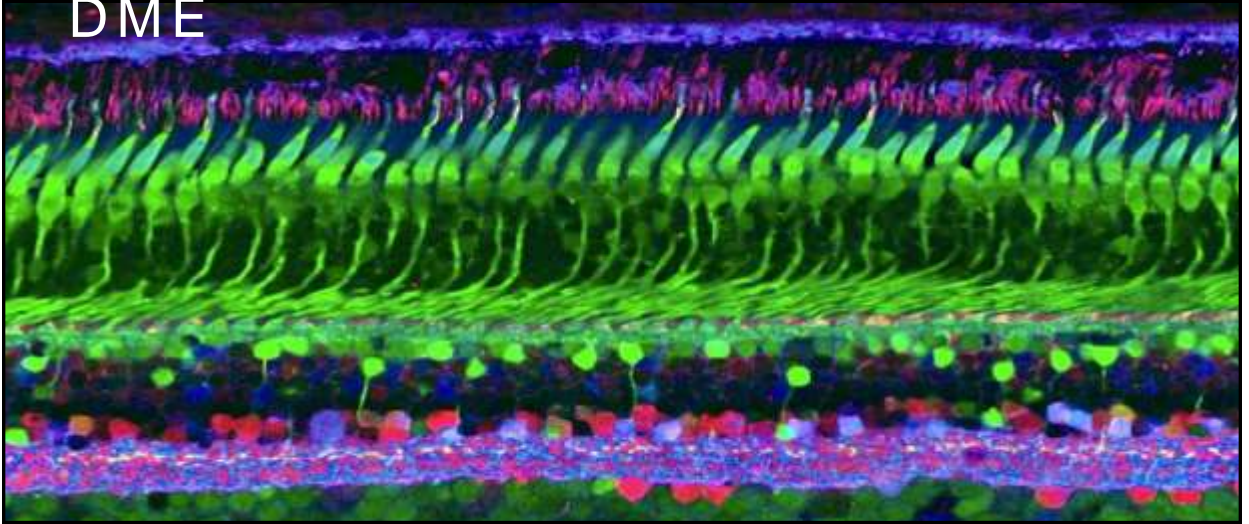
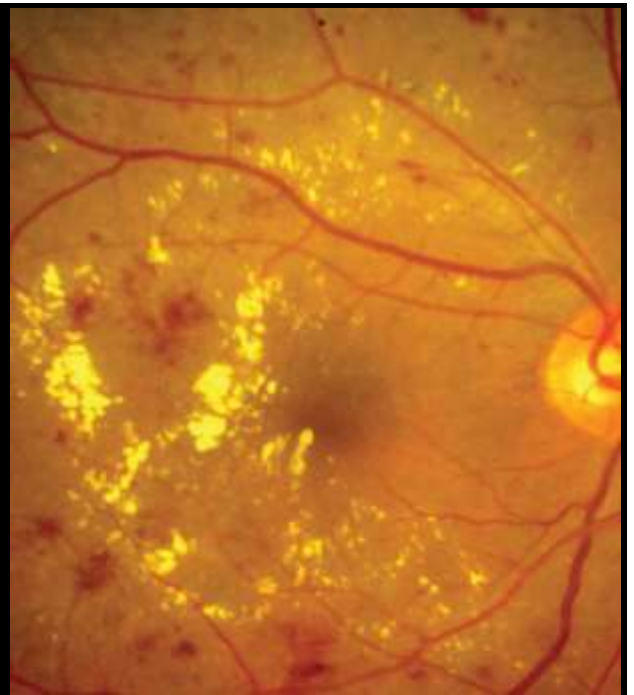


DR. SHERIF SHAWKY
M.SC, ICO

PROGNOSTIC FACTORS FOR DME



- Diabetic macular edema (DME) is the leading cause of visual impairment in both type I and type II DM.
- All patients with DM are at risk of developing DME.



INCIDENCE

- 3% in mild NPDR.
- 38% in moderate to severe NPDR.
- 71% in PDR.

The Wisconsin Epidemiologic Study of Diabetic Retinopathy XXIII 2009



PROGNOSTIC FACTORS FOR DME

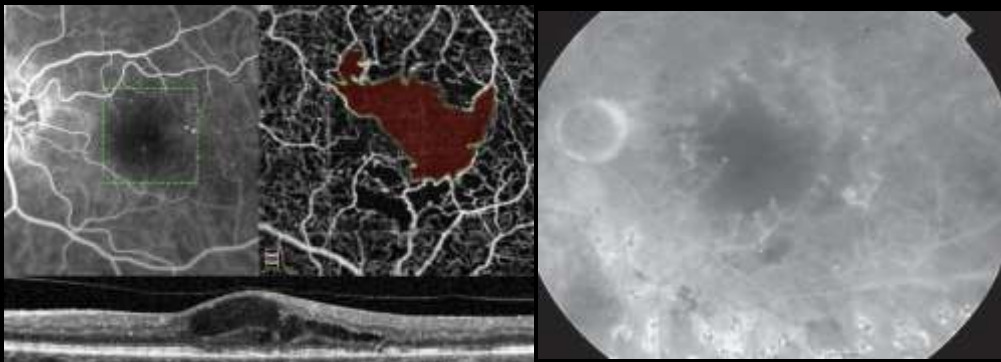
1-CLINICAL EXAMINATION

Best corrected visual acuity

- the worse the VA at the beginning of treatment the worse the prognosis

2-FLOURESCENIN ANGIOGRAPHY AND OCTA

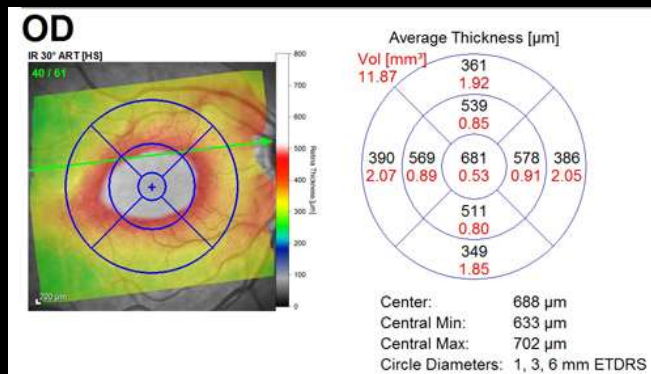
- Ischemic maculopathy.
- Poor perfusion of the optic nerve head.



