient and it didn't work; 2) My patients do better in monovision; or 3) I followed the fitting guide and didn't succeed. Our industry partners want us to be successful with their lenses, and they work hard to support us. Here, I dispel three of the most common myths about multifocal lenses.



CLS New Norm - Is Newer the Better 6/1/2015

Every day, we get new product updates in our email inboxes, publication posts, at conferences or continuing education events, or from company representatives. New products bring new concepts and new ideas. But in reality, when do new products trump the old, and what dictates when we should switch?



CLS Materials & Design - Scleral My Dry Eye 7/1/2015

Specialty contact lenses are not always prescribed simply to improve clarity of vision—they are occasionally indicated for managing other conditions as well. Up until recently, only a small number of specialty contact lens practitioners were fitting scleral lenses, despite the fact that several decades of peer-reviewed reports in the literature indicate the therapeutic benefits of scleral lenses. Patients who have severe ocular surface disease, such as keratoconjunctivitis sicca, may also benefit from wearing scleral lenses as a protective medical device.



Is Keratoconus Surgery the New Normal? 8/1/2015

We live in an age of quick fixes. Those who are overweight are looking for a magic weight loss pill, and individuals who are in pain want a painkiller to solve their ailments rather than looking for a more permanent solution to their problems.



Sclerals Can Be Notch-tastic! 9/1/2015

A middle-aged Hispanic male who had keratoconus had exhausted all other contact lens modalities, and scleral lenses were the only specialty lenses that could provide adequate vision. However, due to severe, bilateral pingueculae, he suffered from significant irritation and redness during and after scleral lens wear.

Advanced Ocular Care



Advanced Ocular Care - Contact Lens Technology

Highlights

When we began our careers, we thought that contact lens technology was amazing. In 1899 Charles Duell, commissioner of the US patent office said: “Everything that can be invented has been invented.” By no means do we want to say that we were silly enough to think that technology had hit its end, but the strides enjoyed by contact lens’ technological development has not slowed at all in recent years.



Advanced Ocular Care - Making the Recommendation: Considerations When “Prescribing” OTC Drops and Medications, Advanced Ocular Care

Although there is a vast array of prescription therapeutic options to help manage the various ocular diseases optometrists see in clinical practice, there is certainly a role for over-the-counter (OTC) products to help treat these conditions. One of the least effective ways to recommend OTC products is to offer patients several types of samples in a given category and leave the choice up to them. From a patient’s perspective, this practice risks commoditizing the products; when it comes time for him or her to make a purchasing decision, the products may be viewed as indistinct from one another with cost as the major differentiating factor.



Advanced Ocular Care - You May Be Listening, But Are You Hearing What Your Patients Are Saying?

A complaint of irritated eyes can often be perplexing, to say the least. We have a number of technological advances to help us differentiate among the numerous etiologies of ocular irritation. Many of us also have technicians taking preliminary histories to improve our office efficiency. That said, is the use of communication to decipher the etiology of a patient's irritated eyes a lost art?



Advanced Ocular Care - Natural is Better

All things being equal with price and performance, most of us given the option would choose the organic, the green, the natural. It just seems to be better, for our body and for the environment. Fortunately, in health care, there are more and more options that fit into this model.

Decoding the Omegas and Alphas

Selecting the right ocular nutrition for your dry eye patient

Tracy Doll, O.D., F.A.A.O

Disclosures

- I have not been paid to endorse any products seen today.
- I do offer nutraceutical treatment options for my patients
- I have been a paid consultant for my opinion by Allergan

Validity to Nutraceuticals in Eye Health

- AREDS formulation for ARMD
- Nutritional deficiencies can lead to visual impairment
 - Vit A

Nutraceutical Option for all Types of Dry Eye

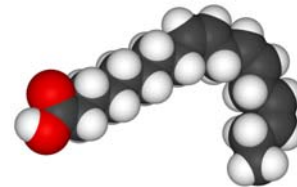
- Evaporative- 70% of all dry eye disease
 - MGD
- Aqueous Deficient- remaining 30%
 - Autoimmune disease (Sjogrens)
- Clinically, it is very common to see the two types together
- Proper nutrition and supplementation is beneficial for all kinds of dry eye ocular surface disease.

Which nutraceuticals for dry eye?



The Omegas/ PUFAs Basics

- “Omega” is in reference to the terminal carbon atom farthest from the functional carboxylic acid group (–COOH).
- The Number defines the position of the first site of unsaturation relative to the omega end of that fatty acid .
 - Example: an omega-3 fatty acid like α -linolenic acid (ALA), which harbors three carbon-carbon double bonds (sites of unsaturation), has a site of unsaturation between the third and fourth carbons from the omega end.
- Humans do not make PUFAs intrinsically
- Must consume them in diet



Omega -3 Fatty Acids

- There are three major types of omega-3 fatty acids
 - α -linolenic acid (ALA)
 - eicosapentaenoic acid (EPA)
 - docosahexaenoic acid (DHA)
- Once ingested, the body converts ALA to EPA and then to DHA
- How/Why they work for dry eye:
 - EPA and DHA are important precursors potent anti-inflammatory lipids called resolvins (Rvs) and protectins (PDs)
 - Stop inflammation
 - Also smooths meibum secretions

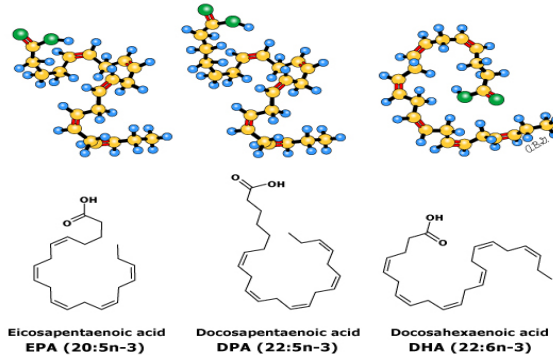
Omega-3 Dietary Sources

- ALA: flax seeds, walnuts, pecans, hazelnuts, kiwifruit, algae, sea buckthorn oil
- EPA/DHA:
 - Cold water fishes (salmon, tuna, and herring), krill
 - Krill may be better at lifting mood?
 - Marine microalgae

FISH vs. PLANT

- Which is superior?
- ALA sources (plant) must first be converted to EPA
 - 3 independent reactions
- EPA then to DHA
 - 2-4 more reactions


Structure of long-chain n-3 PUFA found in fish oil



Long-chain n-3 PUFA are almost exclusively derived from seafood sources and include eicosapentaenoic acid (EPA, 20:5n-3), docosapentaenoic acid (DPA, 22:5n-3), and docosahexaenoic acid (DHA, 22:6n-3). Given the long carbon chains and multiple double bonds, these fatty acids have complex 3-dimensional configurations, very different from the relatively straight chains of most other fatty acids.

