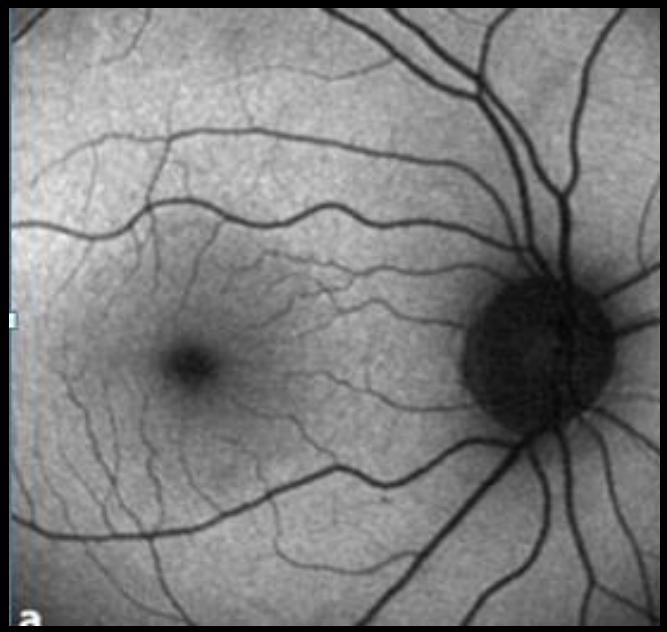
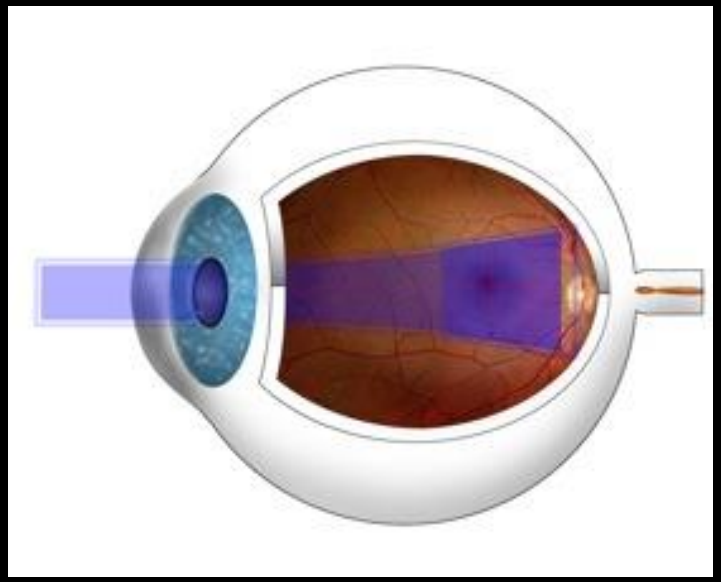
# RETİNA HASTALIKLARINDA OTOFLORESANS GÖRÜNTÜLEME

DR BURÇİN KEPEZ YILDIZ
PROF DR ŞENGÜL ÖZDEK

# OTOFLORESANS

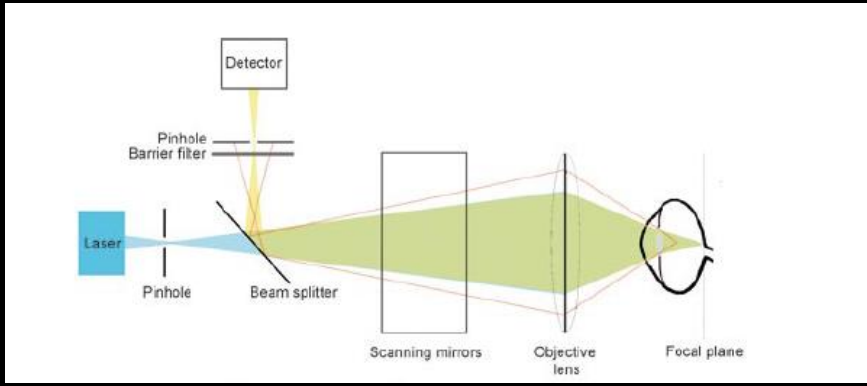
- Herhangi bir floresans madde kullanılmadan retinada bulunan florofor maddelerin belirgin dalgaboylarındaki ışıkla uyarılması sonucunda ışık yayması

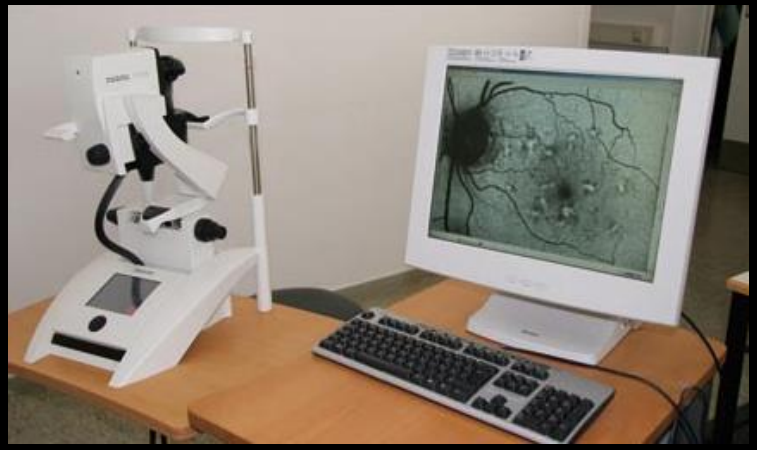




# FUNDUS OTOFLORESANSI

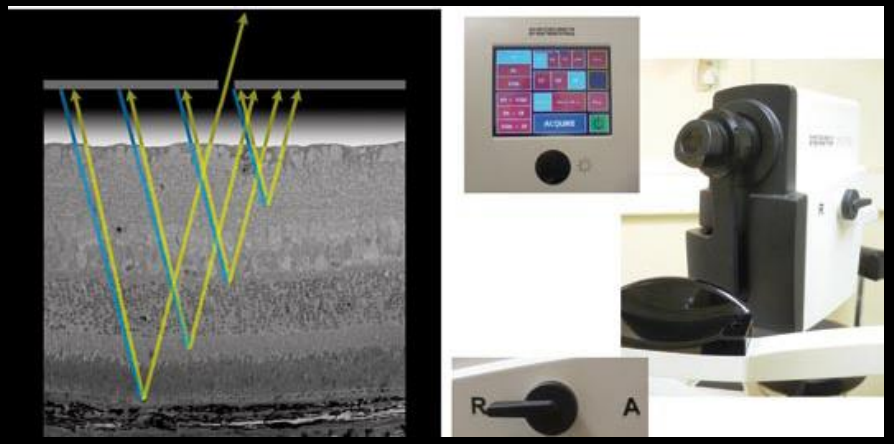
- Floroforların oluşturduğu otofloresansın bariyer filtreden geçirilmesi
- Konfokal SLO/HRA2 yüksek duyarlı fundus kamera ile noninvaziv olarak kaydedilmesi
- FOF yoğunluğu düşük olduğu için software ile yoğunluğun arttırılması
- Kantitatif değil,rölatif FOF yoğunluğu

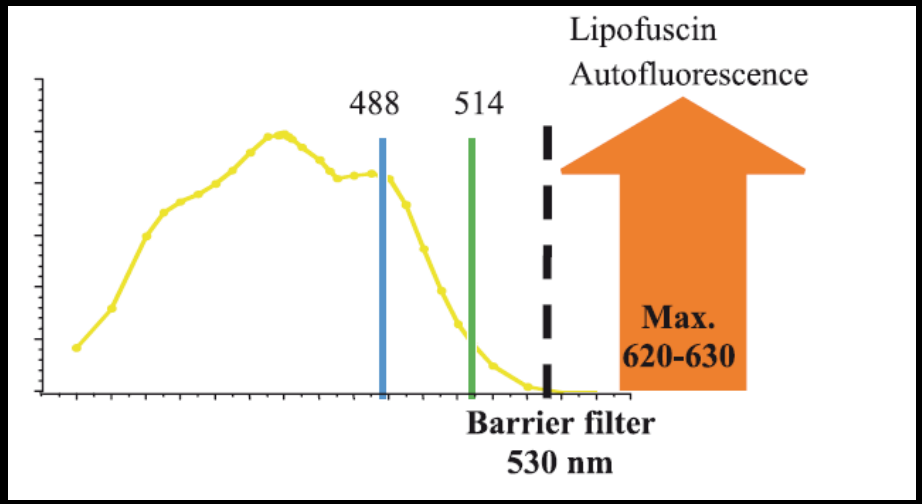


# KONFOKAL TARAYICI LAZER OFTALMOSKOPİ (c SLO)

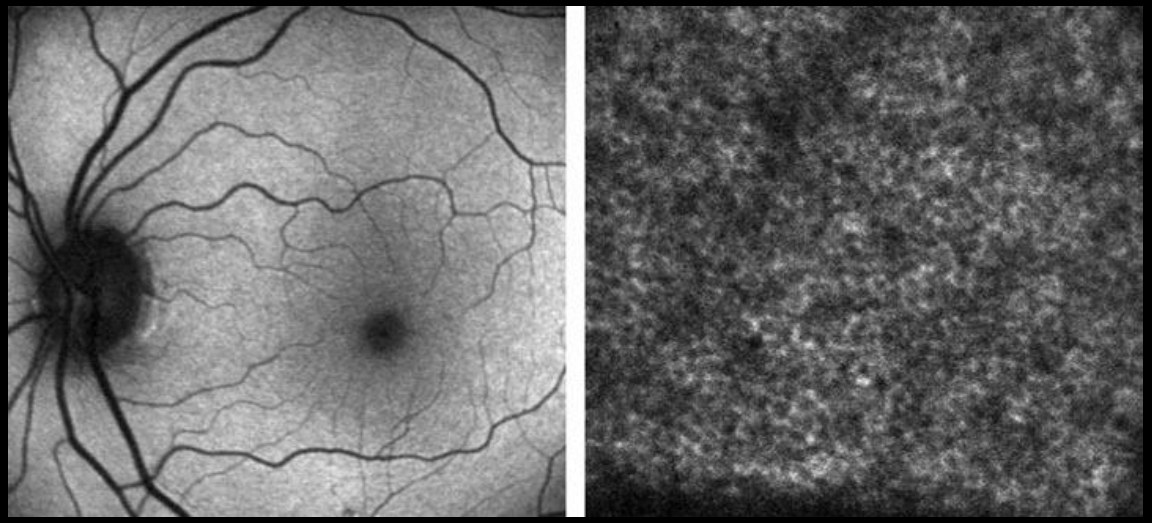
- Retina önü dokularda oluşan otofloresansı etkin bir biçimde azaltır. (LENS, KORNEA)
- HRA 2
- Uyarıcı ışık olarak 488 nm dalga boyunda argon lazer
- Bariyer filtre ile 500 nm ve üzerinde dalga boyları filtre edilir.
- Kızıl ötesi modunda fundus odaklanıp FA modunda florescein verilmeksizin
- Birden fazla otofloresan görüntünün ortalaması



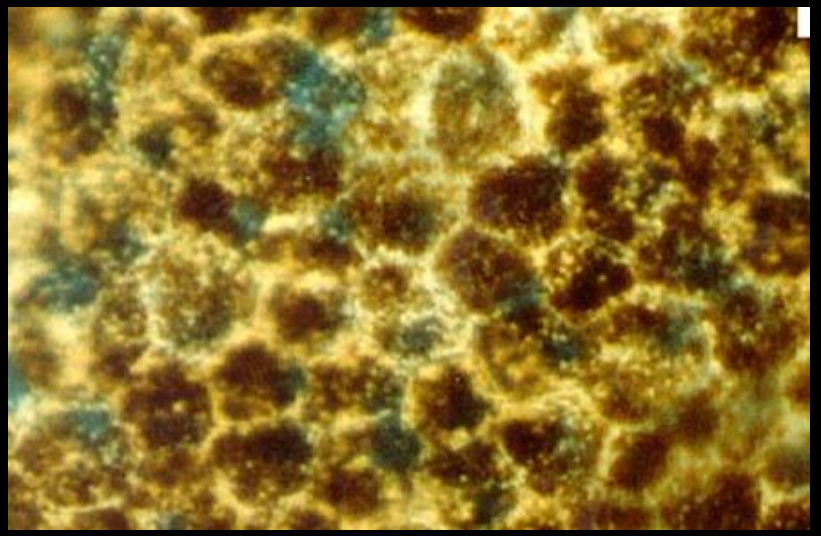



# FUNDUS OTOFLORESANSI (FAF)

- FAF esas kaynağı RPE'deki lipofusin
- Lipofusin.. Lizozomal birikinti ve yıkılamıyor.
- Primer olarak fagosite edilmiş fotoreseptör dış segmentlerinden kaynaklanıyor.
- Lipofusin yaşla birlikte artıyor
- >70 yaş..RPE'nin %20-33'ü lipofusin ve melanolipofusin ile dolu.



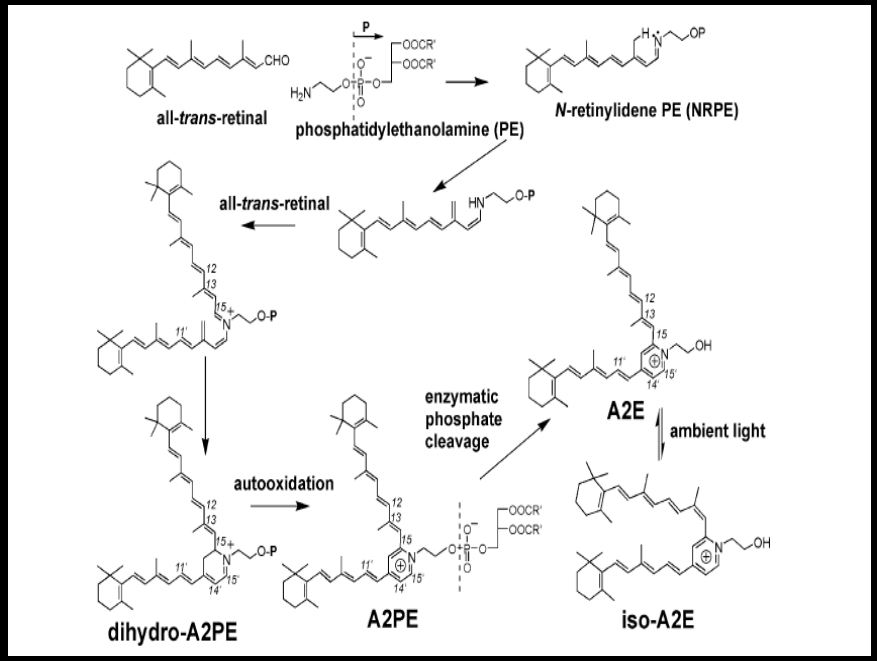
# LİPOFUSCİN

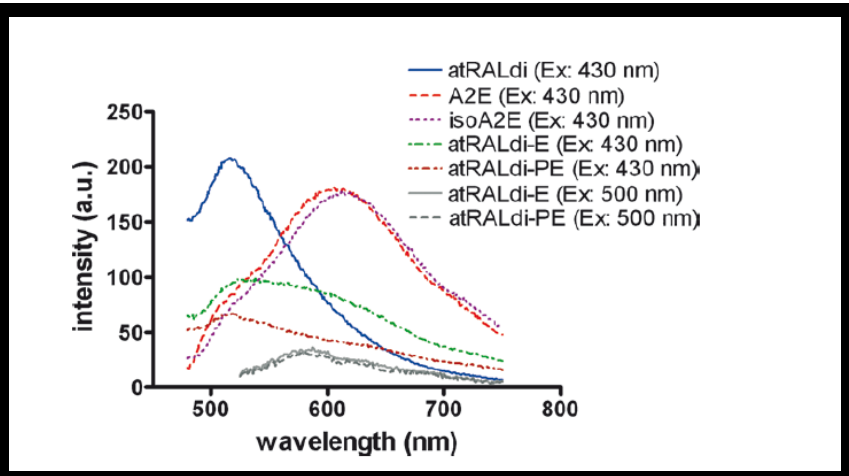


- %19-51 oranında lipid
  - Trigliserid
  - Kolesterol
  - Fosfolipid
  - Serbest yağ asitleri
- %30-58 protein
  - Amiloid β prekürsör protein
- %2 demir, bakır, aluminyum, çinko, kalsiyum,magnezyum
- Karbonhidrat
- Postmitotik hücre ve dokularda en yoğun: retina, kas, nöron