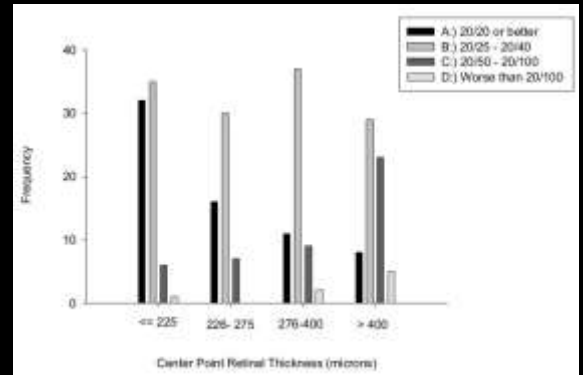
OCT POOR PROGNOSTIC FACTORS

A-CENTRAL MACULAR THICKNESS

The more the CMT the worse is the prognosis



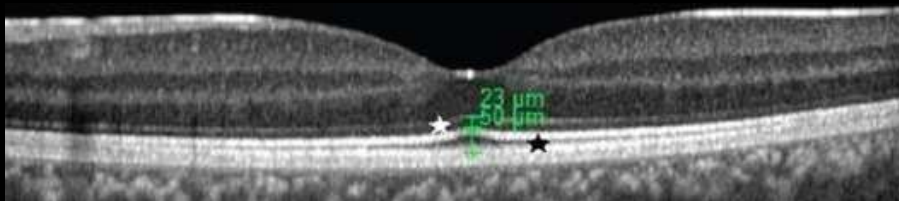
- IN 2007, a study by DRCR showed that retinal thickness only accounts for up to 27% of variability in the measured BCVA, suggesting that other factors are important determinants of VA in the presence of diabetic macular edema.



Diabetic retinopathy clinical research network :Relationship between Optical Coherence Tomography–Measured Central Retinal Thickness and Visual Acuity in Diabetic Macular Edema, Ophthalmology , Volume 114 , Issue 3 , 525 - 536

B-FOVEAL BULGE

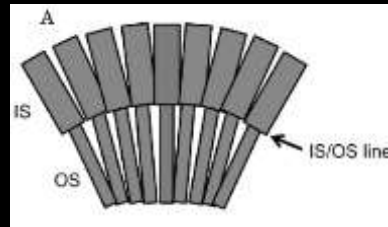
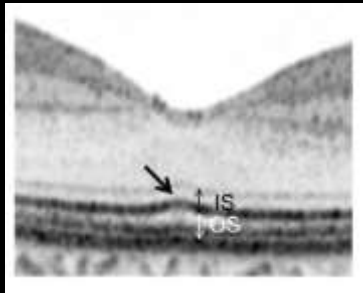
- FOVEAL BULGE IS THE TERM USED FOR THE BULGE IN THE INNER SEGMENT-OUTER SEGMENT (IS-OS) LINE AT THE CENTER OF FOVEA SEEN ON OCT.
- ACCORDING TO INTERNATIONAL NOMENCLATURE OF OPTICAL COHERENCE TOMOGRAPHY PANEL, THE IS-OS LINE HAS BEEN NEWLY DESCRIBED AS ELLIPSOID ZONE (EZ).



- Photoreceptor inner segment (white solid star) measured as the distance between ELM and inner border of ellipsoid zone.
- Photoreceptor outer segment (black solid star) measured as the distance between ellipsoid zone and inner border of RPE

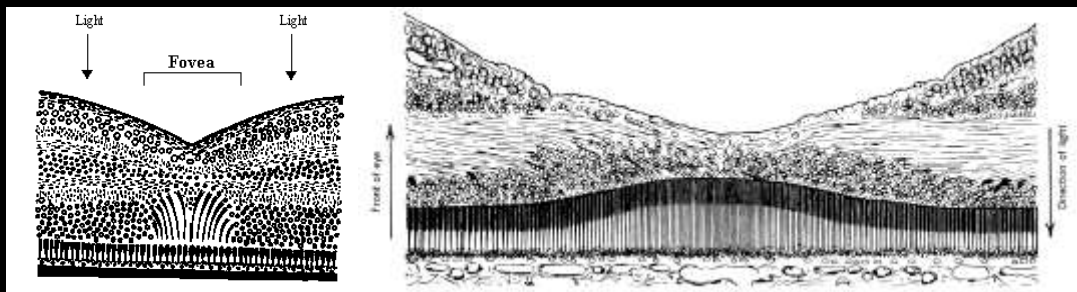
B-FOVEAL BULGE

- FOVEAL MATURATION SEES CENTRIFUGAL MIGRATION OF INNER RETINAL LAYERS AWAY FROM FOVEA AND CENTRIPETAL MIGRATION OF CONE PHOTORECEPTORS TOWARD THE CENTER OF FOVEA LEADING TO BULGE FORMATION.