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Ethyl-Ester Format vs. Triglyceride Format

TG- Triglyceride	EE- Ethyl ester
<ul style="list-style-type: none"> • Naturally occurring • Costly- must find higher quality sources of marine life • Better sources are needed to insure lack of contaminants • More bio- availability of EPA and DHA in the body as detected in blood stream of human subjects and organs of animal models 	<ul style="list-style-type: none"> • Processed • Less Expensive- Can refine lower quality fish oil to generate • Removes contaminants (heavy metals) • Needs extra processing by the liver to remove the ester component- to get the EPA/DHA out, this can lead to "fish-burp" • The addition of lecithin which is a fat emulsifier reduces the fish-burp • The Rx format of this for systemic hyperlipidemia does not interfere with omeprazole, warfarin or atorvastatin

TG or EE for Dry Eye?

- There is clinical evidence for both forms that show effectivity in treating dry eye conditions.
- Take into consideration liver /gastro-intestinal status of the patient

What about other Omegas?

- Omega 6
- Omega 7
- Omega 9

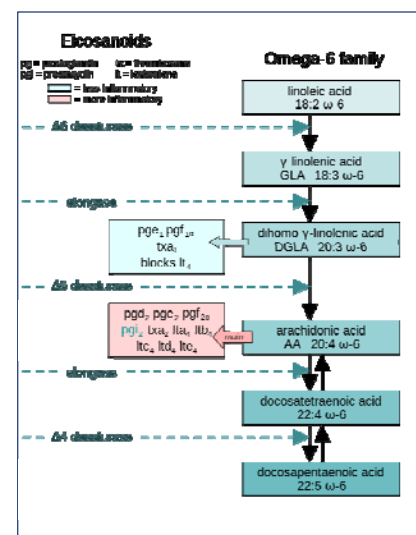
The Wrong Omega- 6



- Avoid: Linoleic acid (LA)
 - Promotes inflammation on its pathway to arachidonic acid (AA)
 - AA is the precursor for the synthesis of the biologically active eicosanoids, the prostaglandins (PGs), thromboxanes (TXs), and leukotrienes (LTs)
 - LA: Particularly in vegetable oils (corn, soybean, peanut), grains
 - AA is easily found in American Diet:
 - Animal fats (chicken, eggs, beef, pork)- higher in organs
 - Grains
- If we can't get rid of LA, we need to create competition AA

The Competition: The Right Omega-6

- Go for: Gamma Linoleic acid (GLA)
 - GLA is converted to an anti-inflammatory substance called dihomo-gamma linolenic acid (DGLA) before GLA becomes AA.
- DGLA incorporates into the cell membrane faster than AA
- Diets enriched in GLA result in an alteration in the ratio of membrane arachidonate (immediate precursor is AA) to DGLA.
- Leads to creation of less inflammatory eicosanoids
- It also leads to the creation of a tear production-stimulating eicosanoid: prostaglandin E₁



Dietary Sources of GLA

- GLA is found mostly in rarer plant-based oils:
 - Hard to come across these easily in diet
 - Borage seed, evening primrose, acai berry, hemp and black currant seed oils
- The body needs help promote the conversion of GLA to DGLA
 - Magnesium, Zinc, Vit C, Vit B3.
 - Careful about vitamin deficiencies
- No Black Currant Seed Oil for anyone with ASA allergy



Balancing the Omegas

- Omega-3 and Omega-6 PUFAs compete for incorporation into cell membranes
 - Omega -3 PUFAs will compete with the enzymes that convert AA into the biological eicosnaoids. It stops DGLA from becoming AA!
 - Need at least 1:1 ratio of omega- 3 to 6 to reduce inflammation in the body
 - One study showed that women with lower than a 1:15 omega-3:omega-6 EFA ratio had a 2.5 times greater prevalence of dry eye
- Take Away:
 - Get the right Omega-6 PUFAs in the body: GLA
 - Get a double dose of anti- inflammatory action by using omega- 3 and 6

Omega- 9



- Non-essential fatty acid (created from unsaturated fat in the diet)
- Polyphenols- Oleic Acid/ Elaidic Aid
- Anti-microbial, anti-inflammatory (COX)-1 and -2 activities, thromboxanes, leukotrienes, cytokines, CRP
- Anti-angiogenic and anti-proliferative activity, improve vascular function
- Not studied exclusively in relation to the eye
- Food sources: Olive Oil, Canola Oil, Peanut Oil, Macadamia Oil, sunflower oil (unsaturated fats)

Omega Eye Drops

- Not currently available in the US
- Positive outcomes in animal studies
- Most common response on dry-eye patient discussion boards is that they sting and induce red eye.
 - I could not find a positive review



So how much do my patients take?