# LİPOFUSCİN

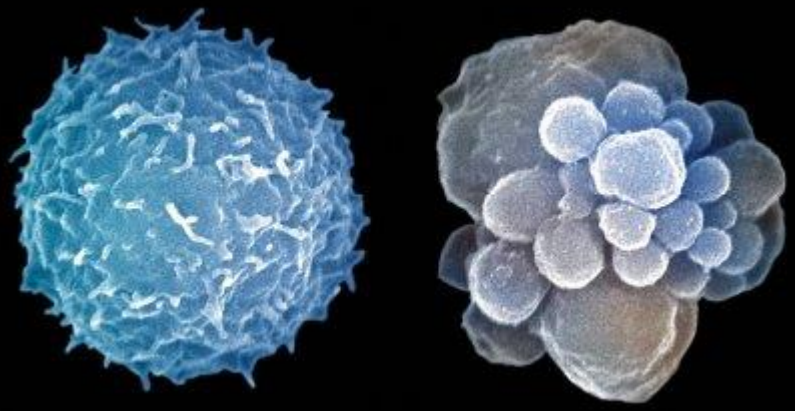
Lipofusin floroforların dietle alınan Vitamin A ile ilişkili olduğu gösterilmiş.
Vitamin A siklusunun yan ürünü
Ana madde: A2E ve A2E'nin fotoizomerleri
**A2E**.. 11cisretinal'in fotoizomerizasyonu sonucunda oluşur
Vitamin A aldehid (all-transretinal) ve etanolamin 2:1 oranında
Görünür dalga boyu spektrumunda absorpsiyon
Uyarıcı ışık 480-510 nm, emisyon 600-640 nm



# RPE LİPOFUSİN

- Fazla birikimi…
- hücresel disfonksiyon ve dejenerasyon
- Fotokimyasal mavi ışık hasarı..fototoksik
- Proteinlerin lizozomal yıkımının inhibisyonu
- Membranların deterjan etkisiyle yıkımı
- RPE apoptozisi
- DNA hasarı



RPE'de lipofuskin birikimi ⇒ sw FAF artışı ⇒ RPE hasarı ⇒ sw FAF azalma

# OTOFLORESANS

HETEROJEN DAĞILIM

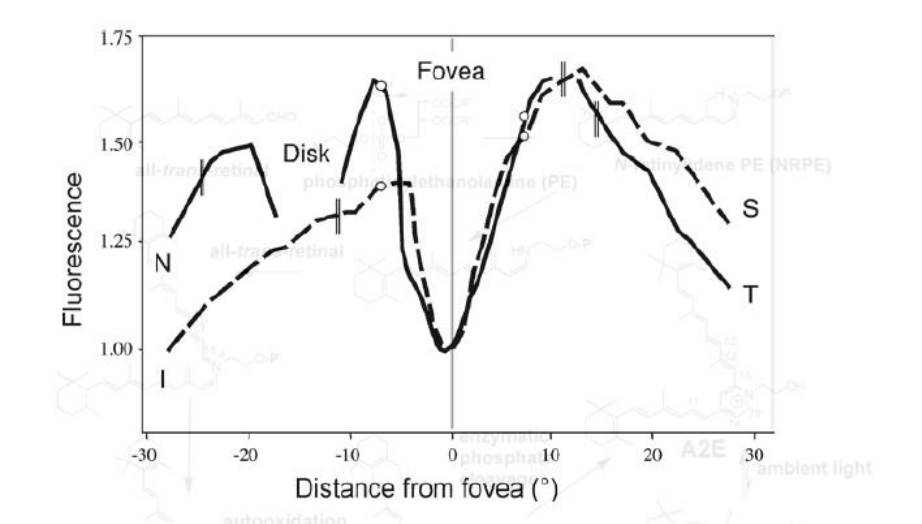
Foveadan 7- 13 derece sonra Üst Temporalde otofloresans maksimum

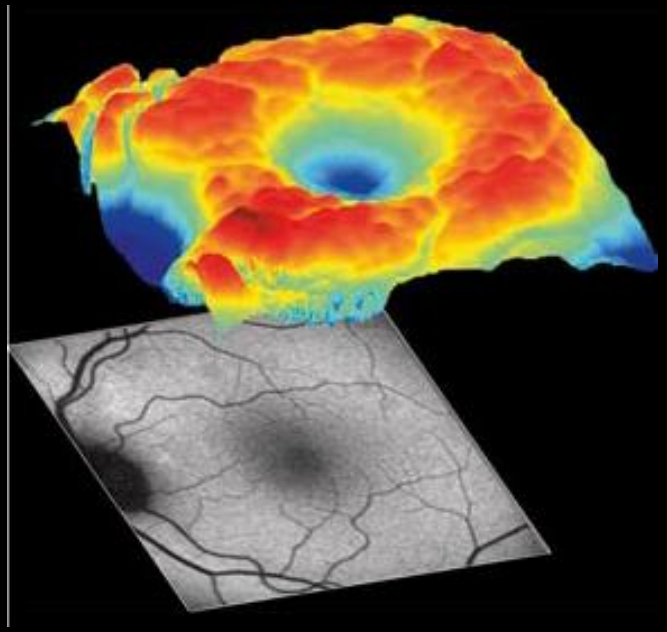
Foveada minimum

RPE melanin yoğunluğu

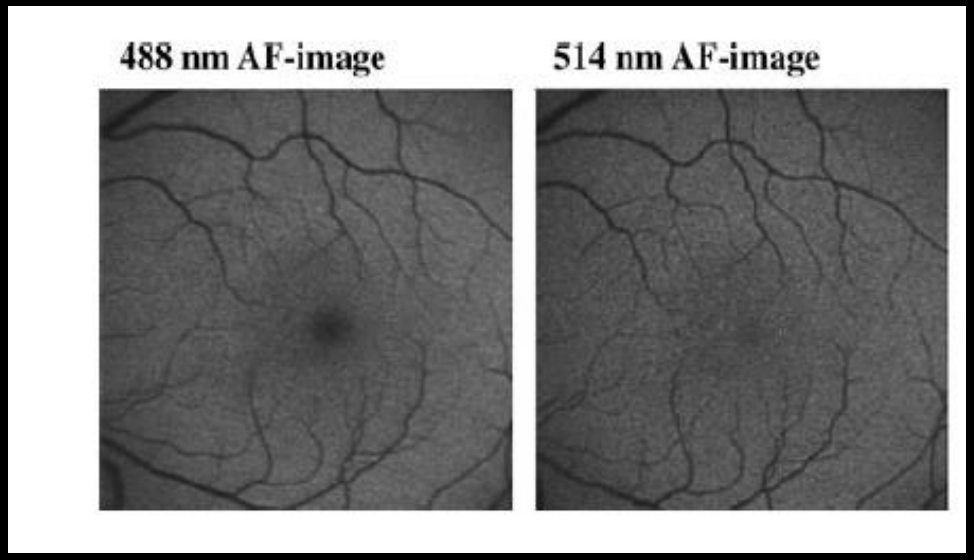
Kon/rod dağılım dengesizliği

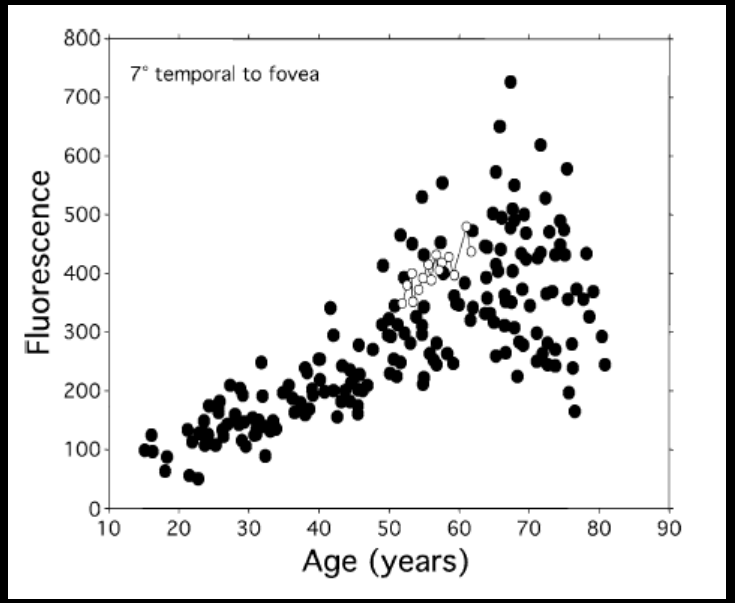
Foveal kon kaynaklı fagozom sayısı: ekstrafoveal rod kaynaklı fagozom sayısı/3



- 430-600 nm arasında FAF elde edilebilir
- Ancak en yüksek etkinlik 480-510 nm
- 70  yaşa kadar FAF artar 70 yaştan sonra azalır
- Atrofi
- lens optik dansite değişimi
- %40 floresan granul = melanolipofuskin ,lipofuskinden daha az floresan
- Lens ve okuler medyadan etkilenir.(dalga boyu arttıkça daha az etkilenir. )



# FUNDUS OTOFLORESANSI TİPLERİ

FUNDUS OTOFLORESANS GÖRÜNTÜLEME (FUNDUS AUTOFLUORESCENCE, FAF)

Kısa dalga boyu (short wavelength, SW-AF)

RPE-lipofusin

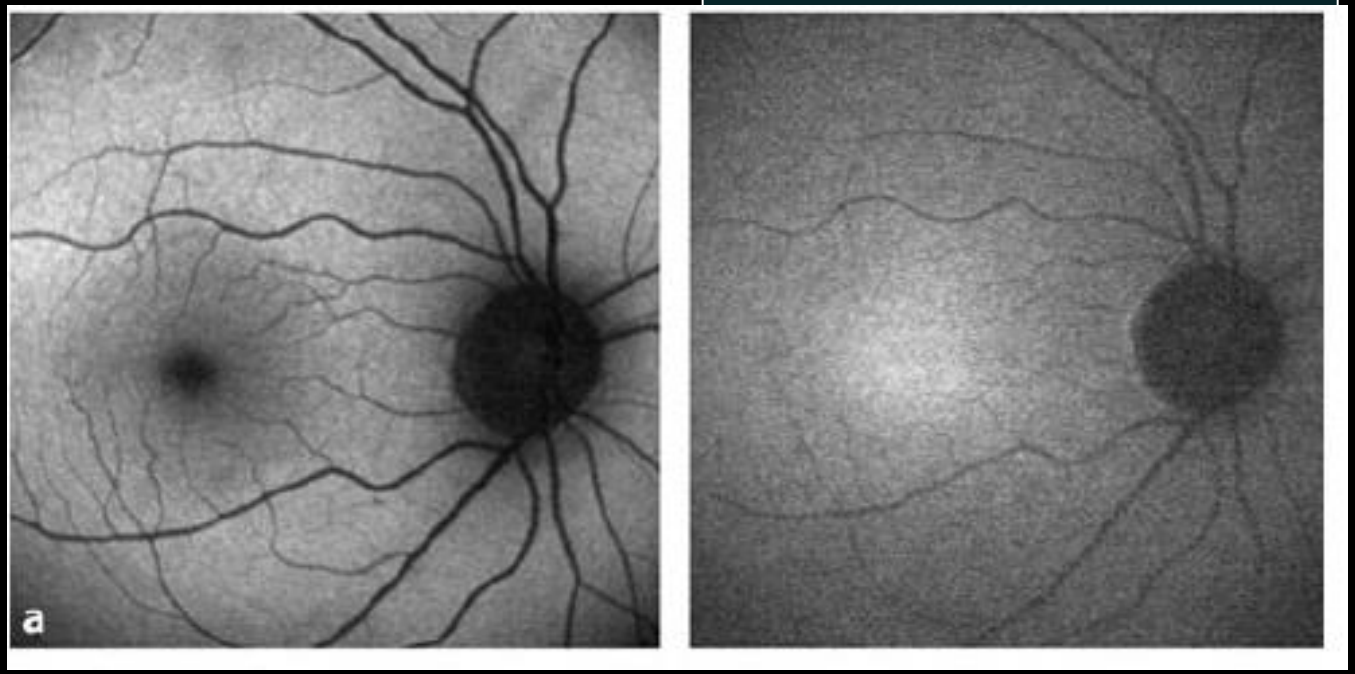
488 nm mavi argon lazer ile eksitasyon, 600-640 nm emisyon, 500 nm bariyer filtre

KIZIL-ÖTESİ FUNDUS OTOFLORESANSI (NEAR-İNFRARED OTOFLORESANS, NIR-AF)

RPE & koroid –melanin

787 nm diod lazer ile eksitasyon

ICG'nin 800 nm bariyer filtresi

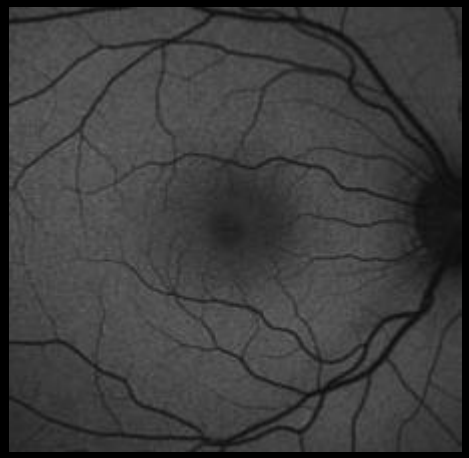


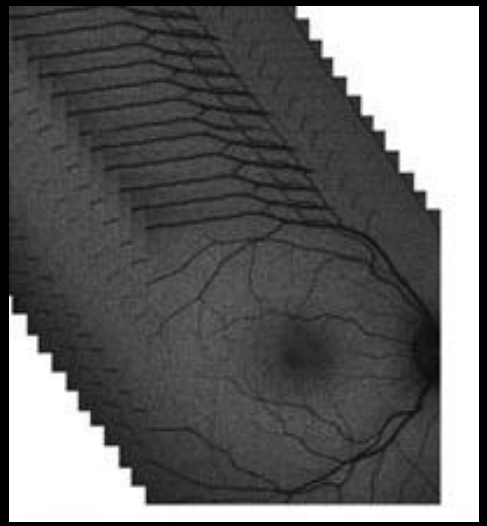
# FUNDUS OTOFLORESANSIN KAYNAĞI FLOROFORLAR

- Fotoreseptör dış segmentlerinde : prekürsör A2PE = lipofuskin like FAF
- RPE içinde lizozomlarda lipofuscin
- esas kaynak A2E
- İso A2E
- All trans retinal dimer etonalamin grupları
- Melanolipofuskin, melanolizozom
- Melanin: çok zayıf
- Drusen, bazal membran depozitleri
- Eski kandaki porfirin
- Eski subretinal sıvı: Fagosite edilmiş dış segment artıkları

# NORMAL FAF GÖRÜNÜMÜ

- Optik sinir RPE, lipofusin içermemesi nedeni ile siyah görünür. Otofloresans yok
- Retina damarları kan tarafından emilim olduğu için siyah görünür. Otofloresans yok
- Makulada dış pleksiform tabakalarda yer alan lutein ve zeaksantine bağlı olarak azalmış otofloresans (550 nmden kısa dalga boylarında )





# HİPO-OTOFLORESANS

- RPE LİPOFUSİN YOĞUNLUĞUNDA AZALMA

RPE atrofisi (coğrafik atrofi)