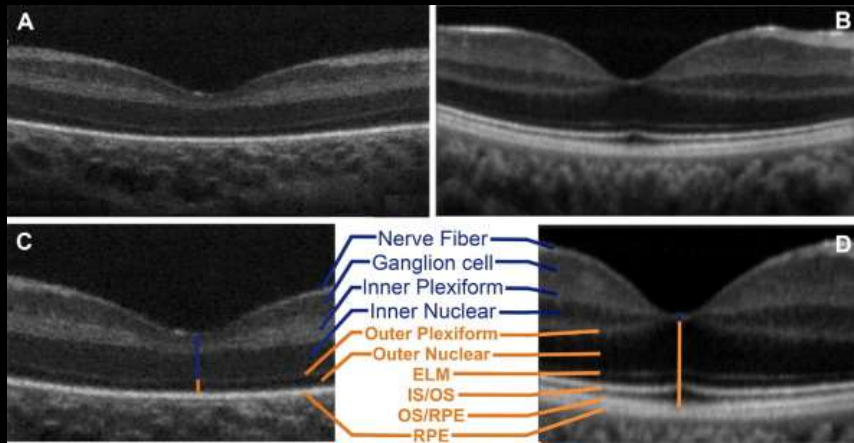
B-FOVEAL BULGE

- FOVEAL BULGE IS THE SITE OF MAXIMUM CONE DENSITY AND HENCE THE SITE OF MAXIMUM VISION.



B- FOVEAL BULGE

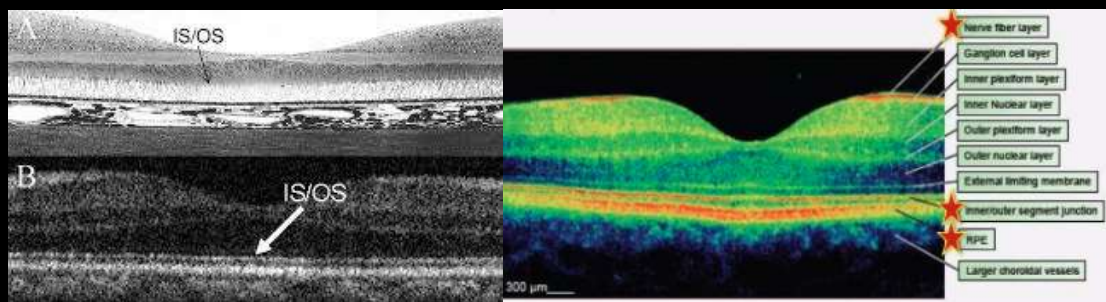
- DAMAGE OF FOVEAL PHOTORECEPTORS RESULTS IN ABSENCE OF FOVEAL BULGE WHICH LEADS TO POOR VA.



SAURABH, KUMAR ET AL. "AGE-RELATED CHANGES IN THE FOVEAL BULGE IN HEALTHY EYES." MIDDLE EAST AFRICAN JOURNAL OF OPHTHALMOLOGY 24.1 (2017): 48-50. PMC. WEB. 28 JUNE 2018.

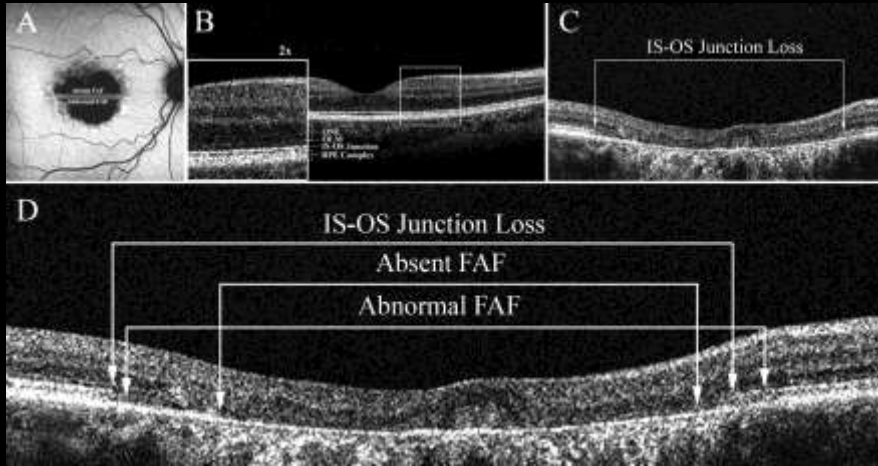
C- IS/OS DISRUPTION

- IS/OS represented by a hyper-reflective line just above the RPE.



C- IS/OS DISRUPTION

- Its disruption reveals damage of macular photoreceptors.



C- IS/OS DISRUPTION GRADING

Grade 0:
Intact IS/OS junction

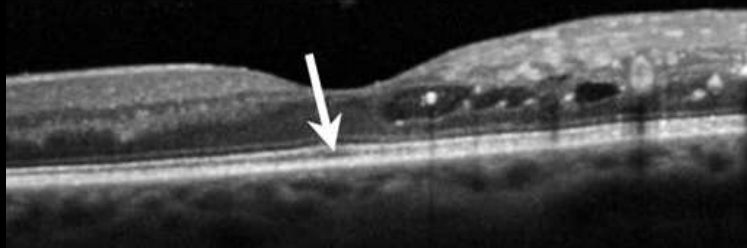
Grade I:
Disruption less than or equal 200 μm

Grade II:
Disruption more than 200 μm

C- IS/OS DISRUPTION GRADING

Grade 0:

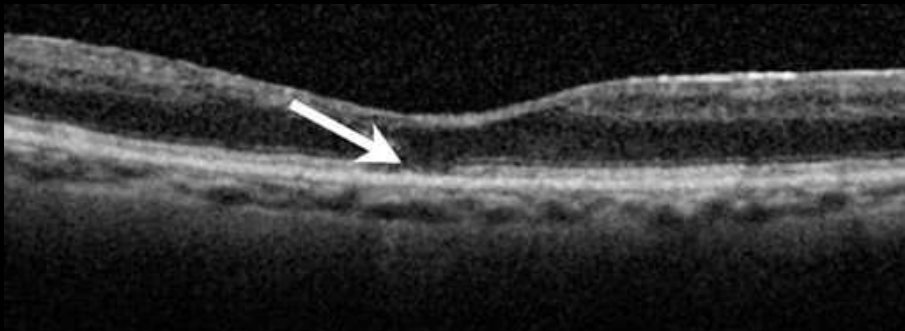
Intact IS/OS junction



C- IS/OS DISRUPTION GRADING

Grade I:

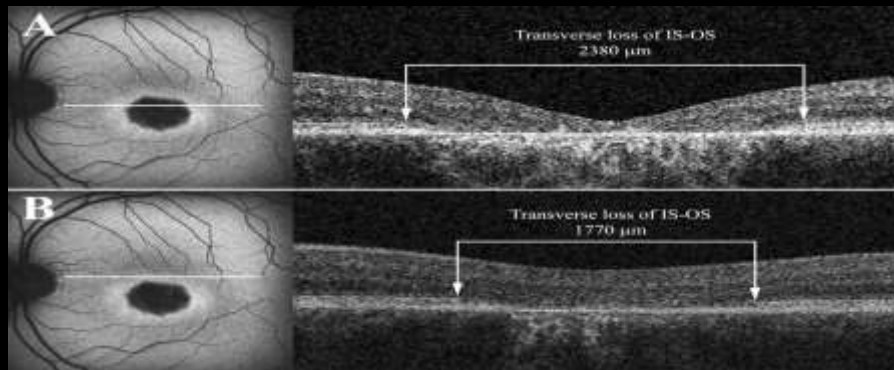
Disruption less than or equal 200 um



C- IS/OS DISRUPTION GRADING

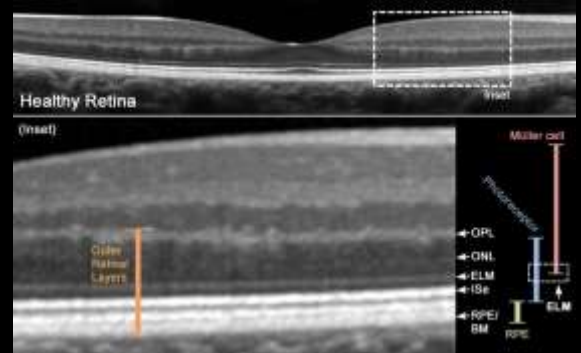
Grade II:

Disruption more than 200 μm



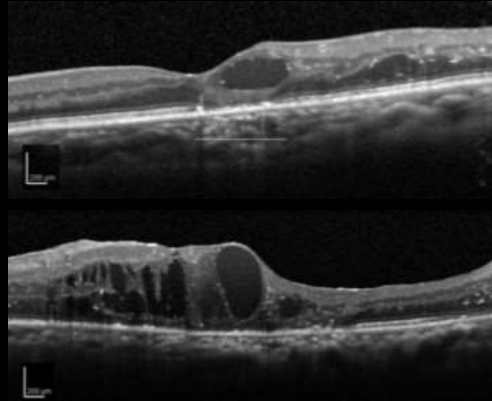
D-ELM AND HYPER-REFLECTIVE FOCI

- The external limiting membrane (ELM) is a structure that separates the inner segments from the outer nuclear layer, where the Müller cells are joined to the photoreceptor cells.
- ELM corresponds to the adherens junctions between the Müller cells and photoreceptor cells and also prevents passage of macromolecules.



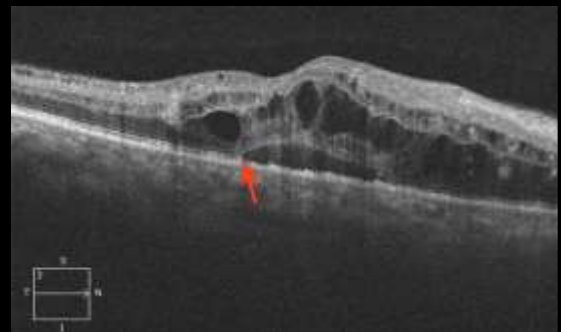
D-ELM AND HYPER-REFLECTIVE FOCI

- ELM acts as **barrier** against the diffusion of macromolecules (proteins and lipids) from retinal damaged vasculature.
- So damage of ELM facilitates the passage of the macromolecules.



D-ELM AND HYPER-REFLECTIVE FOCI

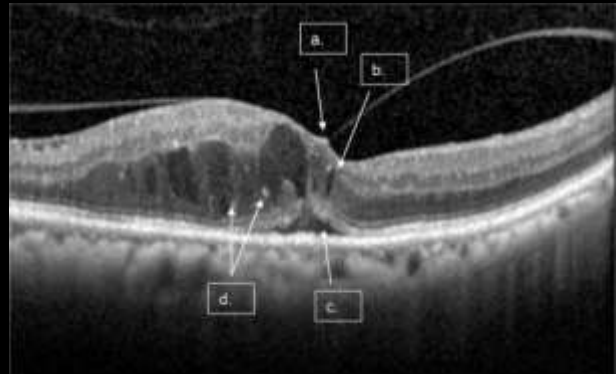
- Recently, several studies have shown that ELM interruptions are associated with lower visual acuity outcome in patients with clinically significant DME (CSME).
- Possibly this is because the integrity of the ELM has a critical role in restoration of the photoreceptor microstructures and alignment.



CHEN, XINJIAN ET (2012). QUANTIFICATION OF EXTERNAL LIMITING MEMBRANE DISRUPTION CAUSED BY DIABETIC MACULAR EDEMA FROM SD-OCT. INVESTIGATIVE OPHTHALMOLOGY & VISUAL SCIENCE, 53. 10.1167/IOVS.12-10083.