- Sit tight- more info coming

The Alphanumerics

- Vit A
- Vit B6
- Vit C
- Vit D3
- Vit E

Vit A



- Fat soluble vitamin
- Needed by genes that express mucin
 - Recall that mucin is the inside tear tear layer
 - Mucin decreases its surface tension, so aqueous layer can spread evenly
 - Well-established link to Vit A deficiency and dry eye
- β -carotene and zeaxanthin
- Dietary source of Vit A
 - Sweet potato, carrot, dark leafy greens, squash, romaine lettuce, dried apricots, cantaloupe, red peppers, tuna, mangos

Vit B6

- Deficiency impairs the metabolism of Omega-3 PUFAs from ALA to EPA and DHA with the most pronounced reduction in the production of DHA.
- Dietary Sources of Vit B6
 - Sunflower seeds, pistachio nuts, fish, turkey, lean pork, dried apricots, raisins



Vit C

- Vitamin C is important in PGE1 biosynthesis
- PGE1 is important for lacrimal gland secretion



- Dietary Sources of Vit C

- Bell peppers (yellow, red, green), Guavas, green leafy vegetables, kiwi, broccoli, berries (strawberries, raspberries, blueberries), citrus fruits, cooked tomatoes, peas, papaya

Vit D3

- Cholecalciferol
- Enhances corneal epithelial barrier function
- Suppresses inflammation by inhibition of cytokines(IL-1 α , IL-1 β , IL-8)

- Dietary Sources of Vit D3

- Oily fish, egg yolk, caviar, pork ribs, lard



Vit E



- Known as tocopherols: α and γ
- Maintains goblet cell production (meibomian glands)
- Stabilizes Omega 3-Fatty Acids
- Anti-inflammatory (particularly γ) in epithelial cells

- Dietary Sources of Vit E
 - Tofu, cooked spinach, almonds, sunflower seeds, avocados, shrimp, oily fish, plant oils (olive, buckthorn, wheat germ, sunflower, grapeseed, olive), broccoli, squash

Supportive Nutraceuticals for Dry Eye

- Zinc
- Turmeric Extract/ Curcumin
- Green Tea Extract
- Lecithin
- Muscin Complex

Zinc

- The conversion of retinol to retinal (from Vit A) requires the action of a zinc-dependent enzyme
- Zinc is necessary for DGLA conversion to PGE1, resulting in tear production
- Found in red meat, seafood, poultry, eggs, wheat germ, mixed nuts, black-eyed peas, tofu, and baked beans



Turmeric Extract: Curcumin

- Turmeric comes from the root of the *Curcuma longa* plant
- Stops lipid conversion in negative Omega-6 pathway
- Shown to decrease levels of inflammatory markers (MMP-9, MAPK, TNF-alpha, p38, JNK, NF Kappa)



Lecithin

- A mixture of the diglycerides of stearic, palmitic, and oleic acids, linked to the choline ester of phosphoric acid
- It is a fat emulsifier
 - A recent study (May 2015) showed that bioavailability of ALA was increased by the emulsification of flaxseed oil with soya lecithin via improved lipolysis in animal models.
 - Anecdotal evidence suggest that is can decrease the incidence of “fish-burp” for EE fish oil formulations
- Dietary Sources: soybeans, egg yolk, brain tissue, beef liver, steak, eggs, peanuts, cauliflower, and oranges

Muscin Complex

- Some companies include a “muscin” complex in their vitamins
- Usually sourced from animals

Green Tea Extract

- polyphenol epigallocatechin gallate, PEG
- Anti-Inflammatory (MAPK, JNK, NFκB, AP-1) in corneal epithelial cells
- Anti-oxidant: decrease in GO-induced Reactive Oxygen Species levels



How much to take

- Monotherapy with fish-oil is recommended in the therapeutic range similar to what is recommended for inflammatory conditions:
 - Between 1000-3000mg daily.
 - What really counts is level of EPA/DHA found in the supplement.
 - Look for at least **600mg** of combined EPA/DHA per 1000mg (1g) capsule
- Different combinations of the omegas, alpha-numeric and others have yielded improvement of signs and symptoms in the literature.
 - The combinations have shown success with lower levels of fish oil

How Much to Take

- The FDA has established an acceptable daily intake of 3000mg (3g) per person of combined EPA and DHA from natural fish oil sources in either oil or capsule form

Study	N	Amount	Timing	Outcome
Creuzot et al, 2006	71	Omega 3: 196 mg EPA/14 mg DHA Omega 6: 41 mg GLA/ 63 LA	6 months	Increased Schirmer's, TBUT (not stat significant) Decreased Corneal staining lissamine (not stat significant) Symptom improvement (nearly stat significant)
Larmo et al, 2010	45 tx 41 placebo	2 g of Sea Buckthorn oil Omega 3: 150mg Omega 6: 245mg Also Vit A, E, K, Omega- 7, Omega-9	3 months	Decreased osmolarity, Decreased symptoms: redness, burning
Brignole-Baudouin et al, 2011	61 tx, 66 placebo	Omega 3: 427.5 mg EPA /285 mg DHA Omega-6: 15mg Also Vit A, B6, B12, C, E, lecithin, zinc	3 months	Reduce the expression of the inflammatory marker in the conjunctival epithelium: HLA-DR & CD11c Symptom improvement: burning, dryness, FB sensation, photophobia, stinging Improvement in BUT, corneal staining, Schirmer
Wojtowicz et al, 2011	36	Omega 3: 450 mg EPA/ 300 mg DHA and 1000 mg flaxseed oil- Also Vit E Thera Tears	3 months	Reduced symptoms Increased tear production and volume
Bhargava R, et al, 2013	264 tx, 254 placebo	Omega 3: 325mg EPA / 175mg DHA Daily In CL wearers	3 months	Increase in Schirmer and TBUT Decrease in symptoms

Study	N	Amount	Timing	Outcome
Kangari, et al, 2013	33tx, 31 placebo	Omega 3: 360 mg EPA / 240 mg DHA	1 month	Increased TBUT and Schirmer's Decrease in OSDI Score
Sheppard et al, 2013	38	Omega 3: 100mg EPA/ 70mg DHA Omega 6: 1570mg Also Vit A, B6, C, E and magnesium, lecithin -HydroEye	6 months	Decrease OSDI Score Maintained corneal surface smoothness Halted the number of inflammatory biomarker on conjunctiva (HLA-DR, CD11c integrin)
ONIT Study 2015	67	Omega 3:EPA 590mg/DHA 440mg Omega 6:900mg Also Vit A Vit D3, E, Tumeric, Green Tea Extract -Ez Tears	3 months	Increase: 38% OSDI, 45% TBUT, 50% Tear Meniscus Height Decrease: 33% in corneal staining, 50% decrease in corneal redness, lid inflammation
Korb, et al, 2015	13 tx, 13 placebo	Omega 3: EPA 528mg/DHA278mg Also Vit E, lid scrubs and lipid drop vs. warm compress	3 months	Increased in amount of secreting MG Improved Speed Scores/OSDI