Herediter retinal distrofiler

- RPE MELANİN YOĞUNLUĞUNDA ARTMA

RPE hipertrofisi

- RPE ANTERİORUNDA ABSORBSİYONUN ARTMASI

İntraretinal sıvı (makula ödemi)

Melanin içeren hücrelerin göçü

Kristalin druzen veya diğer kristalin depozitler

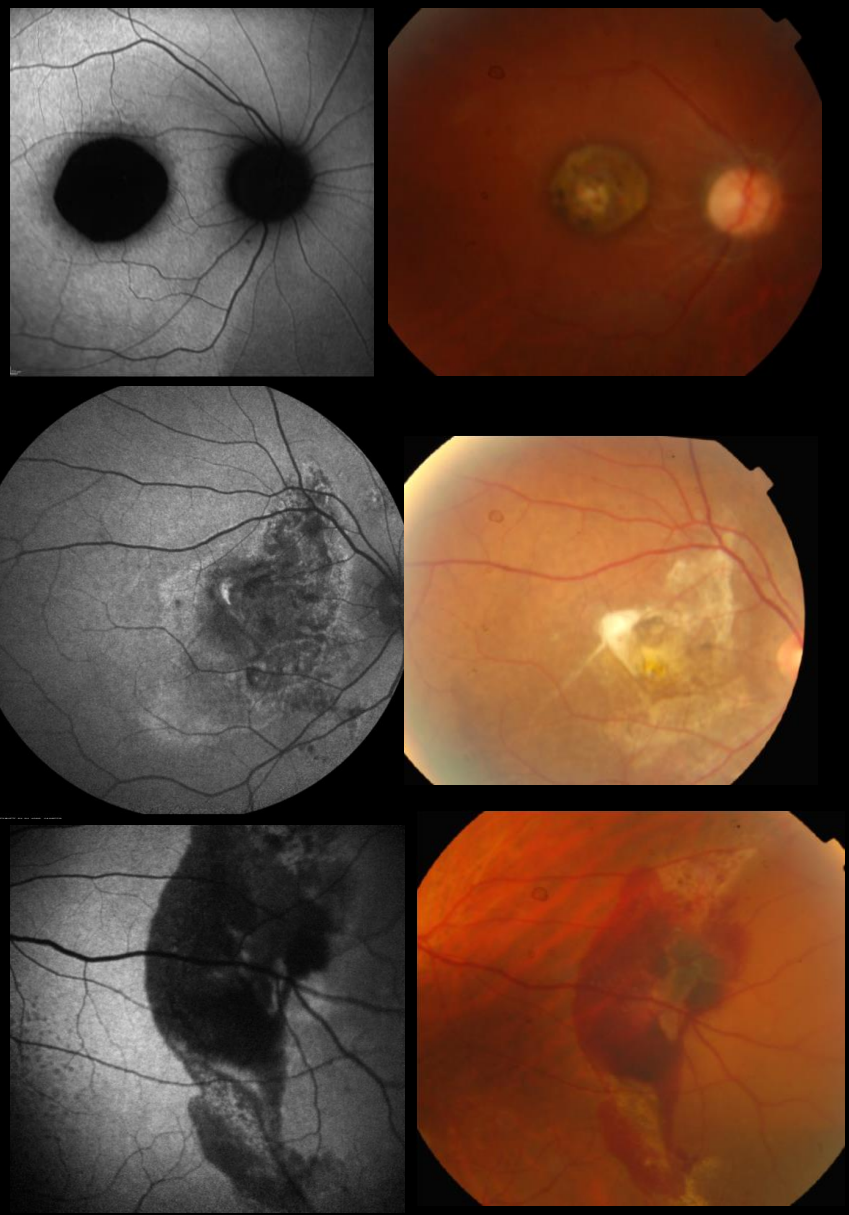
Taze intraretinal veya subretinal kanama

Fibrozis, skar dokusu, lazer skarlarının kenarı

Retina damarları

Luteal pigmentler (lutein ve zeaxanthin)

Ortam opasiteleri (vitreus, lens, ön kamara, kornea)



# HİPER-OTOFLORESANS

- RPE'DE LİPOFUSİN BİRİKİMİ

Lipofusinopatiler (Stargard hst, Best hst, patern distrofi, erişkin vitelliform maküler distrofi)

Yaşa bağlı makula dejenerasyonu (lezyonun genişlemesinden önce junctional zonedaki RPE'ler)

- RPE'İN ANTERİOR VEYA POSTERİORUNDA FLOROFOR MADDE OLUŞUMU- PED ALTI SIVI

Sub-RPE'deki druzen

Lipofusin/melanolipofusin içeren RPE veya makrofajların migrasyonu

Eski intraretinal veya subretinal kanama

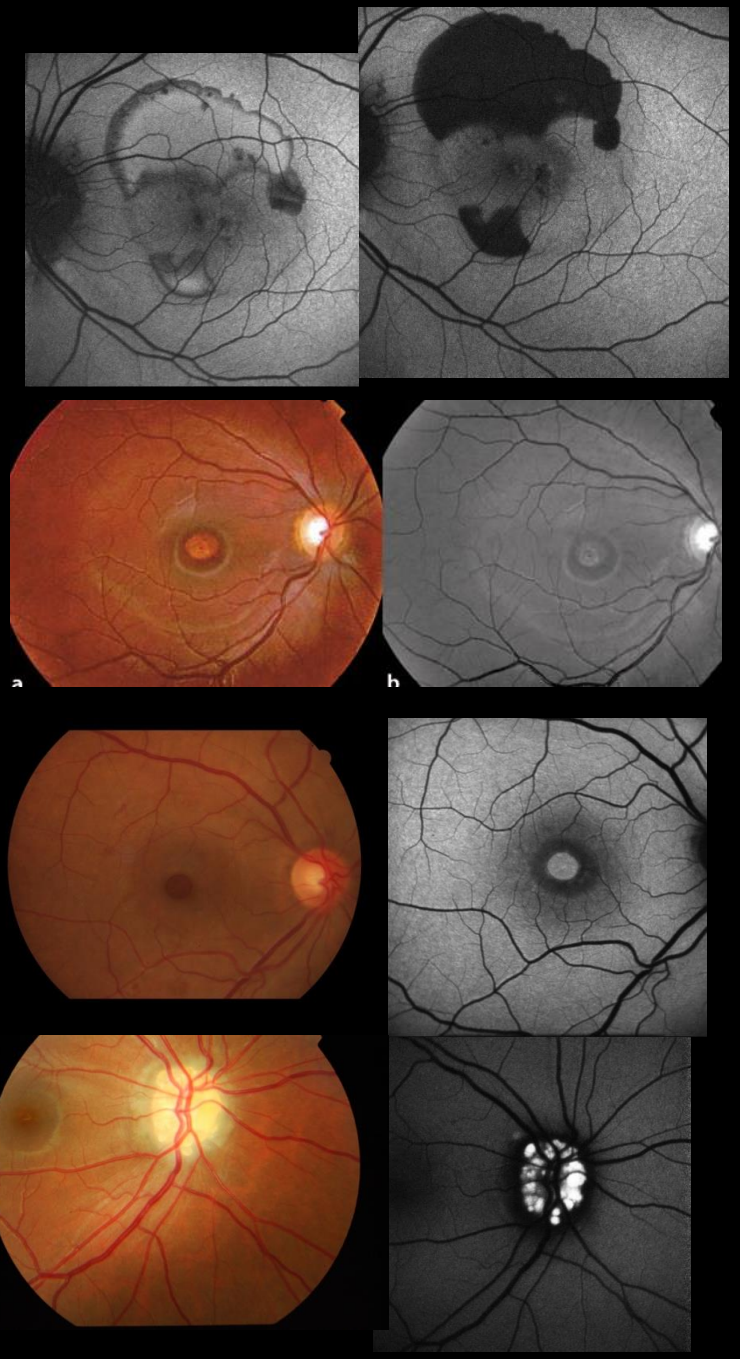
Koroid nevüs veya melanomu

- ABSORBE EDEN MADDELERİN AZALMASI

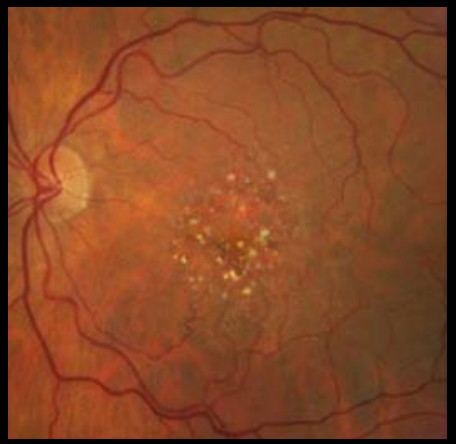
Luteal pigment deplesyonu (idiopatik jukstafoveal telenjiektazi tip 2, makuler hol ,foveal hipoplazi )

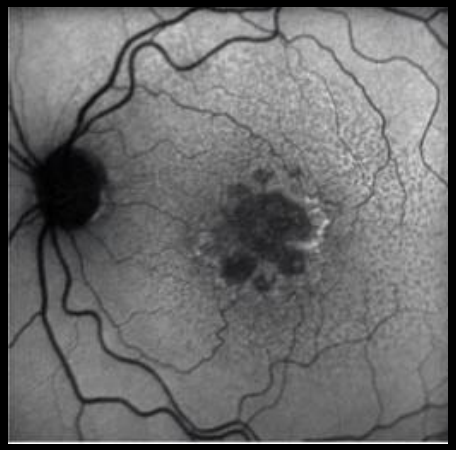
Luteal pigmentin yer değiştirmesi (kistoid makula ödemi)

- OPTİK DİSK DRUZENİ



# SENİL MAKULA DEJENERASYONUNDA OTOFLORESANS





- Drusen
- Fokal hiperpigmentasyon
- Fokal hipopigmentasyon
- HARD/CONFLUENT

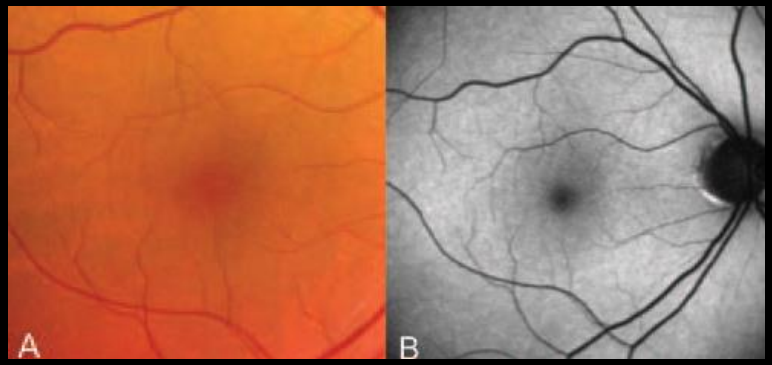
*BOYUT/MORFOLOJİ*

- <64 µm: küçük
- 64-124: orta
- >125: büyük
- Çoklu küçük, tek tük orta CNVM olasılığı: %1.3
- Çoklu orta, büyük drusen: %18
- Retiküler drusen atrofi riski(%21)!!!CNVM riski (%20)
- Soft drusen- konfluen drusen CNVM riski!!(%15)

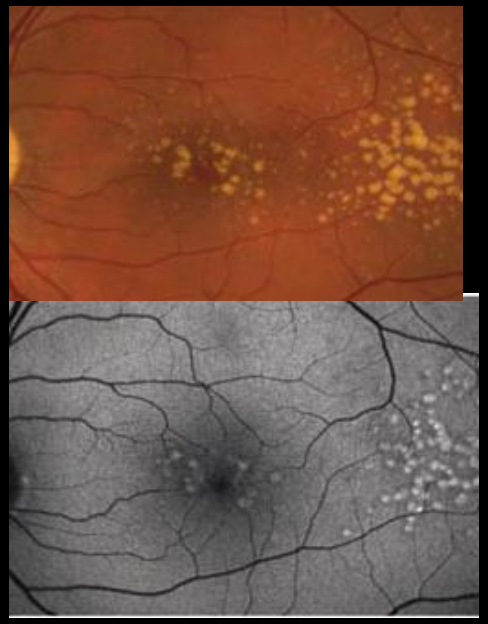
| FAF ↑ | FAF ↓ |
|---|---|
| Soft, confluent drusen | Kristalin drusen |
| Drusenoid PED | Retiküler drusen |
| Hiperpigmentasyon (melanolipofuscin) | Atrofi |

# SMD de FAF PATERNLERİ*

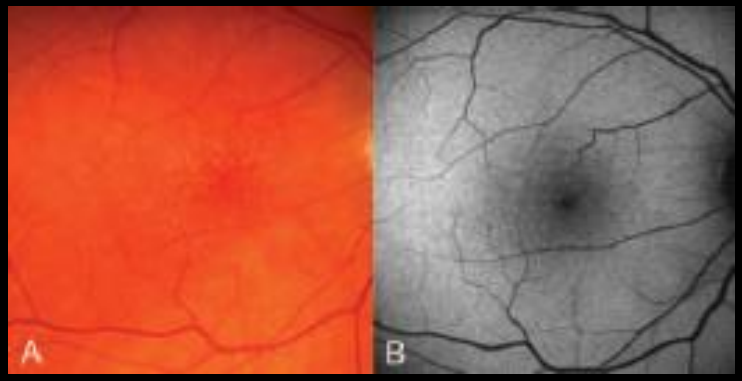
## Normal patern




## Fokal artmış patern



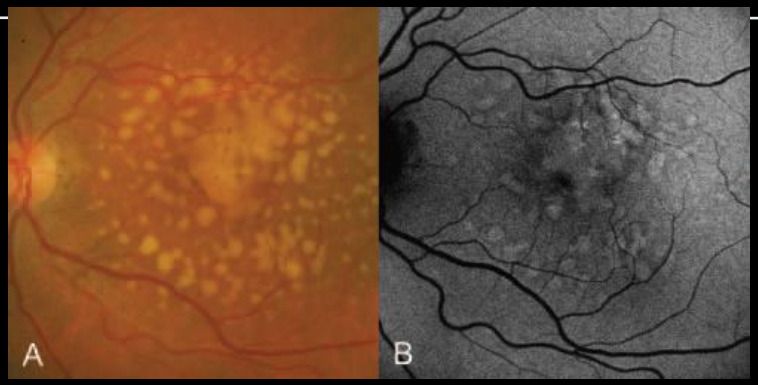
## Minimal değişiklik paterni



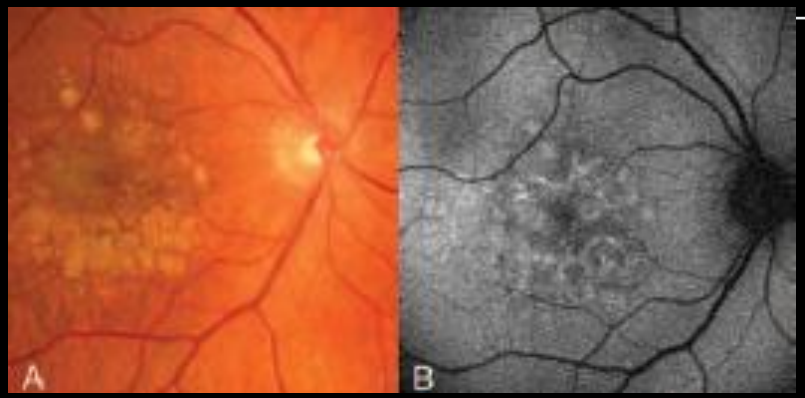

FAF görünümü fundoskopik- anjiografik bulgular ile korele değil, yalnızca büyük drusenler daha uyumlu.