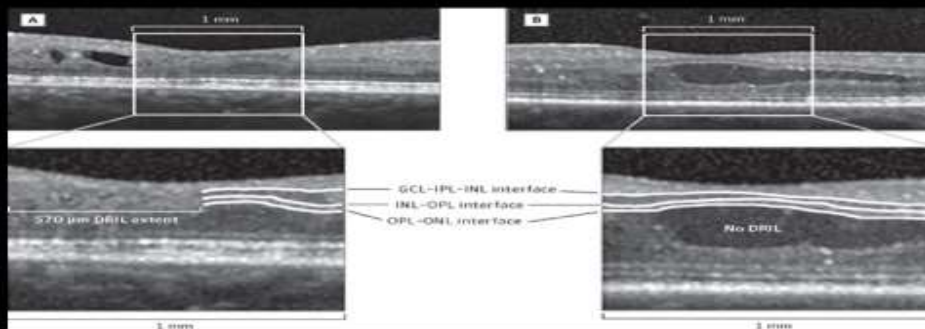
D-ELM AND HYPER-REFLECTIVE FOCI

- These foci represents the initial stage in development of intraretinal exudates.
- Irregular RPE lines detected at higher frequency in those areas where the hyper reflective foci concentrate so that may reveals that these hyper reflective foci are the degenerated retinal cells themselves or macrophages attempting to engulf dead cells.



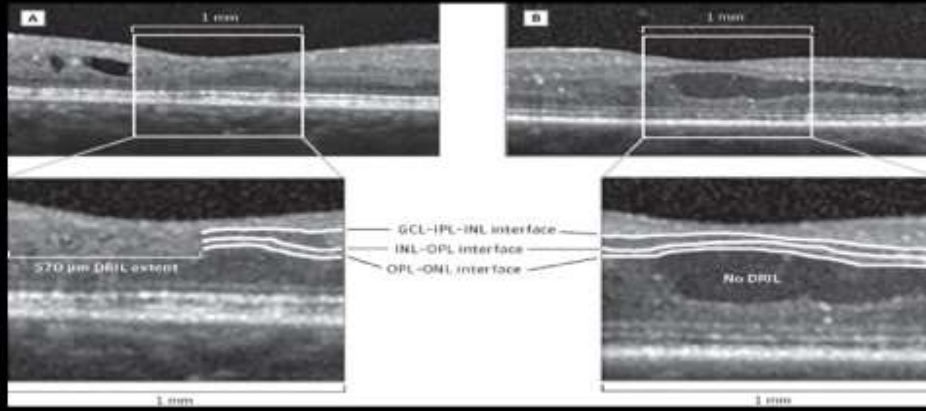
UJI, AKIHITO... [ET AL.] (2012) ASSOCIATION BETWEEN HYPERREFLECTIVE FOCI IN THE OUTER RETINA, STATUS OF PHOTORECEPTOR LAYER, AND VISUAL ACUITY IN DIABETIC MACULAR EDEMA. AMERICAN JOURNAL OF OPHTHALMOLOGY, 153(4): 710-717.

E-DISORGANIZED RETINAL INNER LAYERS (DRIL).



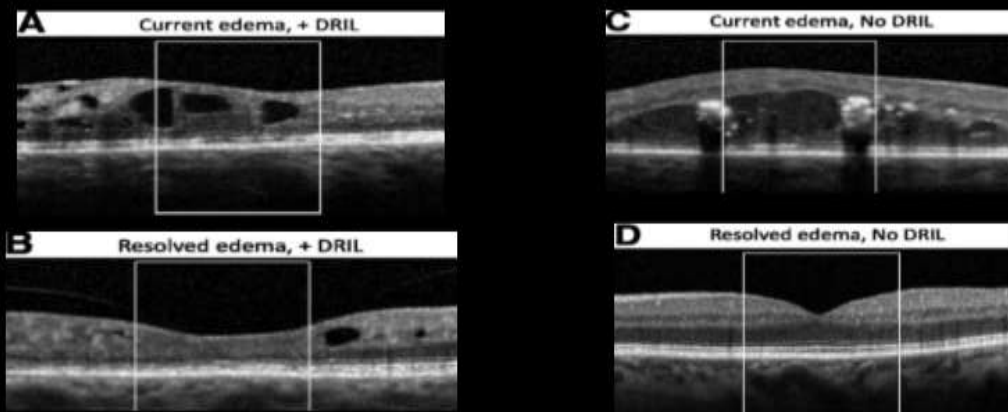
Presence of DRIL is defined as the inability to identify the boundaries between the ganglion cell-inner plexiform layer complex (evaluated as a single layer complex due to the difficulty of distinguishing between these two layers in scans of normal retinas without pathology), inner nuclear layer, and outer plexiform layer

E-DISORGANIZED RETINAL INNER LAYERS (DRIL).



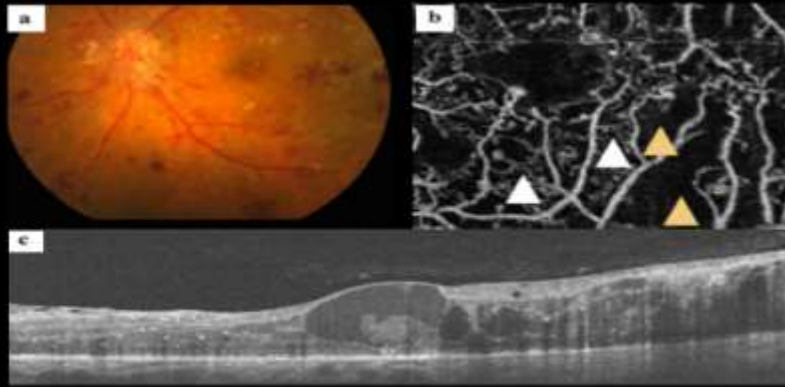
- A: DRIL is present, and retinal layer boundaries can only be partially identified at the right-hand edge of the 1-mm box.
- B: DRIL is absent, and all retinal layer boundaries can be identified throughout the 1-mm box.