Prescription Omega- 3

- LOVAZA
 - Each 1-gram capsule of LOVAZA contains at least 900 mg of the ethyl ester format of omega-3 fatty acids sourced from fish oils
 - 465mg of EPA and 375mg of DHA
 - Suggested dose is 4 capsules daily
- Vascepa
 - Only contains EPA- 1 gram
 - Suggested dose is capsules daily

Cost of Rx Omega-3 = \$\$\$

Not Yet Released

- Epanova
 - Triglyceride Rx form of Omega-3
 - Not yet available in the US
- Omtryg
 - Generic Lovaza

Waiting Results from the Following Studies

- The Influence of PRN Dry Eye Omega-3 Nutritional Regimen on Tear Osmolarity In Cases Of Dry Eye Disease Study (in Phase 2/3)
 - Triglyceride form
- A Parallel Bioavailability Study of Fish Oil-Ethyl Ester Versus Fish Oil-Triglyceride Versus Krill Oil
- Dry Eye Disease in the Vitamin D and Omega-3 Trial (VITAL)
 - Vitamin D3 (2000 IU) or omega-3 fatty acids (Omacor fish oil, 1 gram)
 - Examine whether omega-3 fatty acids or vitamin D3, compared to placebo, reduce the incidence and/or progression of dry eye disease
- The Dream Trial is also currently recruiting patients to take
 - 2000 mg EPA and 1000 mg DHA per day to check the efficacy for dry eye

Combination Therapies

- There are commercially available supplements that contain combinations of the effective omegas, alphas and others
- Different combinations of the omegas, alpha-numeric and others have yielded improvement of signs and symptoms in the literature.
 - The combinations have shown success with lower levels of fish oil

Combination Therapies

- Sea Buckthorn Oil
 - Omega 3, 6, 7, 9
 - Vit A, E
- Pro Omega D- Nordic Naturals
 - Omega 3
 - Vit D
- Pro Omega 3.6.9- Nordic Naturals
 - Omega 3,6,9
- Thera Tears nutrition
 - Fish Oil + Flaxseed Oil (Omega 3)
 - Vit E (α - tocopherol)



More Complex Combinations

- HydroEye
 - Fish Oil (Omega- 3)+ Black Currant Seed Oil (Omega- 6)
 - Vit A,B6,C, E
 - Magnesium, muscin complex, lecithin
- MaxiTears
 - Salmon Oil+ Cod Liver Oil +Flax Seed Oil (Omega 3) + Borage Seed Oil (Omega 6)
 - Vit A, D3
 - Turmeric root, muscin complex
- Ez Tears
 - Fish Oil (Omega 3) + Evening Primrose Oil (Omega 6)
 - Vit A,D3,E
 - Tumeric, Green Tea Extract



Combination Therapy: Omega-Free

- *Antioxidants intake and dry eye syndrome: a crossover, placebo-controlled, randomized trial in Eur J Ophthalmology 2009*
- Antioxidants combination (Oxybiane) for 12 weeks
 - A, E, B2, B6, B12, C, niacin selenium and zinc
- After 12 weeks, improvement in:
 - TBUT, Schirmer Scores
 - Symptoms: Burning, itching, foreign body sensation, redness
- Can obtain through a distributor, though manufactured in Europe



Which combo is Superior?

- Lowest side effects
- Best clinical signs
- Patient symptomatic improvement

How much fish do you have to eat to achieve therapeutic dosages of Omega -3?

Multiply this chart by....

Weekly servings of fish to achieve 250 mg/day of EPA + DHA

Fish name	Number of 3.5 ounce (100 gram) servings*
Oily fish	
Anchovy, canned	1
Herring, Atlantic	1
Salmon, Atlantic	1
Tuna, Bluefin	2
Mackerel, Atlantic	2
Bluefish	2
Trout, Rainbow	2
Sardines, Atlantic canned	2
Striped Bass	2
Tilefish	2
Swordfish	2
Tuna, Albacore canned	3
Salmon, Sockeye	3
Carp	4
Salmon, smoked (lox)	4
King Mackerel	5

Weekly servings of fish to achieve 250 mg/day of EPA + DHA

Fish name	Number of 3.5 ounce (100 gram) servings*
White fish	
Sea Bass	3
Pollock, Atlantic	4
Snapper	6
Flounder and Sole	6
Tuna, light canned	7
Grouper	8
Catfish, wild	8
Halibut	8
Haddock	12
Cod, Atlantic	12
Shellfish	
Mussels	3
Crab, Alaska King	5
Oysters, eastern raw	6
Clams	7
Shrimp	7
Lobster, northern	10
Scallops	11
Crab, Blue	11

EPA: eicosapentaenoic acid; DHA: docosahexaenoic acid.

* Servings rounded up to a whole number of servings.

Data from: United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference. USDA website 2012. Available at: <http://ndb.nal.usda.gov/>. (Accessed June 10, 2013.)

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Side Effects/ Interactions of Omega-3

- Intakes above 3g (3000mg) per day may cause **excessive bleeding** in some people.
 - Careful on those already taking blood thinners, including ASA
- Mainly Gastrointestinal side-effects: constipation, vomiting, burping, indigestion, alternation in taste, diarrhea, anorexia
- Omega 3's need to be processed by the stomach, intestine and liver, so careful in those with organ disease.
 - Look for enteric coating in those with history of stomach troubles and start at a lower dosage.

Other side effects and contraindications

- Vit C: nausea, vomiting, heartburn, stomach cramps, headache
- Lecithin: diarrhea, nausea, abdominal pain or fullness.
- Black Currant Seed Oil: Not for anyone with ASA allergy- chemically similar
- Zinc: nausea, vomiting, diarrhea, metallic taste, kidney and stomach damage
- Turmeric: stomach upset, nausea, dizziness, or diarrhea
- Green Tea Extract: stomach upset and constipation. Green tea extracts have been reported to cause liver problems in rare cases.