Bindewald A, Bird A, Dandekar S, Dreyhaupt J et al, Classification of fundus autofluorescence patterns in early age related macular disease , İOVS,September 2005 vol46 no:9, 3309-14

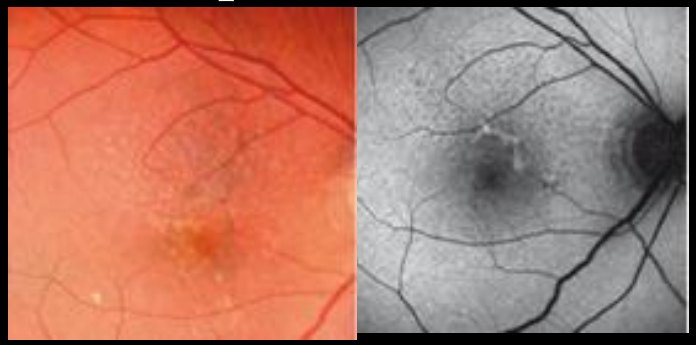
## Yama paterni(patchy)




## Örgü paterni (lace-like)



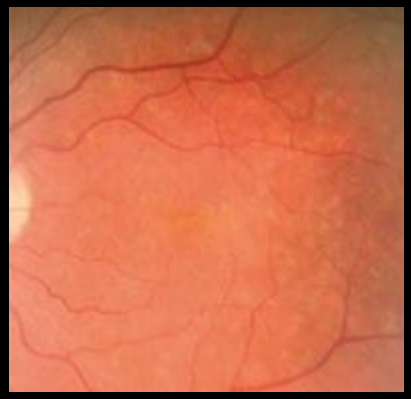

## Lineer patern

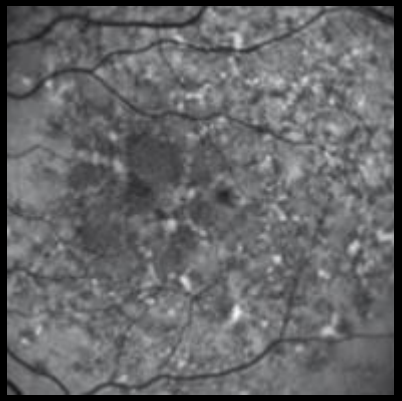


Yama paterni CNVM gelişme riski en yüksek grup .
2005 Fundus Autofluorescence in Age related macula degeneration study 'de 35 patchy paternli olgunun 6sının yaş tipe döndüğü gözlenmiş

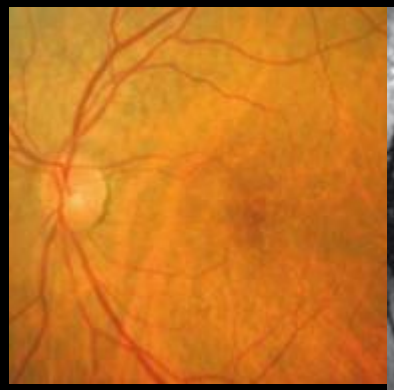
Bindewald A, Bird A, Dandekar S, Dreyhaupt J et al, Classification of fundus autofluorescence patterns in early age related macular disease , İOVS,September 2005 vol46 no:9, 3309-14

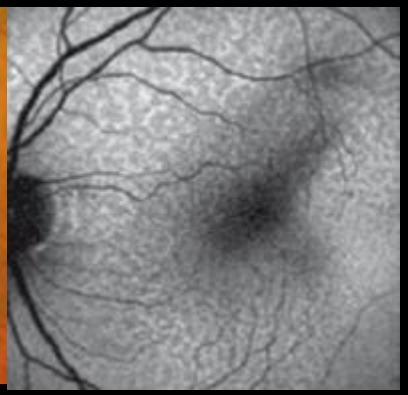
- Alacalı patern (speckled)





- Retiküler patern





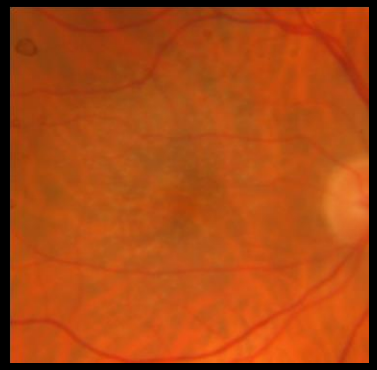
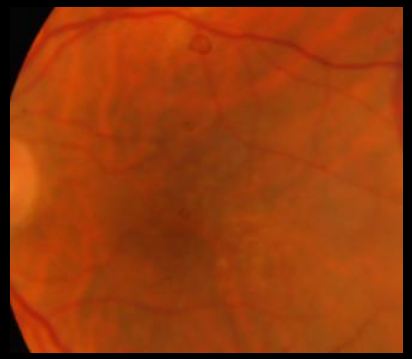
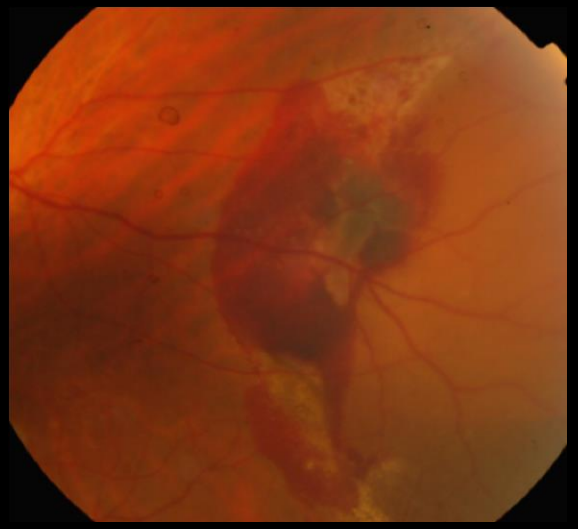
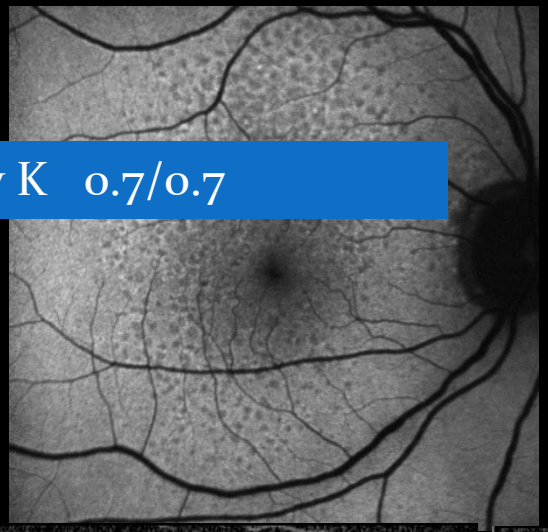
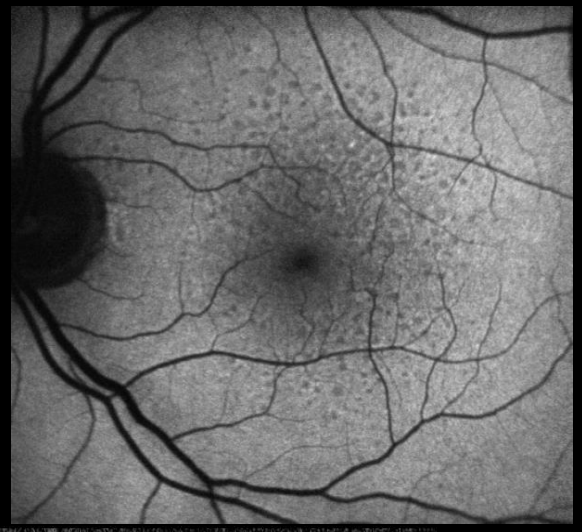
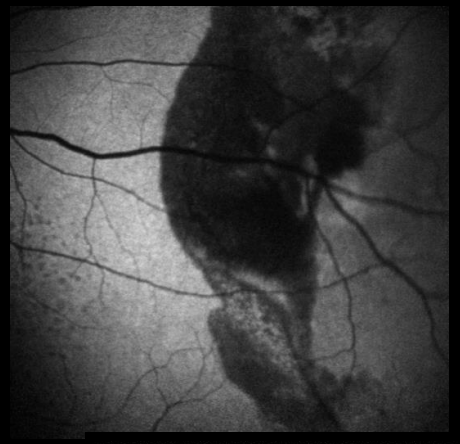
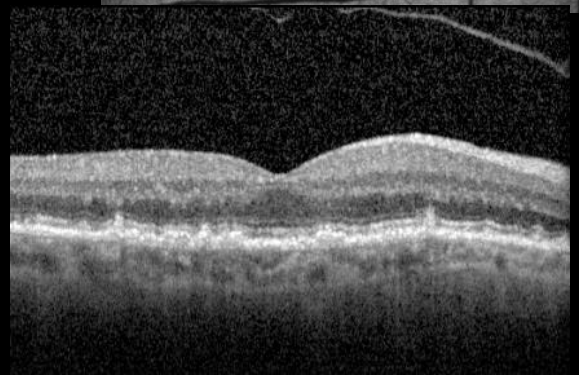
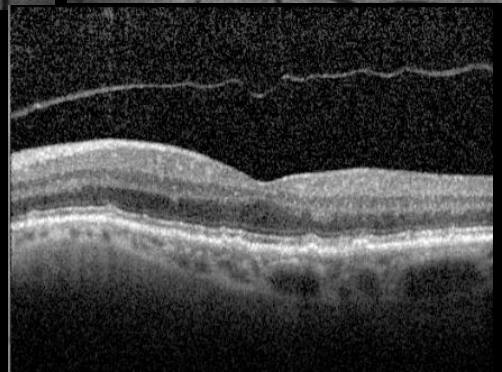
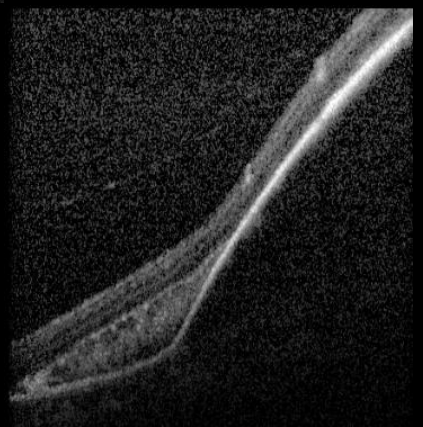
BU KLASİFİKASYON

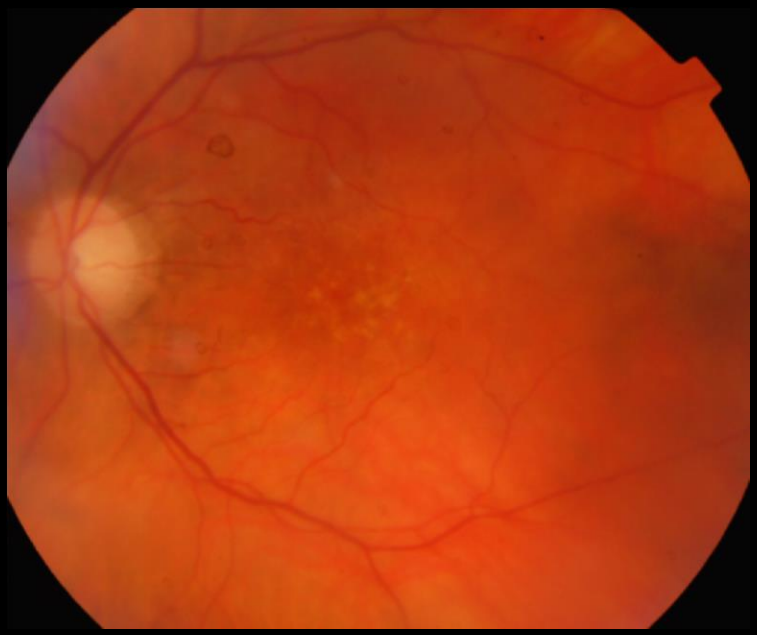
•Longitudinal çalışmalarda prognostik faktörleri belirlemede

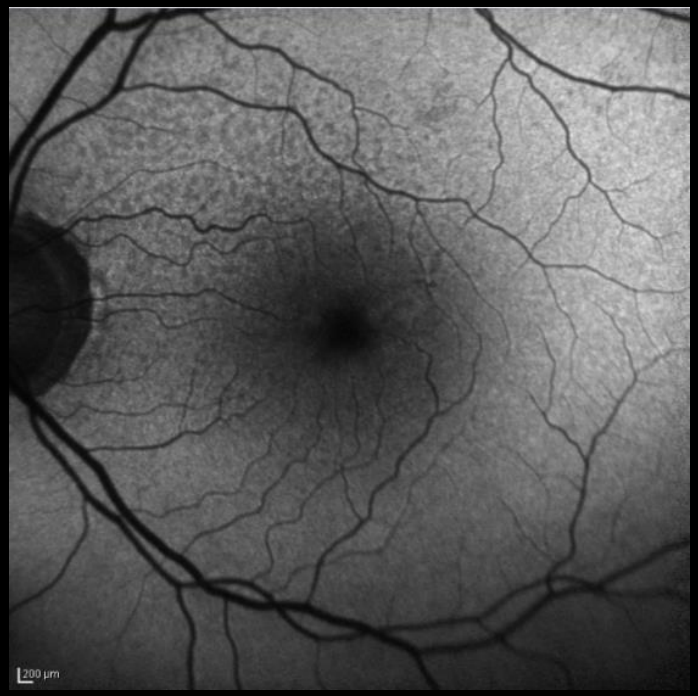
•Hastalığın progresyonunu değerlendirmede

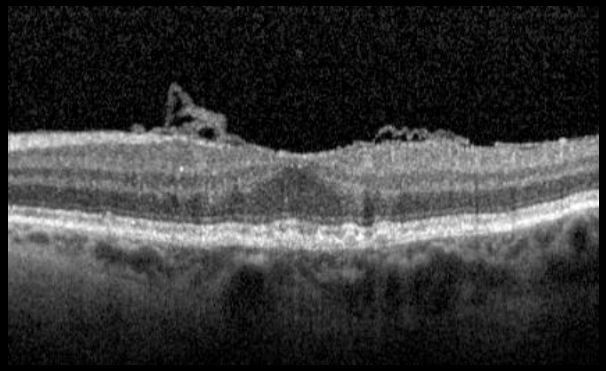
•Fenotip/genotip korelasyonunun ortaya konmasında önemlidir.