E-DISORGANIZED RETINAL INNER LAYERS (DRIL).



foveal DRIL could be present with or without center-involved DME and loss of the normal macular contour did not constitute DRIL by itself, unless there was also concurrent loss of retinal layer boundaries

RECENTLY

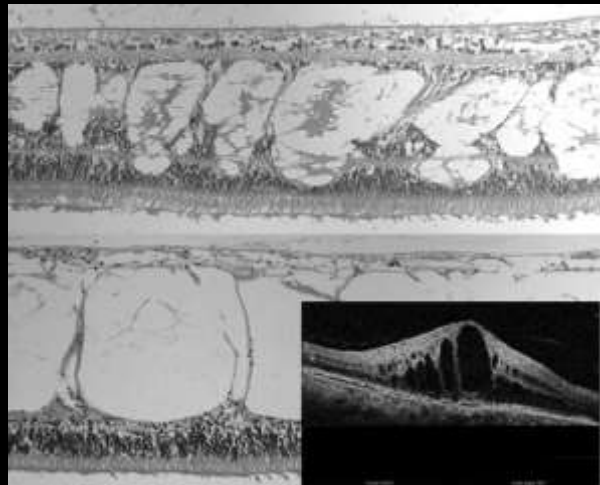


DRIL, ELM and EZ disruption are now believed to be a sign of underlying macular capillary non-perfusion (ischemia).

SCARINCI Et al . "Deep Retinal Capillary Non-Perfusion Is Associated with Photoreceptor Disruption in Diabetic Macular Ischemia." American journal of ophthalmology 168 (2016): 129-138. .

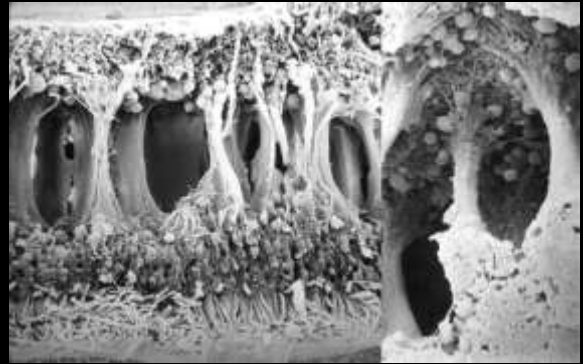
F- CYSTOID MACULAR EDEMA

- Macular edema results from abnormal accumulation of fluid in the central retina and indicates compromised function in BRB.
- Which result in displacement of the spatial relationships between retinal neuronal components.



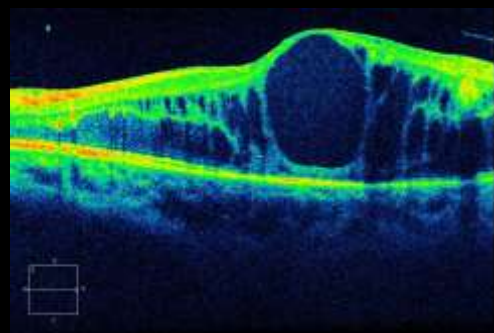
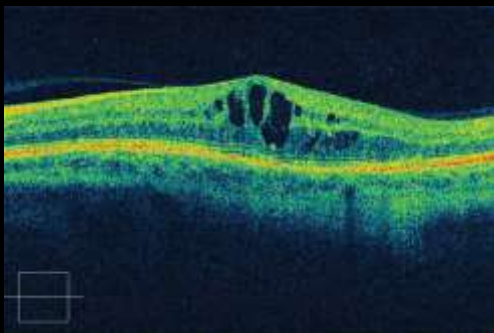
F- CYSTOID MACULAR EDEMA

- Observations from histology and (OCT) of macular edema give a false impression of multiple cysts delineated by tissue structures retina.
- However, scanning electron microscopy shows that Muller and bipolar cells may constitute an important component of them.



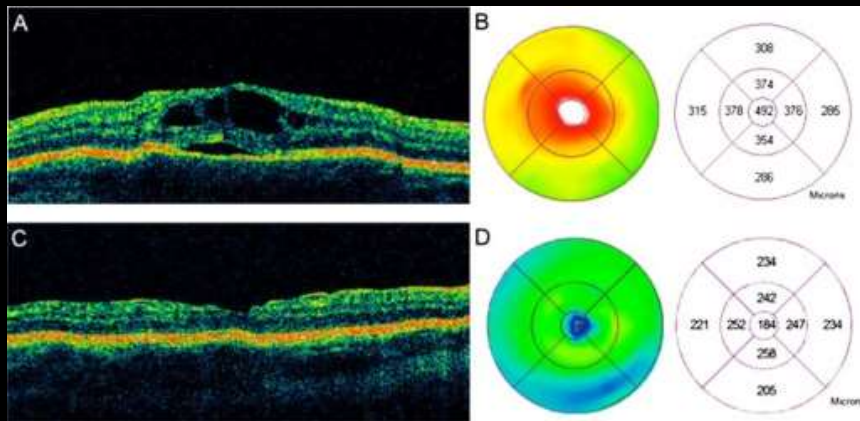
F- CYSTOID MACULAR EDEMA

- Eyes with DCME where the cystoid changes coalesce together with no residual bridging tissue (Muller fibers loss) are associated with a worse prognosis after injection, ie: atrophic changes and thinning of the macula.