The Tricky Patient

- The Vegetarian/Vegan
- The Fish Allergy
- The Dry Mouth
- The Fixed-Income
- The Sensitive Stomach

The Vegetarian/ Vegan

- The trick: don't consume any animals and/or animal products
- Best Options:
 - Vegetative sources
 - EPA/DHA can be obtained from marine microalgae, sea buckthorn
 - GLA can be taken from borage seed/ black currant seed oil
 - Be careful to watch for the ingredients in the capsule, they might be vegetarian, but not vegan.



The Fish Allergy

- The trick: fish could kill them
- The Best Option:
 - Follow the Vegetarian options.

The Dry Mouth

- The trick: Many patient with concurrent Sjogrens or rheumatologic conditions have difficulty swallowing, large pills/capsules in particular
- Best option
 - Small capsules
 - HydroEye has very small capsules- more of them, but smaller
 - Liquid format
 - Nordic Naturals
 - Dietary intake

The Fixed Income

- The trick: quality dietary supplements can be expensive.
- The other trick: fresh fruits, vegetables and fish can also be costly.
- The best option:
 - Dietary sources: grow it, catch it
 - Lower costs: EE instead of triglyceride
 - Prescription Rx vs OTC: Lovaza?
 - Covered in 2nd Tier Cigna
 - Partially covered with Medicare D

Reminders

- Diet is best, but supplements are reasonable choice for *therapeutic* levels of nutraceuticals.
- Make sure fish-oil has at least 600mg combo EPA/DHA per 1000mg
- Combination therapies with Omega-3, Omega-6, Vitamins and other anti-inflammatory compounds have all shown clinical improvement in patient signs and symptoms of dry eye disease

More Reminders

- It is crucial to ask about food allergies, dietary restriction and history of stomach or liver difficulties before prescribing a nutraceutical regimen.
- There are options for every patient

Hands-on Dry Eye Technology

Tracy Doll, O.D., F.A.A.O
Homecoming CE
October 3rd, 2015

Disclosure Slide

- I have not been paid to endorse any product in this presentation.
- I have been a paid “dry-eye consultant” for Allergan
- Oasis has donated collagen punctal plugs at no cost to our students
- Demo models have been provided by the following vendors at my request:
 - EyeEcho
 - OcuScui
 - Bruder
 - RySurg
 - Odyssey

Dry Eye is...

- A chronic condition
- A progressive condition
- A debilitating condition

Traditional Methods of Diagnoses

- Bits of paper/string
- Slit Lamp and Dyes

- What kind of dry eye do you have?

Diagnosing Inflammation



RPS MMP-9

- Disposable, in-office medical laboratory test that checks for the inflammatory marker MMP-9 in the tears
- Is diagnostic of inflammatory-related dry-eye
- Helps to differentiate the category of dry eye
- Does not vary with tear-film level
- Covered by most insurances
- Must obtain CLIA certification for this test
- Recommended as a partner to TearLab



Diagnosing MGD

Korb Meibomian Gland Evaluator

- Information of if glands are functioning and putting meibum on the lid margin
- Consistent expression pressure: 0.3lbs/ square inch
- Same pressure produced as with a blink
- <6 secreting clear-oil secreting glands per eyelid = symptomatic