Bindewald A, Bird A, Dandekar S, Dreyhaupt J et al, Classification of fundus autofluorescence patterns in early age related macular disease , İOVS,September 2005 vol46 no:9, 3309-14

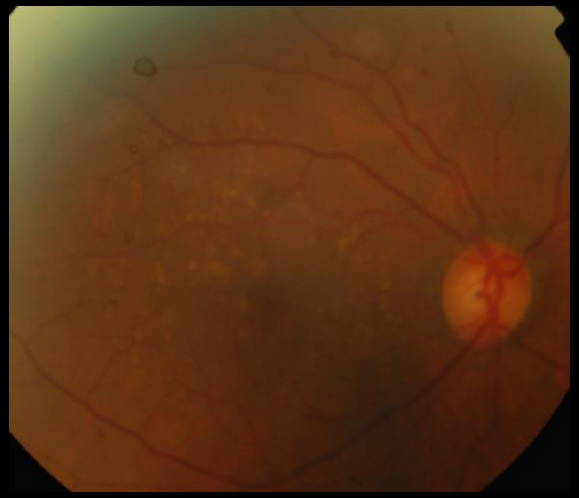






76 y K 0.7/0.7




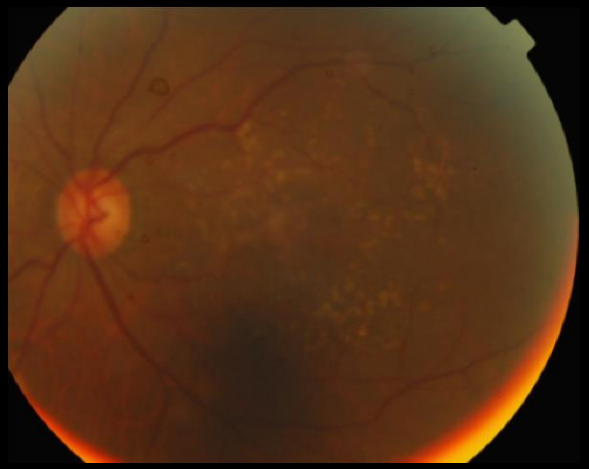


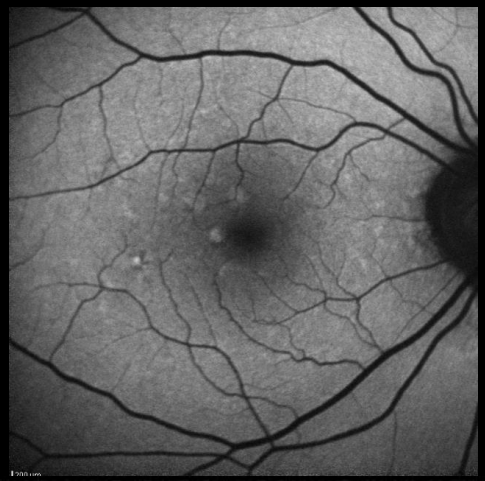


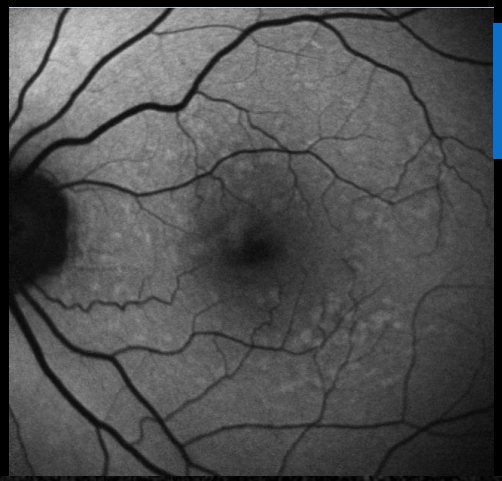



56 Y K

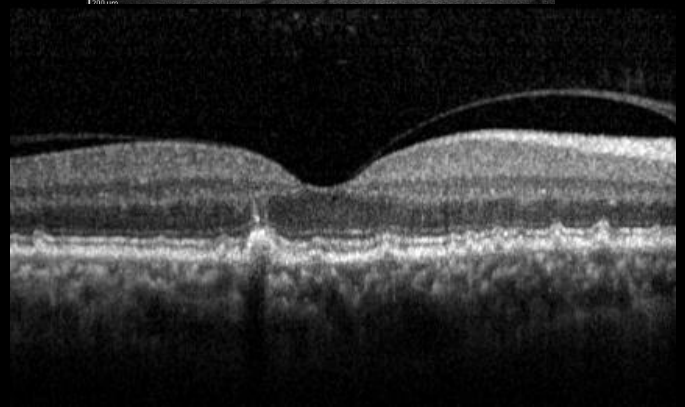


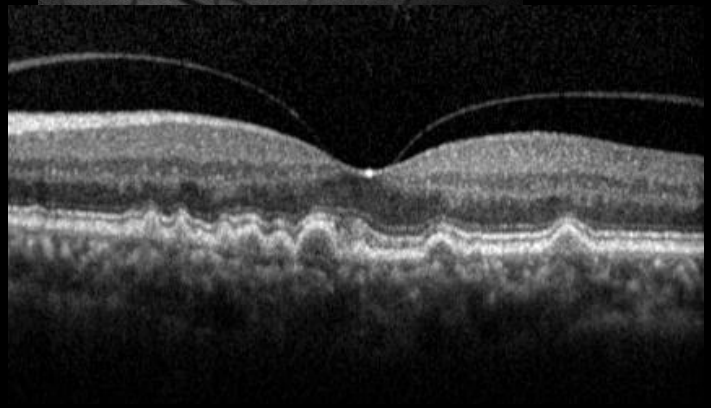




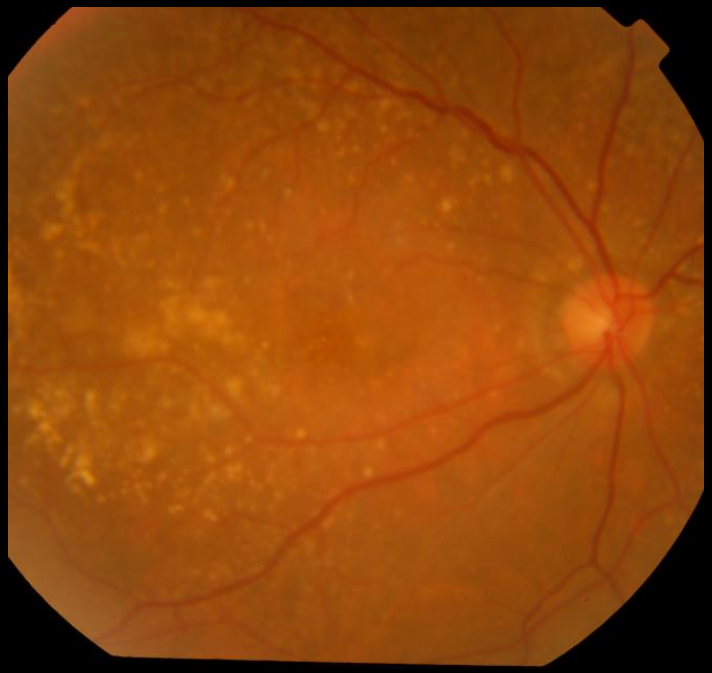


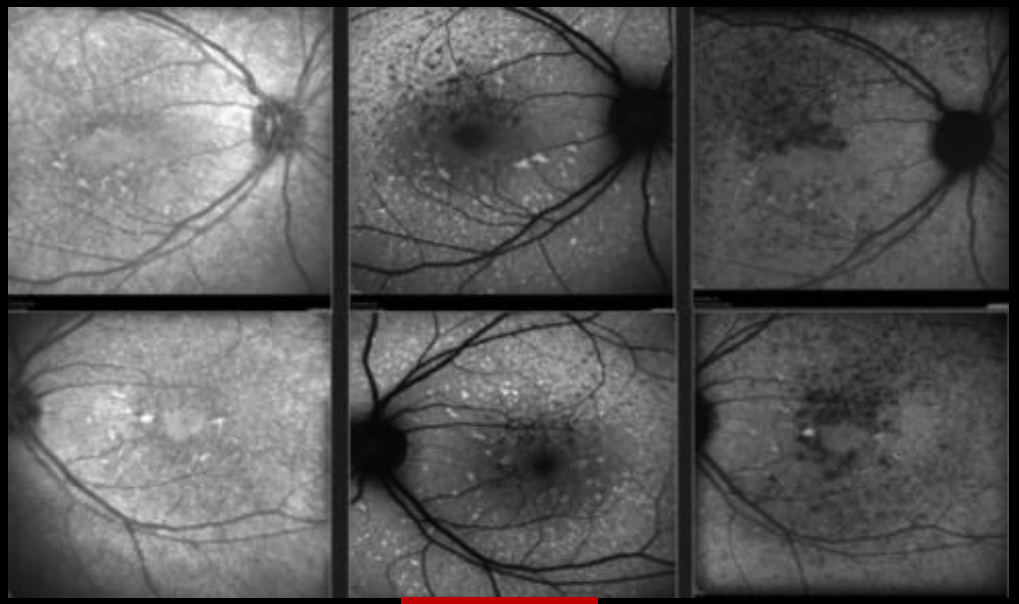
72 y E
GK: 0.8/0.8





# Familyal dominant drusen





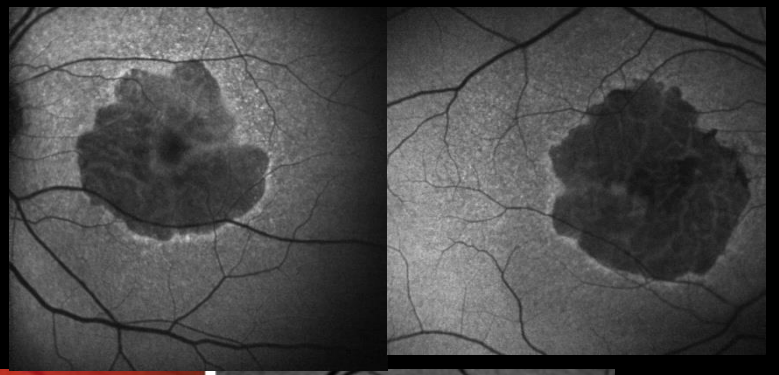
Sw FAF

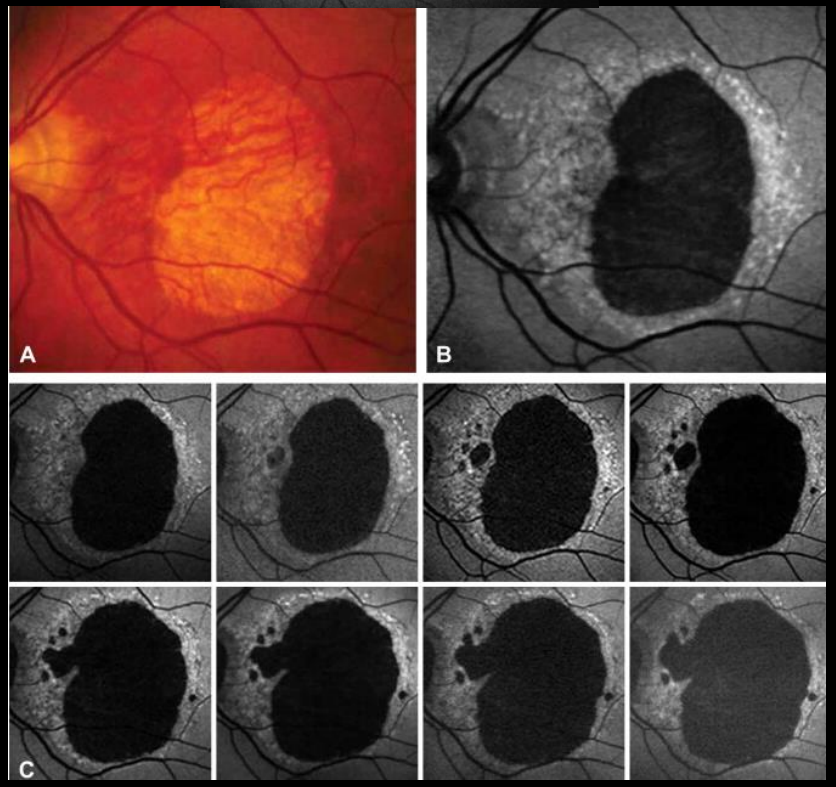
Peripapiller alan tutulmuş

STARGARDT AYIRICI TANI!!!

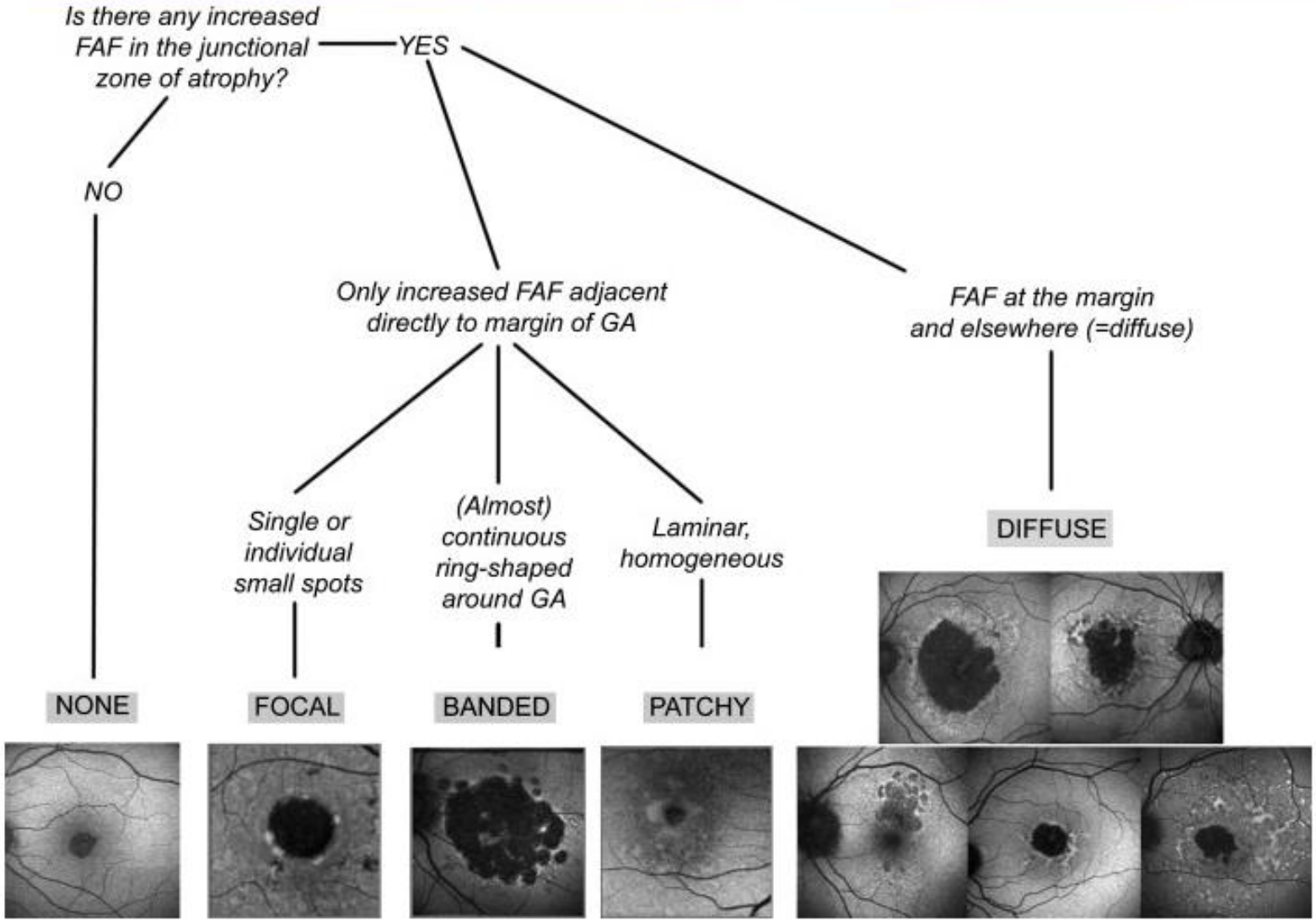
# GEOGRAFİK ATROFİ

- KURU Tip SMD ileri aşaması
- %20 görme kaybı
- Senil makula dejenerasyonunda CNVM den sonra en sık 2. körlük sebebi.
- Unilateral/bilateral
- Soft/konfluen/büyük / kalsifiye drusenler ile ilişkili
- Lipofuskinin toksik etkisi



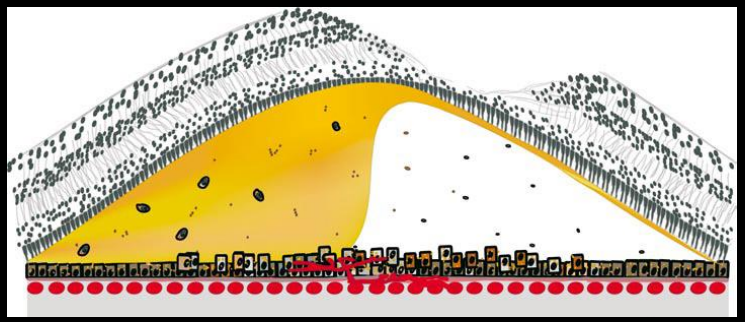



Holz FG, et al. Fundus autofluorescence and development of geographic atrophy in age-related macular degeneration. Invest Ophthalmol Vis Sci 2001;42:1051-1058.