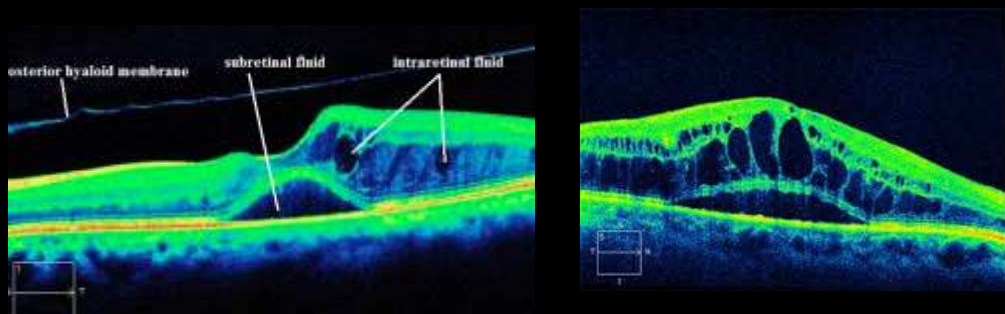
F- CYSTOID MACULAR EDEMA

Atrophic changes and thinning of the macula



G- SEROUS RETINAL DETACHMENT

- The presence of SRF implies a **bad prognostic factor**.
- It indicates **poor RPE function** which increase the liability for fluid to **reaccumulate** again after treatment.
- Impairment of choroidal blood flow in diabetes leads to **hypoxia** which leads to decrease the ability of RPE to pump out fluid.



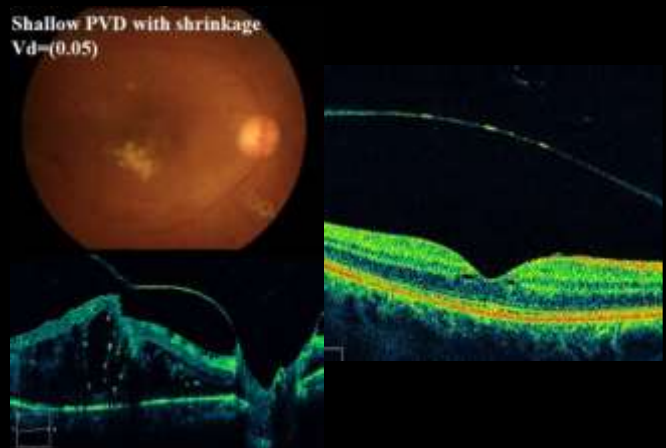
OZDEMIR, H. ET(2005). SEROUS MACULAR DETACHMENT IN DIABETIC CYSTOID MACULAR OEDEMA. ACTA OPHTHALMOLOGICA SCANDINAVICA, 83: 63-66.
DOI:10.1111/j.1600-0420.2005.00387.

H- POSTERIOR VITREOUS DETACHMENT (PVD)

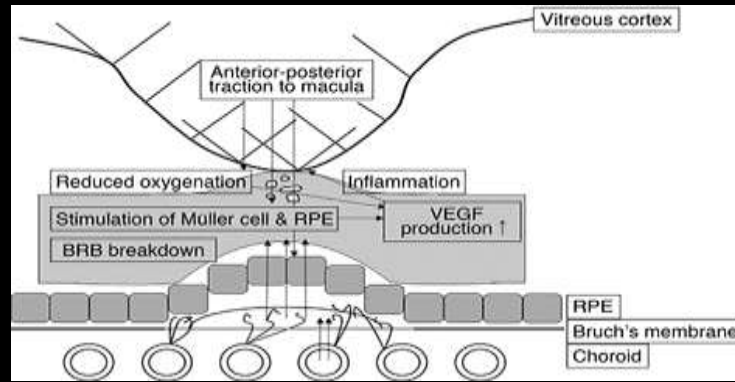
- Vitreous acts as the scaffold for neovascularization arising from the retina. Retinal neovascularization rarely arises from the retina in eyes with a Complete PVD.

H-PVD

- A partial (incomplete) posterior vitreous detachment (P-PVD) or the absence of a PVD is a risk factor for retinal neovascularization and ERM formation.
- A complete posterior vitreous detachment (C-PVD) is a strong negative risk factor for retinal neovascularization.

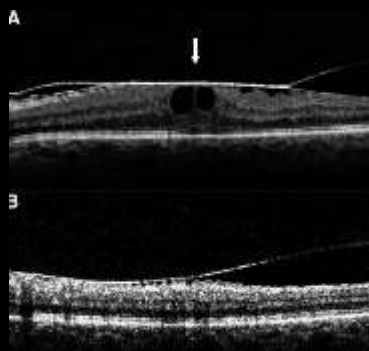


I-VITRO- MACULAR TRACTION



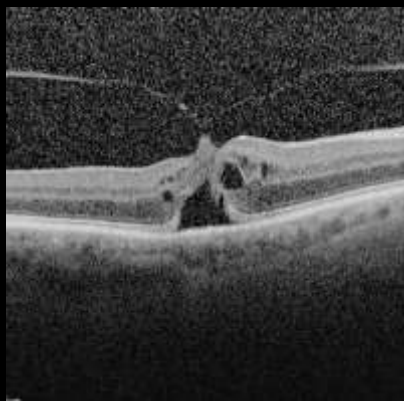
pathogenesis

I-VITRO- MACULAR TRACTION



Tangential traction

I-VITRO- MACULAR TRACTION



A-P Traction

I-VITRO- MACULAR TRACTION

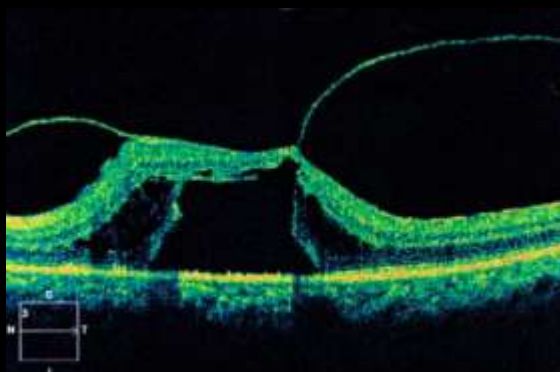
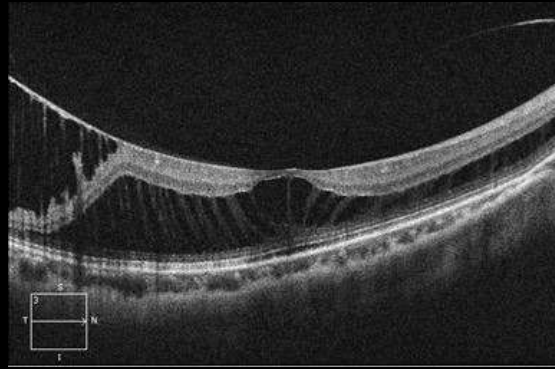