http://www.reviewofoptometry.com/content/d/dry_eye/c/35148/

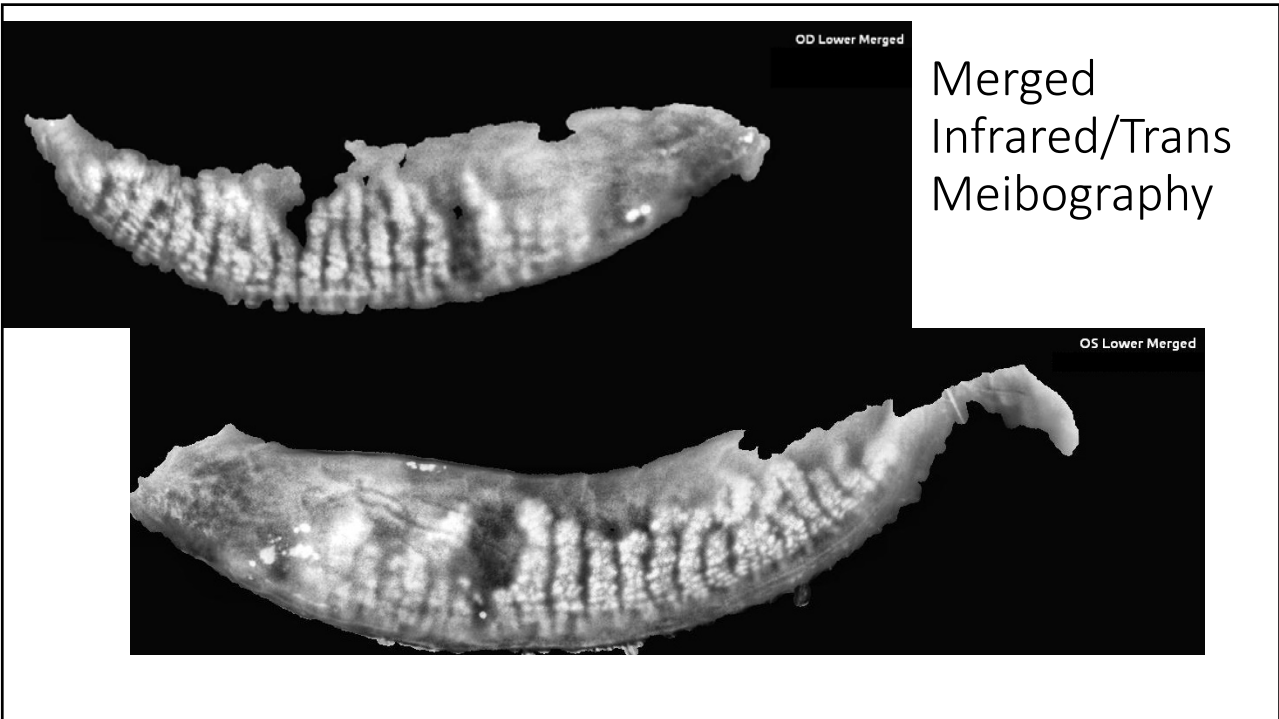


Dynamic Meibography

- Infrared
- Transilluminated
- Merged

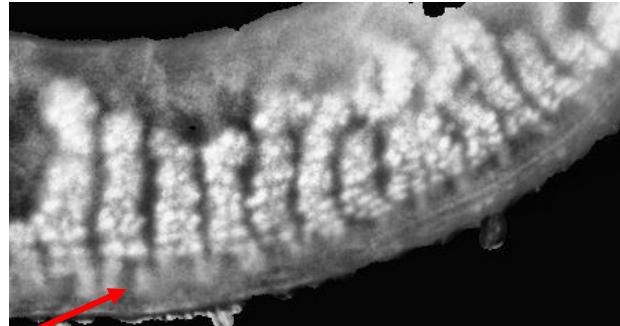
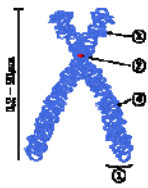
Infrared Meibography Lower Lids



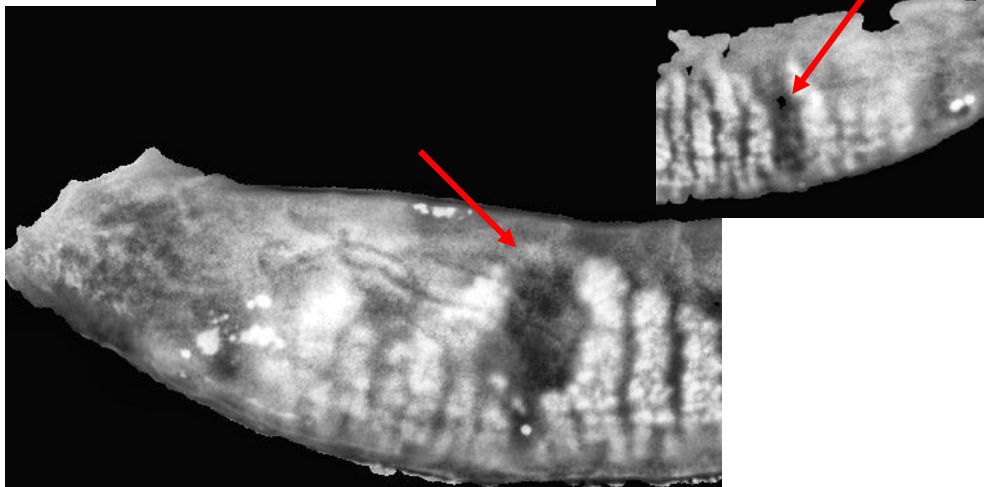


Duct Dilatation is first sign of a problem

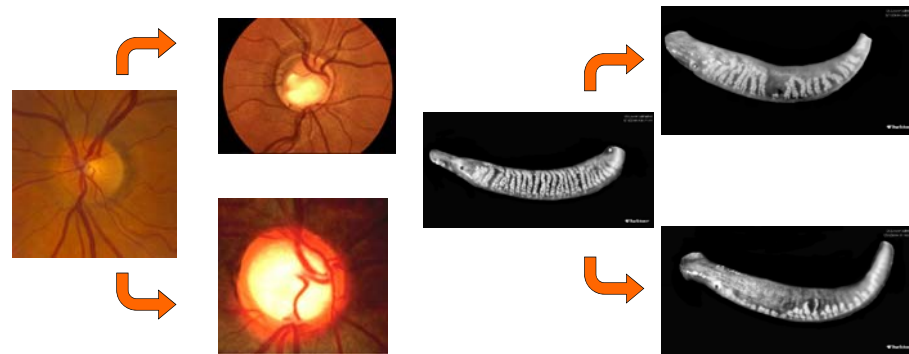
- Meibomian glands should run side by side
- Obstruction causes the base of the glands to separate
- Known as “tuning-forking”
- Also looks like “a chromosome”



Gland-Drop Out



Chronic Obstruction and Dryness leads to Loss of Structure

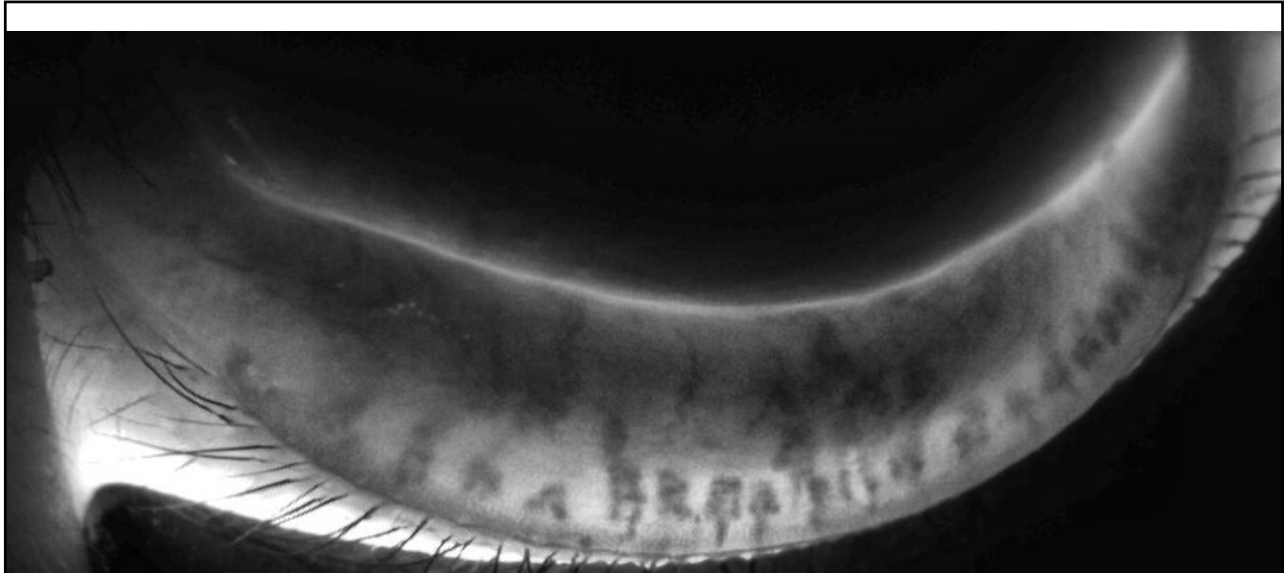


Now MGD is detected and managed with ability to also visualize structure
 Any compromise to gland structure is an indication to consider therapeutic intervention