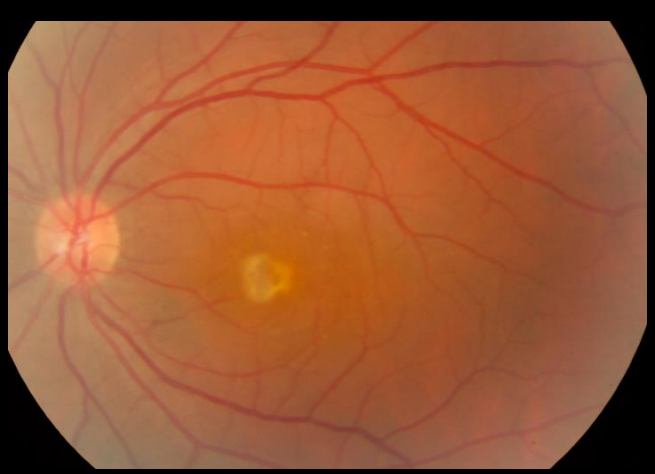


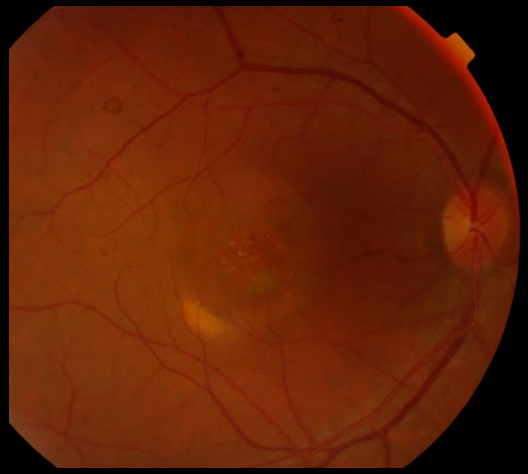

Schmitz-Valckenberg S, Fleckenstein M, Scholl HP, Holz FG. **Fundus autofluorescence and progression of age-related macular degeneration.** Surv Ophthalmol. 2009 Jan-Feb;54(1):96-117.

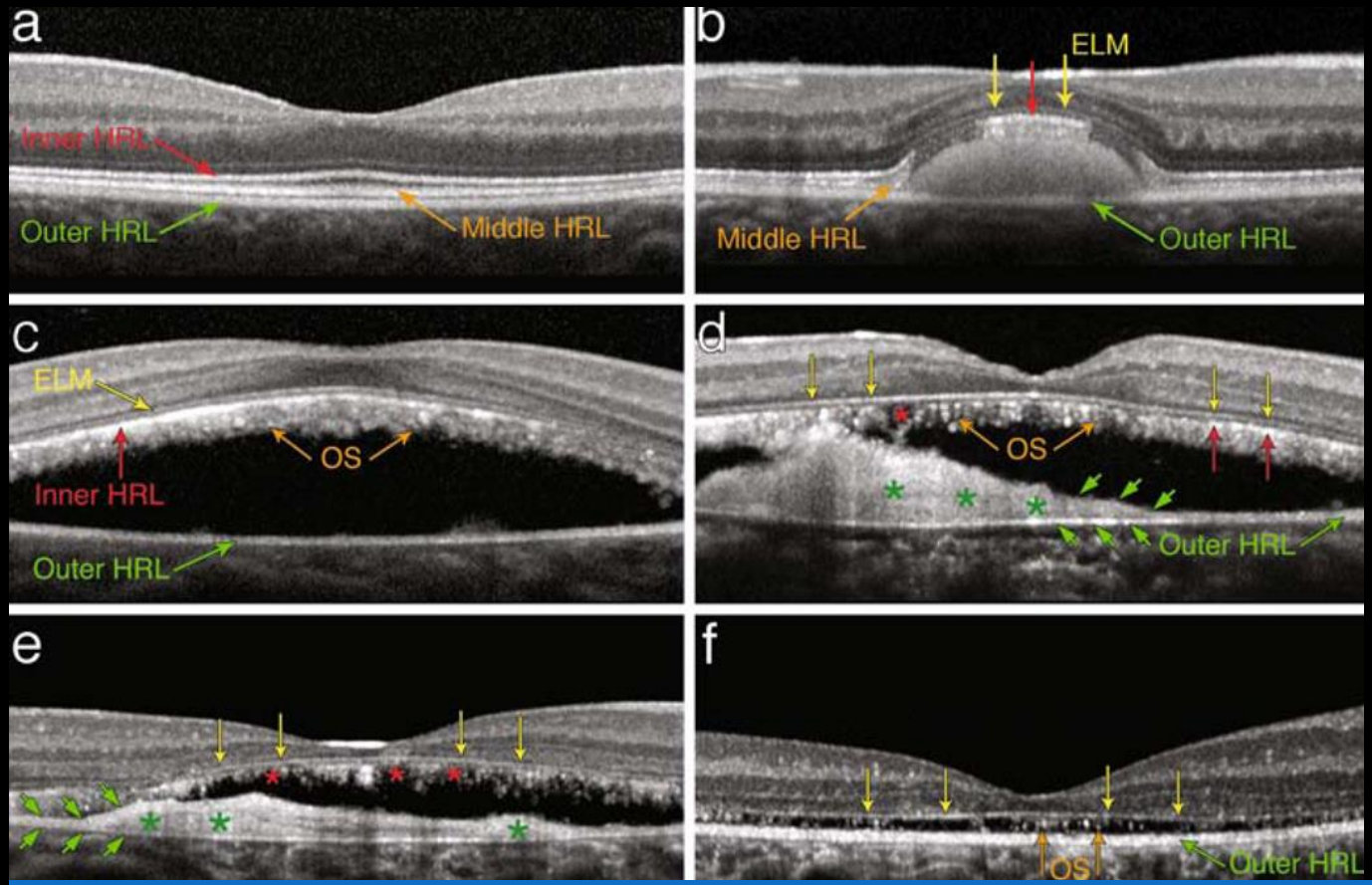
# BEST VİTELLİFORM MAKULER DİSTROFİ



- 1905, makulayı etkileyen hastalık
- Semptomlar ilk dekadda ortaya çıkabilir.
- OD ( inkomplet penetrans ve değişik varyasyonlarda )
- VMD2 geninin ürünü olan bestrofin defekti ( Ca duyarlı  Cl kanallarının düzenleyicisi )







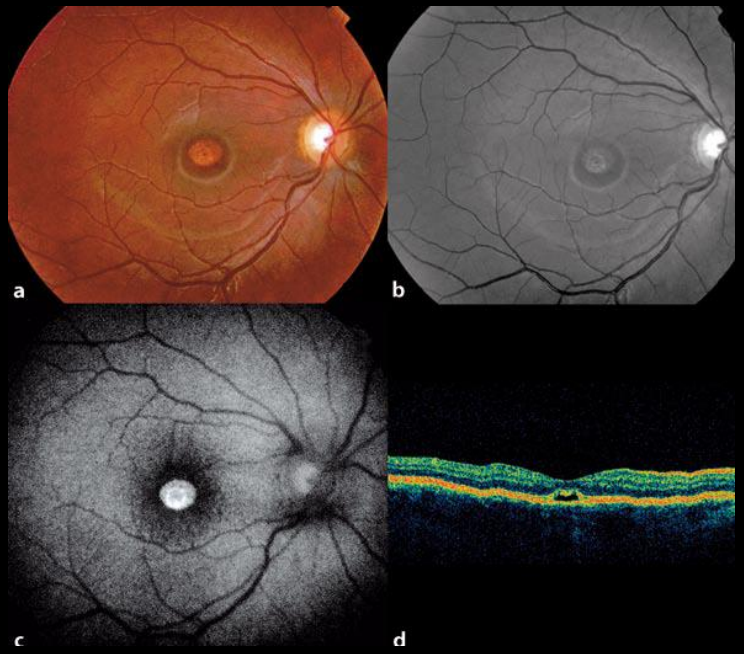

Graefes Arch Clin Exp Ophthalmol. 2010 October ; 248(10): 1377–1386

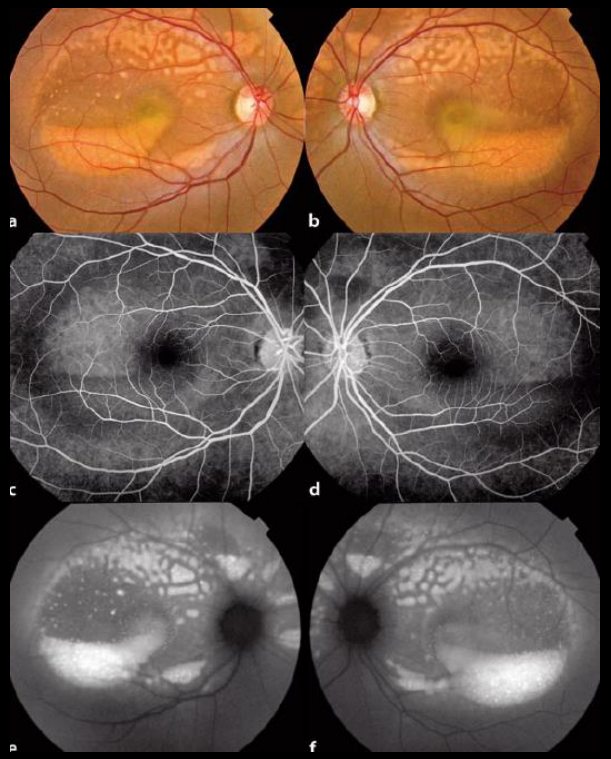
- RPE ve altında lipofusin granüllerinin birikimi
- EVRE 1: previtelliform evre
- EVRE 2: vitelliform evre
- EVRE 3: Psödohipopion evresi
- EVRE 4: vitellorüptif evre
- EVRE 5: atrofik, terminal dönem
- EOG tanıyı destekler.

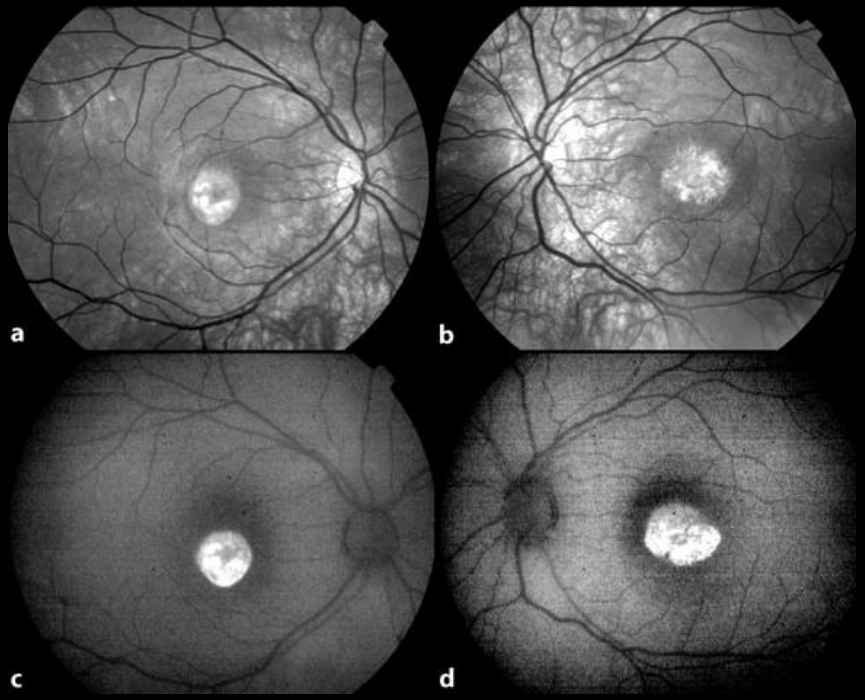
# FUNDUS OTOFLORESANS

RPE deki atrofik alanlarda azalmış otofloresans düşük görme keskinliği , düşük renkli görme , kötü elektrofizyolojik cevaplarla ilişkili.

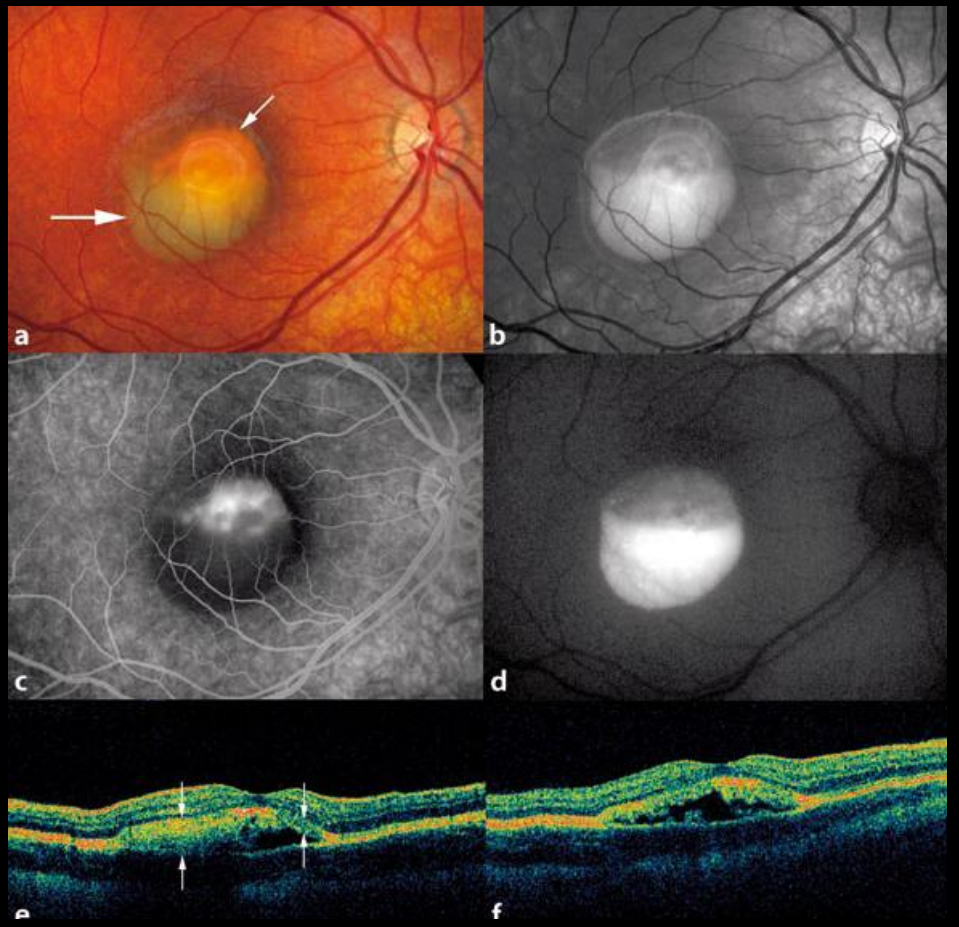
*Klin Monatsbl Augenheilkd 2003 Dec 220(12);861-4*