Table top

I-VITRO- MACULAR TRACTION



Retinoschisis

OCT PROGNOSTIC FACTORS

| | BAD | GOOD |
|----------------------|-----------------------------------|----------------------|
| Foveal bulge | Lost | Intact |
| IS/OS | Lost or disrupted | Intact |
| ELM | Lost or disrupted | Intact |
| Hyperreflective foci | Present | Not present |
| Subretinal fluid | Present (NSD) | Not present |
| Inner retinal layers | DRIL | Arranged |
| Muller fibers | Stretched or lost | Intact |
| Cyst | Large cyst | Multiple small cysts |
| PVD | No PVD or Partial incomplete PVD | Complete PVD |
| VMT | Tabletop> A-P traction>tangential | No |

THANK YOU!



REFERENCES

- 1-*THE WISCONSIN EPIDEMIOLOGIC STUDY OF DIABETIC RETINOPATHY XXIII: THE TWENTY-FIVE-YEAR INCIDENCE OF MACULAR EDEMA IN PERSONS WITH TYPE 1 DIABETES* KLEIN, RONALD ET AL. OPTHALMOLOGY , VOLUME 116 , ISSUE 3 , 497 - 503
- 2-*WU L, FERNANDEZ-LOAIZA P, SAUMA J, HERNANDEZ-BOGANTES E, MASIS M. CLASSIFICATION OF DIABETIC RETINOPATHY AND DIABETIC MACULAR EDEMA. WORLD JOURNAL OF DIABETES. 2013;4(6):290-294. DOI:10.4239/WJD.V4.I6.290.*
- 3-*RELATIONSHIP BETWEEN OPTICAL COHERENCE TOMOGRAPHY-MEASURED CENTRAL RETINAL THICKNESS AND VISUAL ACUITY IN DIABETIC MACULAR EDEMA* OPTHALMOLOGY , VOLUME 114 , ISSUE 3 , 525 - 536.
- 4-*EL MATRI HASSAIRI, A., CHEBIL, A., BEN ABDALLAH, M., MAAMOURI, R., CHAKER, N., AND EL MATRI, L. (2015). CORRELATION OF VISUAL ACUITY AND CENTRAL MACULAR THICKNESS IN DIABETIC MACULAR EDEMA. ACTA OPTHALMOL, 93. DOI:10.1111/AJO.12155-3719-2015-0459.*
- 5-*SAURABH, KUMAR ET AL. "AGE-RELATED CHANGES IN THE FOVEAL BULGE IN HEALTHY EYES." MIDDLE EAST AFRICAN JOURNAL OF OPTHALMOLOGY 24:1 (2017): 48-50. PMC. WEB. 28 JUNE 2018.*
- 6-*MAHESHWARY, ANJALI S. ET AL. "THE ASSOCIATION BETWEEN PERCENT DISRUPTION OF THE PHOTORECEPTOR INNER SEGMENT/OUTER SEGMENT AND VISUAL ACUITY IN DIABETIC MACULAR EDEMA." AMERICAN JOURNAL OF OPTHALMOLOGY 150.1 (2010): 63-67.E1. PMC. WEB. 28 JUNE 2018.*
- 7-*CHEN, XINJIAN & ZHANG, LI & SOHN, ELLIOTT & LEE, KYUNGMOO & NIEMEIJER, MEINDERT & CHEN, JOHN & SONKA, MILAN & ABRAMOFF, MICHAEL. (2012). QUANTIFICATION OF EXTERNAL LIMITING MEMBRANE DISRUPTION CAUSED BY DIABETIC MACULAR EDEMA FROM SD-OCT. INVESTIGATIVE OPTHALMOLOGY & VISUAL SCIENCE. 53. 10.1167/IOVS.12-10083.*
- 8-*UJI, AKIHITO, [ET AL.] (2012) ASSOCIATION BETWEEN HYPERREFLECTIVE FOCI IN THE OUTER RETINA, STATUS OF PHOTORECEPTOR LAYER, AND VISUAL ACUITY IN DIABETIC MACULAR EDEMA. AMERICAN JOURNAL OF OPTHALMOLOGY. 153(4): 710-717.*
- 9-*OZDEMIR, H., KARACORLU, M. AND KARACORLU, S. (2005), SEROUS MACULAR DETACHMENT IN DIABETIC CYSTOID MACULAR OEDEMA. ACTA OPTHALMOLOGICA SCANDINAVICA, 83: 63-66. DOI:10.1111/J.1600-0420.2005.00387.*
- 10-*KAKEHASHI, A., TAKEZAWA, M., & AKIBA, J. (2014). CLASSIFICATION OF POSTERIOR VITREOUS DETACHMENT. CLINICAL OPTHALMOLOGY (AUCKLAND, N.Z.), 8, 1-10. [HTTP://DOI.ORG/10.2147/OPTH.S44921](http://doi.org/10.2147/OPTH.S44921).*
- 11-*SUN JK, LIN MM, LAMMER J, ET AL. DISORGANIZATION OF THE RETINAL INNER LAYERS AS A PREDICTOR OF VISUAL ACUITY IN EYES WITH CENTER-INVOLVED DIABETIC MACULAR EDEMA. JAMA OPTHALMOL. 2014;132(11):1309-1316. DOI:10.1001/JAMAOPHTHALMOL.2014.2350*