Slide by TearScience

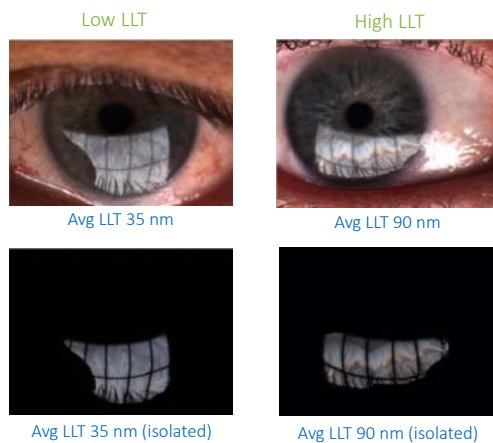
Glands Loss is Irreversible

- Patients need at least 6 glands out of the 24-30/lid to express with a deliberate blink to be asymptomatic
- Chronic obstruction and inflammation leads to gland drop-out
- This isn't just an "older" adult problem



How old is this patient?

LipiView® II Interferometer



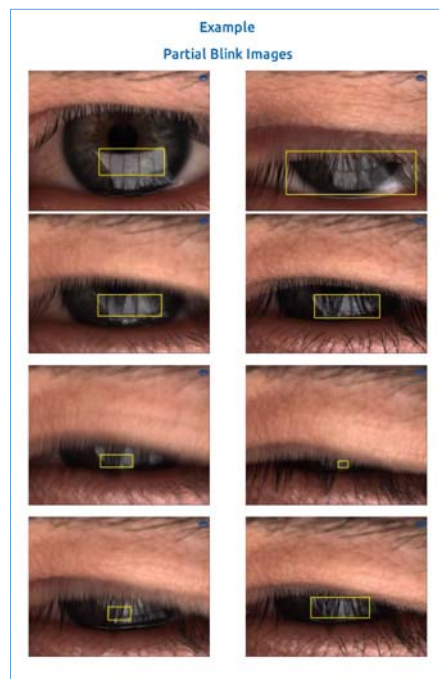
- A Lipid Layer Thickness of <math><60\text{nm}</math> has been correlated with symptomatic dry-eye
- > 90nm indicates a good LLT

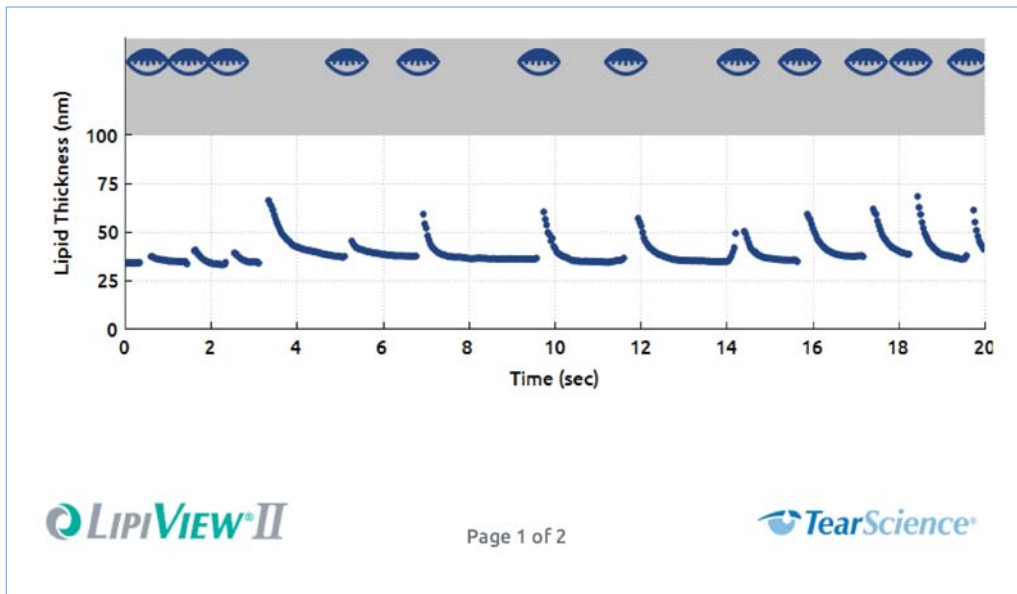
Diagnosing Daytime Exposure

- The incomplete blink rate

Measuring Blink Rate

- LipiView measures complete vs. incomplete blinks
- Video recording
- > 40% partial/ incomplete indicates exposure

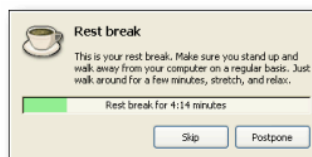




Blinking



- Dry eye can be related to exposure from lack of blinking
- Medication side effects or occupational
- Apps and software can be installed on computers and smart phones to remind patients to blink regularly
 - EyeLo: <http://eyeleo.com/>
 - Dry Eye Zone Blinkers: <http://www.dryeyezone.com/reminders/#>
 - Work Rave: <http://www.workrave.org/>
 - EyeWing App for Droids



eyeWing
Relieve your dry eyes naturally



Treating Blepharitis

Blepharitis and Tea Tree Oil

- Reports of Demodex (parasitic mite) on the eyelid of geriatric populations varies, but Demodex is highly associated with Blepharitis
- The active ingredients in Tea Tree Oil kill Demodex
 - The active ingredient identified is 4-Terpineol