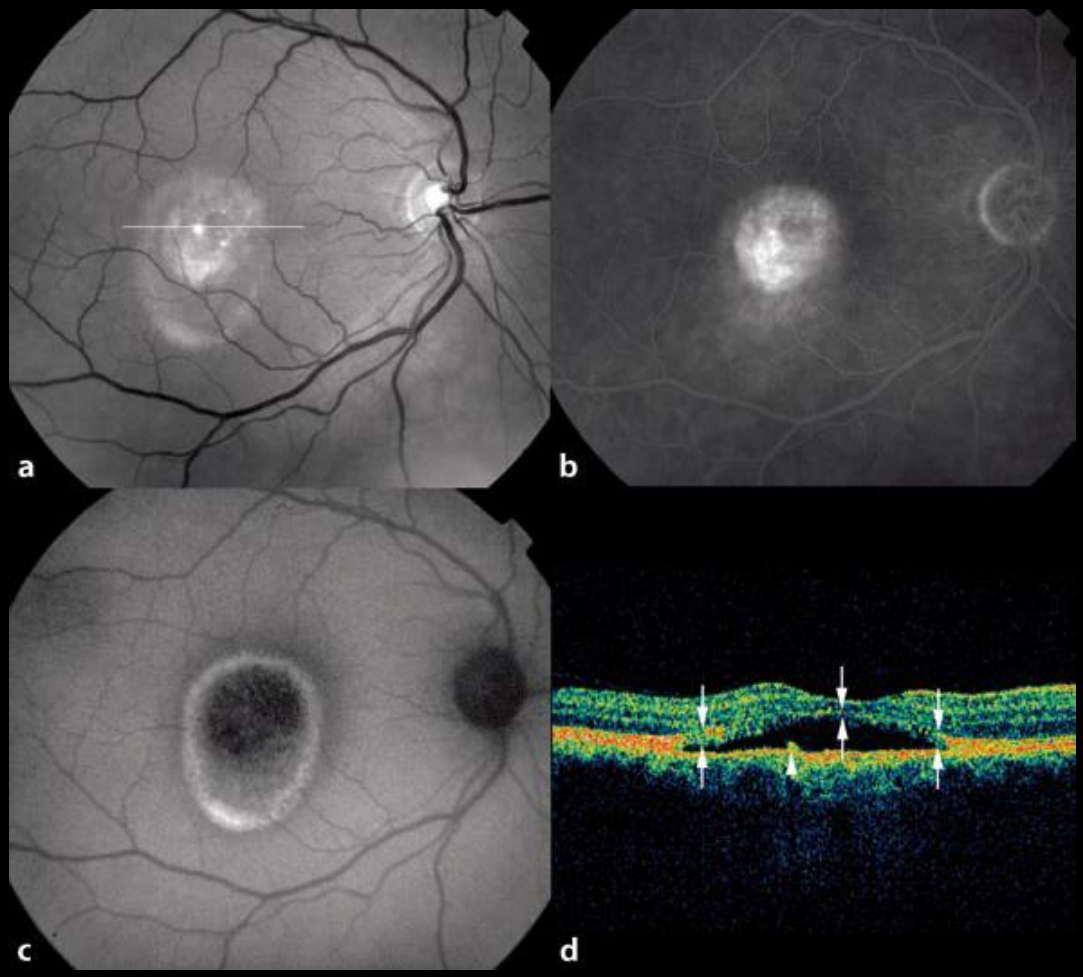



6,5 yaşında hasta

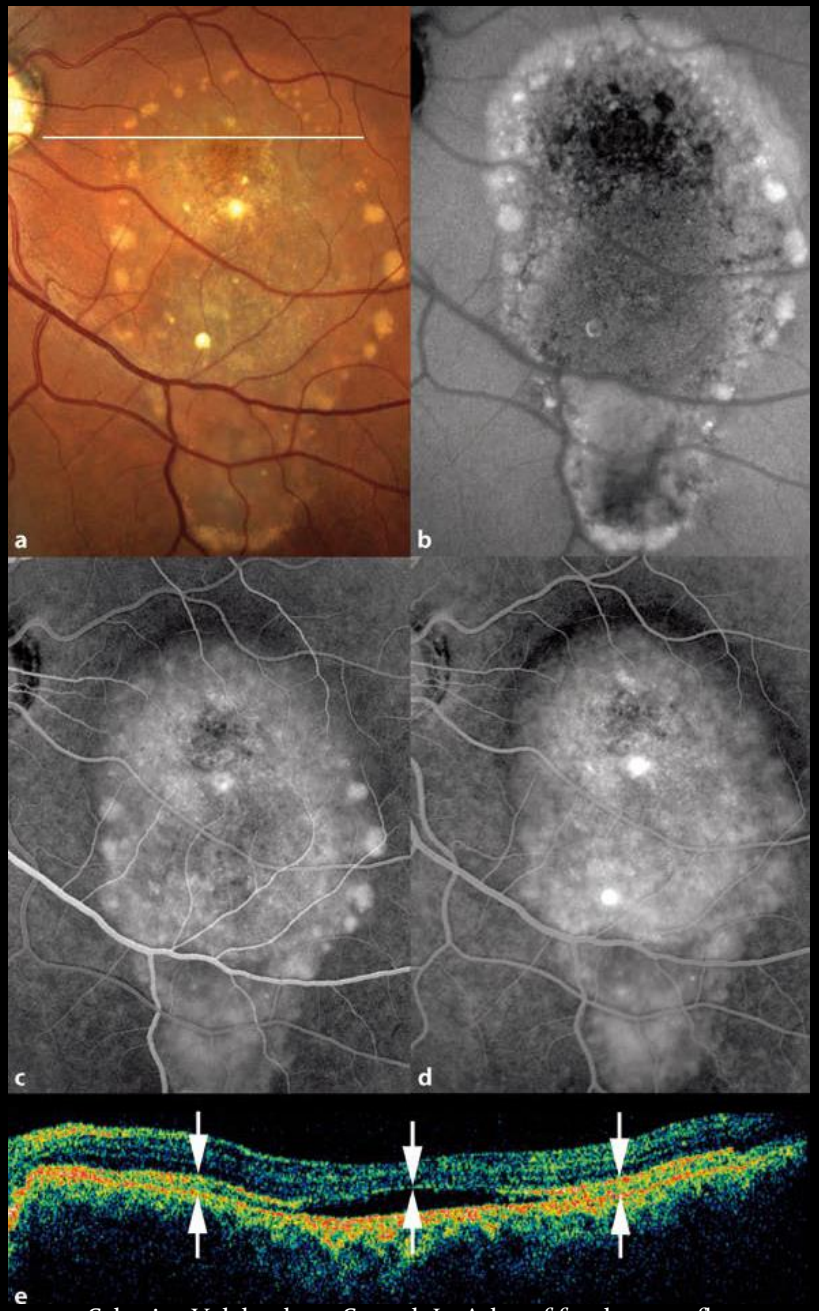



4 yıl sonra

Schmitz-Valckenberg S, et al. In:Atlas of fundus autofluorescence imaging.
Holz FG, Schmitz-Valckenberg S, Spaide RF, Bird AC, eds.2007, Springer




Schmitz-Valckenberg S, et al. In:Atlas of fundus autofluorescence imaging.
Holz FG, Schmitz-Valckenberg S, Spaide RF, Bird AC, eds.2007, Springer




42 yaş bayan
Gk 20/80

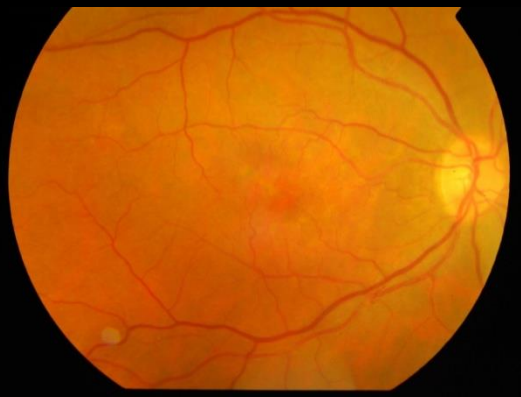
Schmitz-Valckenberg S, et al. In:Atlas of fundus autofluorescence imaging. Holz FG, Schmitz-Valckenberg S, Spaide RF, Bird AC, eds.2007, Springer

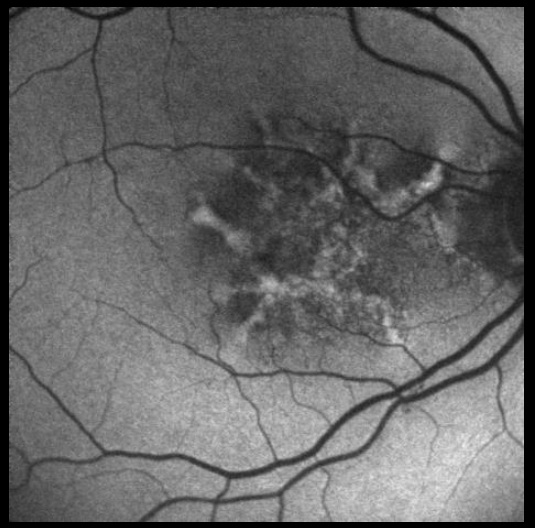

BEST ‘İN ATİPİK FAF BULGULARI

# PATERN DİSTROFİ

- Peripherin 2 geninde mutasyon
- OD (SPORADİK/OR)
- Makulada sarı/turuncu materyal birikimi
- Paternine göre 5 tipi var:

- Adult onset vitelliform makulopati
- Multifokal PD
- Kelebek şekilli PD
- Retiküler PD
- Fundus pulverulentus





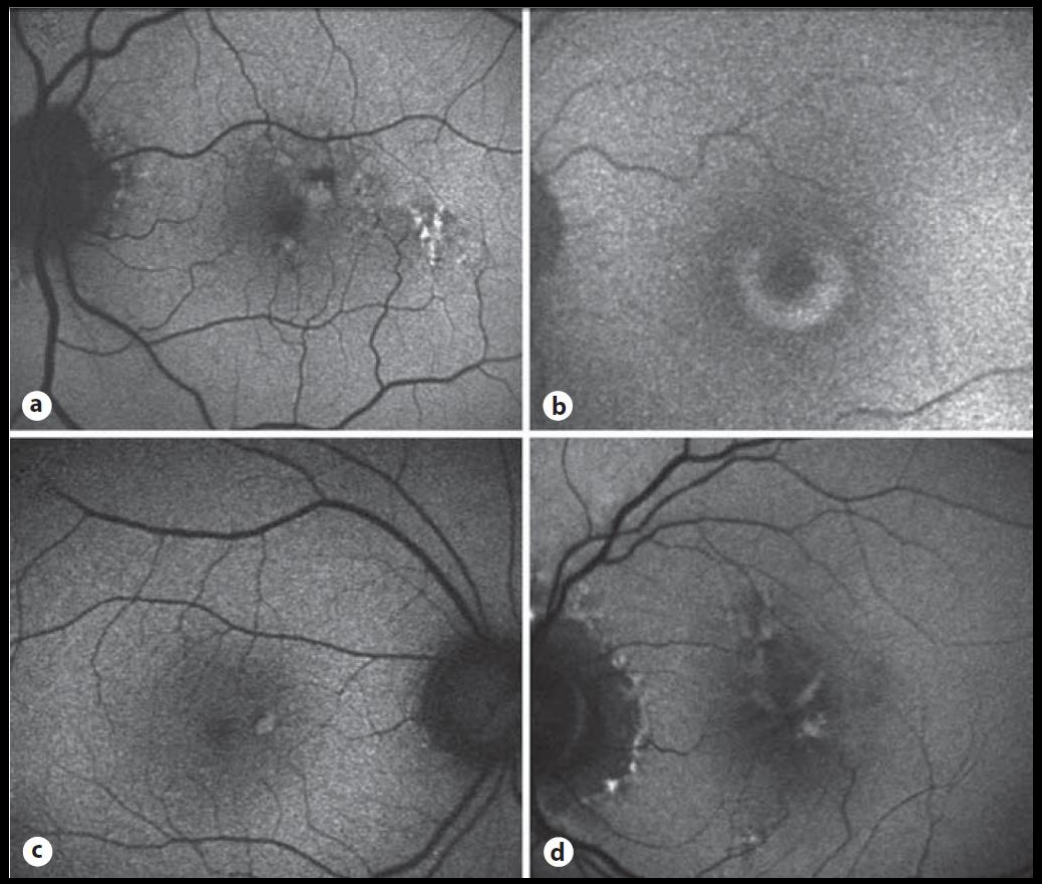
# PATERN DİSTROFİ -2

- Zaman içinde farklı paternlere  geçiş
- Genellikle orta yaşlarda ortaya çıkar
- Santral görüş hafif etkilenir uzun yıllar stabil kalır.
- EOG hafif –orta subnormal
- Normal görülen taşıyıcılarda bile EOG subnormal
- Karanlık adaptasyon, renkli görme ,ERG normal

# Adult onset vitelliform makulopati

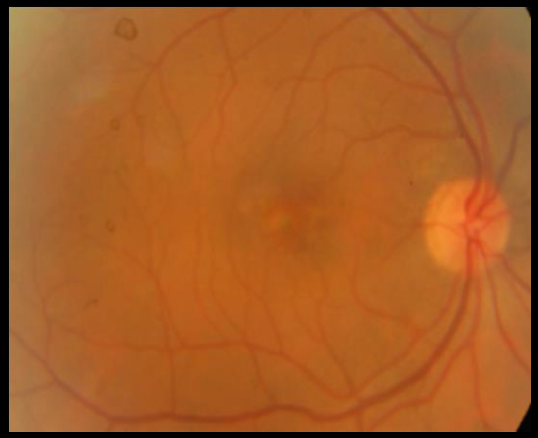
- Patern distrofilerin en sık görülen formu
- OD/Sporadik (%91 aile öyküsü yok)
- RDS geni veya bestrofin geninde defekt
- 1/3 disk çapında ,bilateral merkezinde pigmentasyon olan/olmayan, sarı, yuvarlak veya oval subfoveal vitelliform lezyonlar
- Lezyon etrafında veya perifer retinada küçük sarı birikimler
- Hücre dışı artıkların birikimi/RPEde lipofusin birikimi

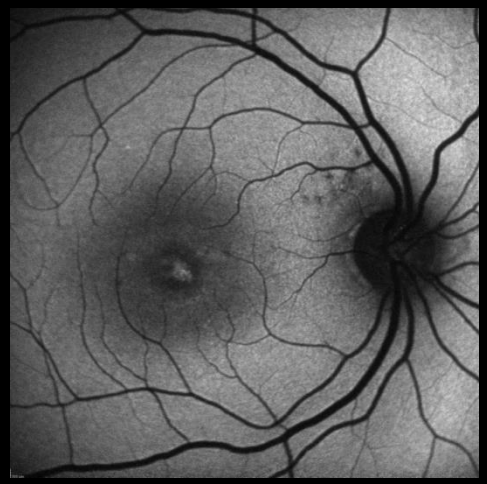
# FAF PATERNLERİ

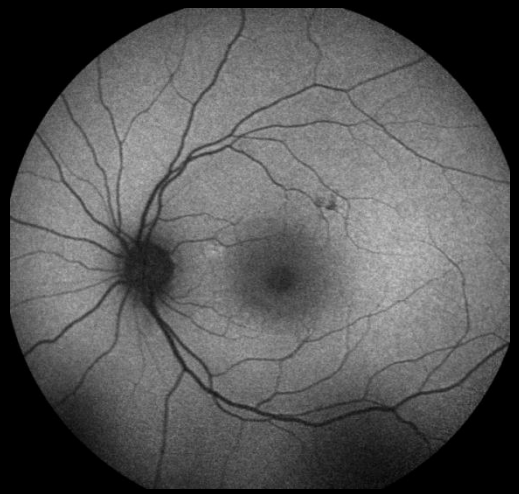



a: patchy
b: ring-like
c:focal
d: lineer

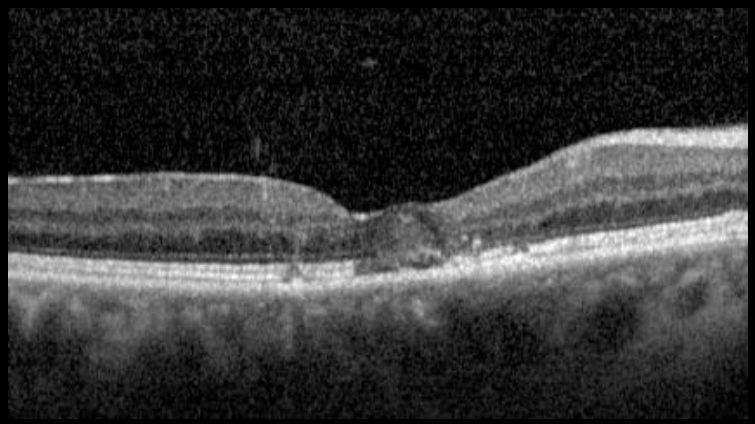
**Fundus autofluorescence, optical coherence tomography and visual acuity in adult-onset foveomacular dystrophy,** Furino C, Boscia F, Cardascia N, Sborgia L, Sborgia C. Ophthalmologica. 2008;222(4):240-4.