Lid Scrubs At Home

- Avenova
 - Hypochlorous Acid 0.01%
- Tea-Tree Oil Derivatives
 - Cliradex Lid Scrubs
 - Ocusoft Lid Scrub Plus
 - Thera Tears Steri Lid



Tea Tree In the Office

- Higher concentration of Tea Tree Oil, that is meant to be applied **ONLY** by a doctor
 - Cliradex Kit
 - Ocusoft Demodex Kit



BlephEx

- Surgical grade PVC sponge dipped in a lid scrub solution (tea tree, hypochlorous acid)
- Sponge rotates at 1,000 RPM
- Goal: to remove all exotoxins and scurf that are associated with Demodex blepharitis.
- Off-label use for debridement of Line of Marx



Treating MGD

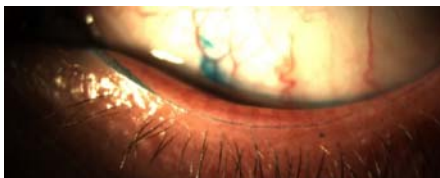
The Modern Hot Compress

- Good: Ocusci/ Thermalon/ Bruder
 - Beads/Pearls
 - Up to 10 minutes of heat
- Better: DERM by EyeEcho
 - Beads/pearls with a wettable liner
- Best: Tranquileyes XL
 - Provides 20 -25 minute moist heat therapy.
 - Option of heating/cooling modalities:
 - Thermoeyes Beads- glycerin/H2O (60x)
 - Instant Thermoeyes- Sodium Acetate (100x)



Debridement of Line of Marx

- Look for ocular chronic dryness as keratinized deposits from the friction between dry lid, cornea, and conjunctiva with the globe.
 - Staining along the lid margin, blocking the meibomian glands= Line of Marx
 - **Lid Wiper Epitheliopathy**
- The goal is simply to remove all lissamine dye/keratinized material from the glands from the eyelid.
- Instill a topical anesthetic, then use a golf spud to gently debride



The Pressure is On

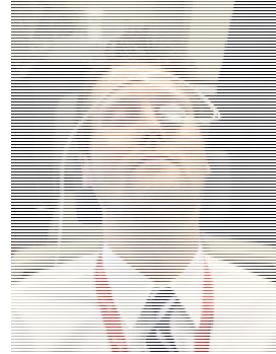
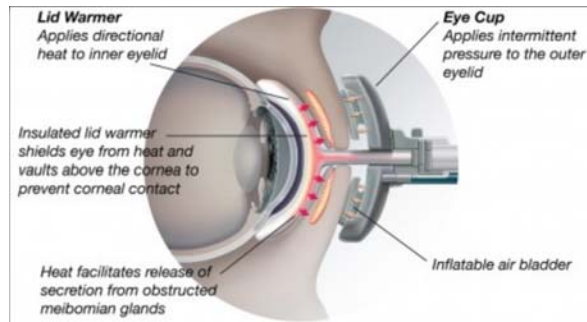
- After debriding the surface of the glands, they need to be expressed to remove any poor meibum and inflammatory debris.
- Cold meibomian glands are expressed at 20-30lbs per square inch
- Pre-heated expression (110 degrees) drops the needed pressure to 10lbs
- Even with heat applied to front surface of eyelid, most patients will experience discomfort.

LipiFlow



- LipiFlow® Thermal Pulsation scheduled in 4 weeks
- FDA approved device
- This treatment method uses a disposable “activator” placed between the globe and the eyelid
- The eye is protected by a shell that is similar in diameter to a scleral contact lens.
- Applies constant pulsatile pressure and **108.5** degree heat to **interior** eyelids for 12 minutes

LipiFlow[®]



Does LipiFlow[®] Work

- A recent review of 31 peer reviewed articles/abstracts (including five registered randomized controlled clinical trials):
 - A single dose, 12-minute therapy results in:
 - Mean gland function improvement is ~ 3x baseline
 - Mean symptom improvement is ~ 2x (symptoms are halved)
 - Sustained effect:
 - Nine center randomized controlled study: mean improved gland function and symptom relief was 12 months and longer.
 - Uncontrolled studies: significantly longer (these include combination therapy, lid margin health)

1. Blackie CA, et al. Treatment for meibomian gland dysfunction and dry eye symptoms with a single-dose vectored thermal pulsation: a review. Current Opinion in Ophthalmology 2015, 26:306-313.

Recommendations for Primary Care

- Korb MGE
- Transilluminator meibography
- Debridement with golf-spud

Other methods available at Pacific Dry Eye Solutions

- Lid-seal test for nighttime exposure
- Tear Lab Osmolarity
- Oculus Keratograph 5M NIKBUT
- Oculus Keratograph Tear Film Scan
- The Sjo Test
- Nutraceutical Counseling
- Amniotic membranes
- Evaporative Eyewear (night/day)

Thank you!



Tulalip CE

Sunday, Sept 20, 2015
Tulalip Resort Casino,
Tulalip, Washington
6 hours, \$250
Dina Erickson & Beth Kinoshita

UPCOMING EVENTS



Homecoming CE

Jefferson Hall, Pacific University
Saturday, October 3, 2015
6 hours, \$100 (special homecoming rate)

GLAUCOMA SYMPOSIUM

Saturday, January 9, 2016
Willows Lodge, Woodinville, Washington
7 hours with Howard Barnebey & Murray Fingeret
For more information contact FREDERIM@pacificu.edu



2016 ISLAND EYES CONFERENCE

January 17 - 23, 2016
Sheraton Maui Resort
Up to 29 hours of OD Education \$700 - \$800
Nate Lighthizer, Leo Skorin, Denise Goodwin, Stanley Teplick,
and featured speakers from Waterloo Class of 1994



Coeur d'Alene CE

April 15 & 16, 2016
The Coeur d'Alene Resort, Idaho
10 hours \$350

2016 VICTORIA CONFERENCE

July 21 – 24, 2016
Delta Ocean Pointe, Victoria, BC
20 hours of education \$450 - \$550



For more conference information contact: JEANNE@pacificu.edu