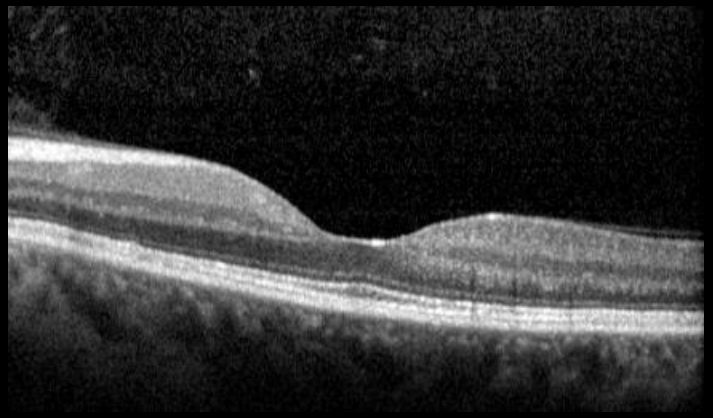


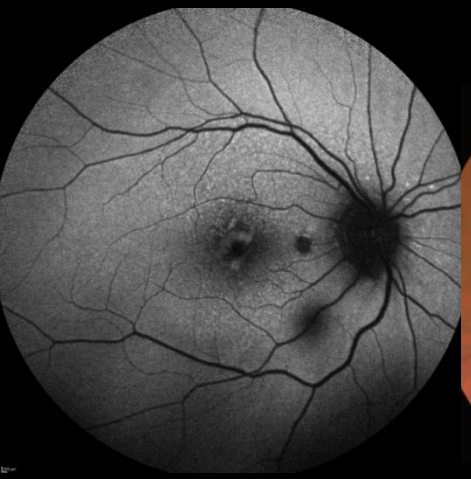
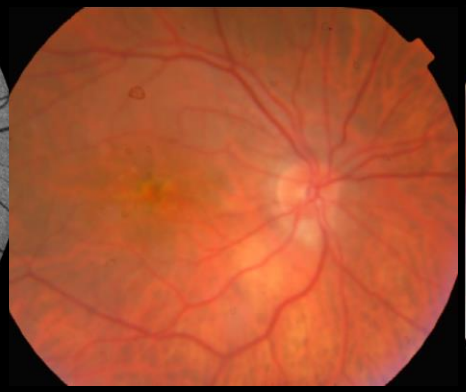
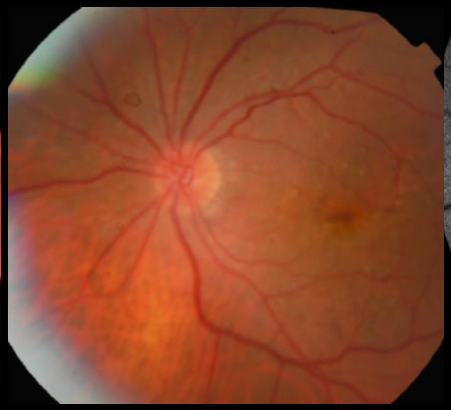
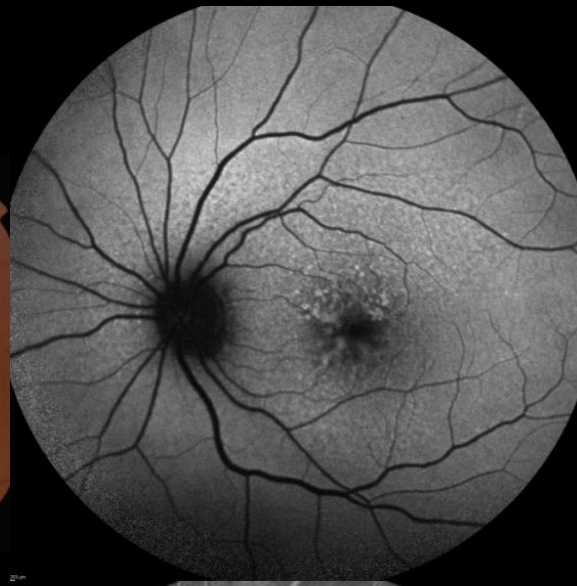
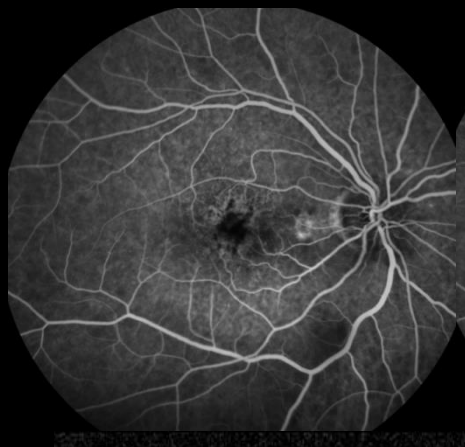
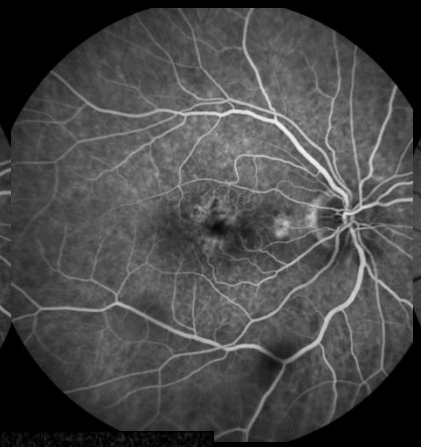
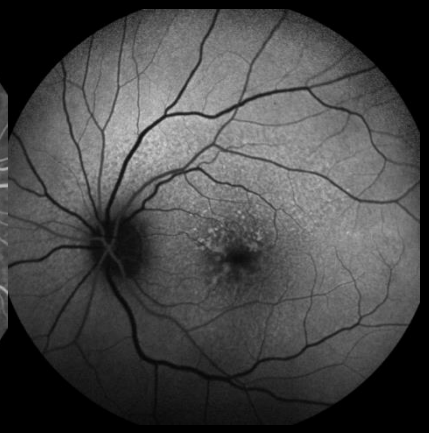
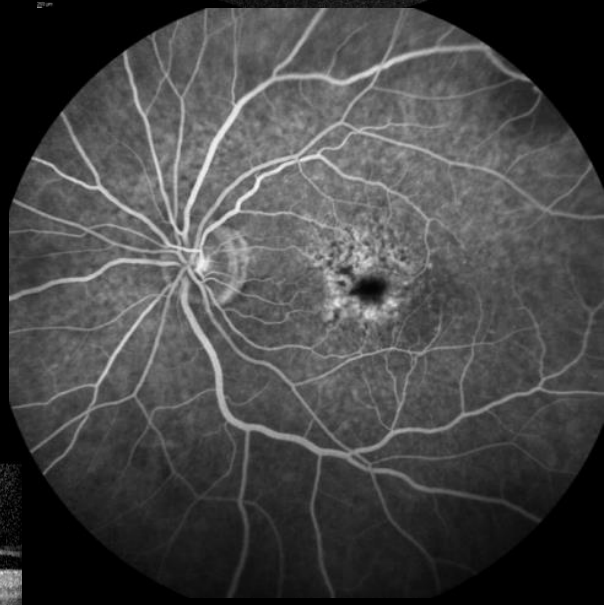
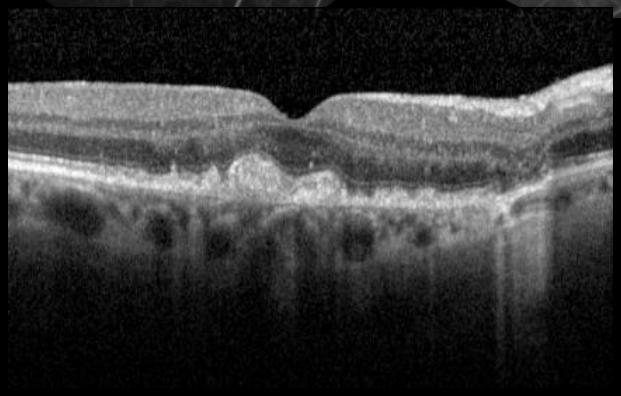
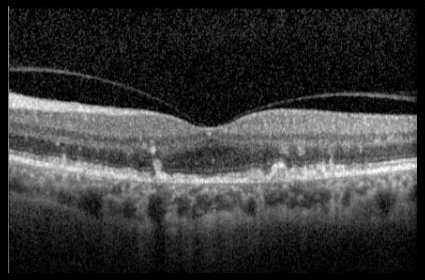




50y bayan,
GK: Tam/Tam



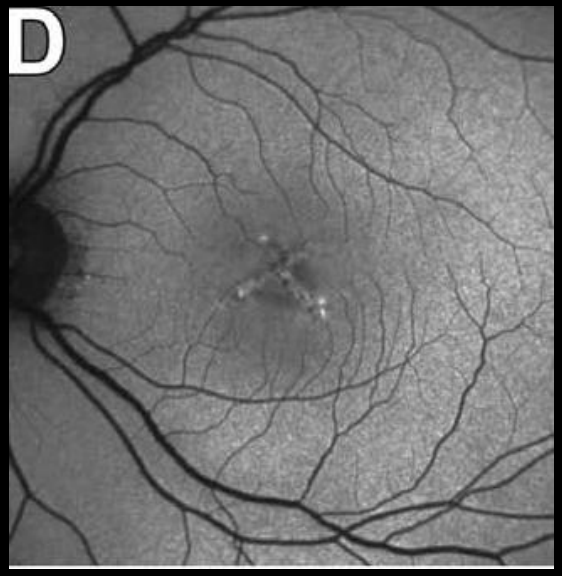


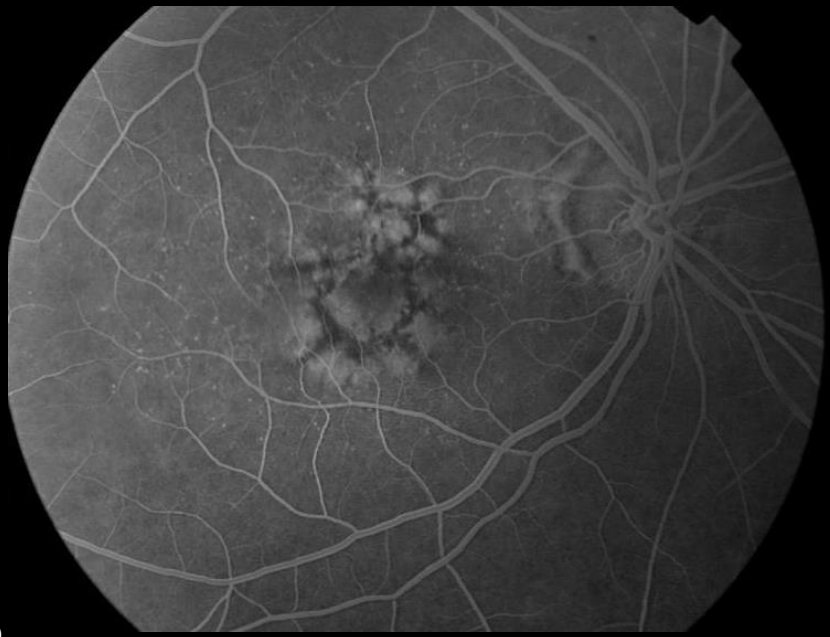











69 Y E HASTA
GK: 0.7/0.5

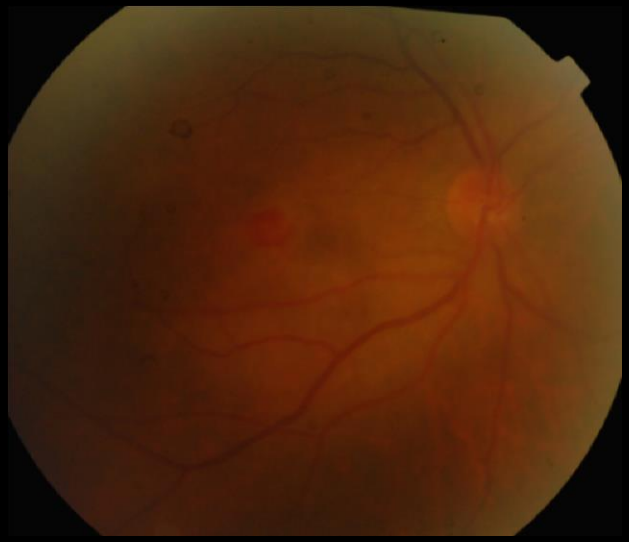
# Kelebek şekilli patern distrofi

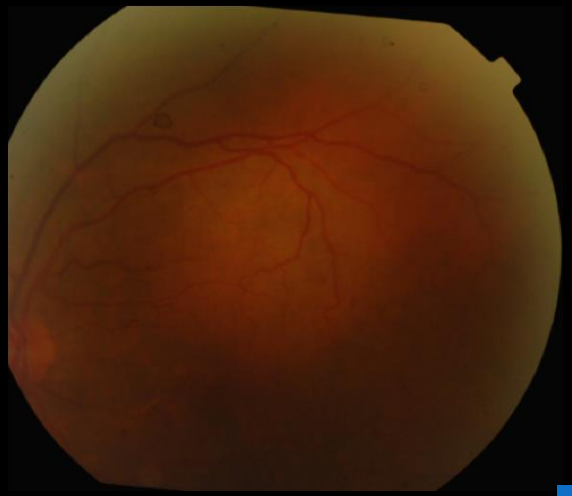
- RPE düzeyinde sarı/kahverengi materyal birikimi( kelebek şeklinde)
- Subnormal EOG/ hafif azalmış- normal GK
- atrofi/progresyon gösteren süreç

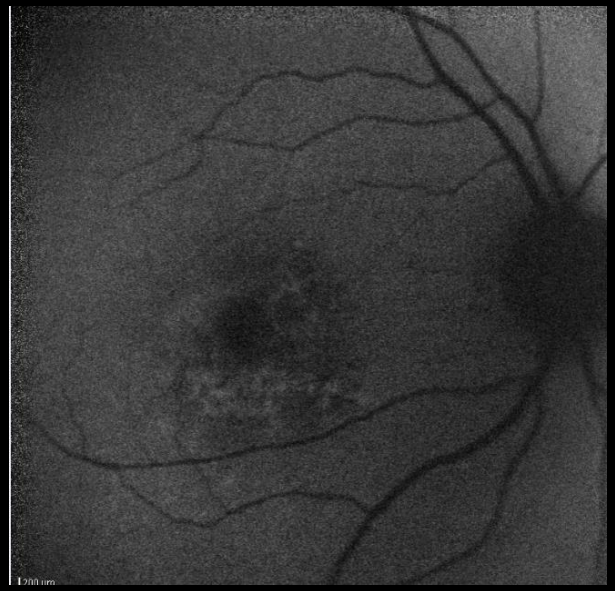


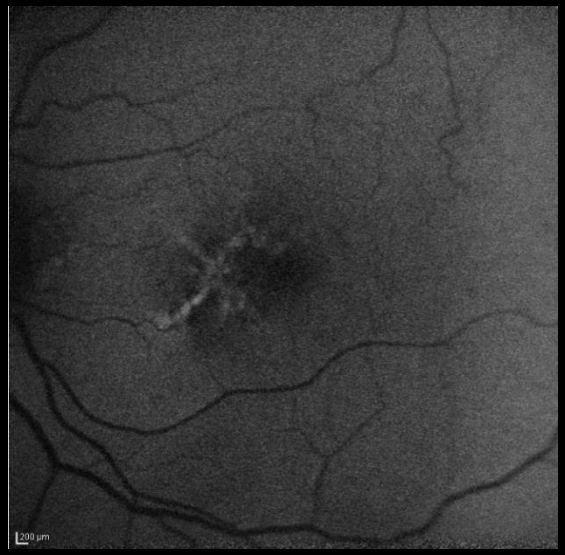



Fundus autofluorescence imaging of retinal dystrophies, Camiel J.F. Boon, B. Jeroen Klevering, Jan E.E. Keunen, Carel B. Hoyng, Thomas Theelen, Vision Research 48 (2008) 2569–2577





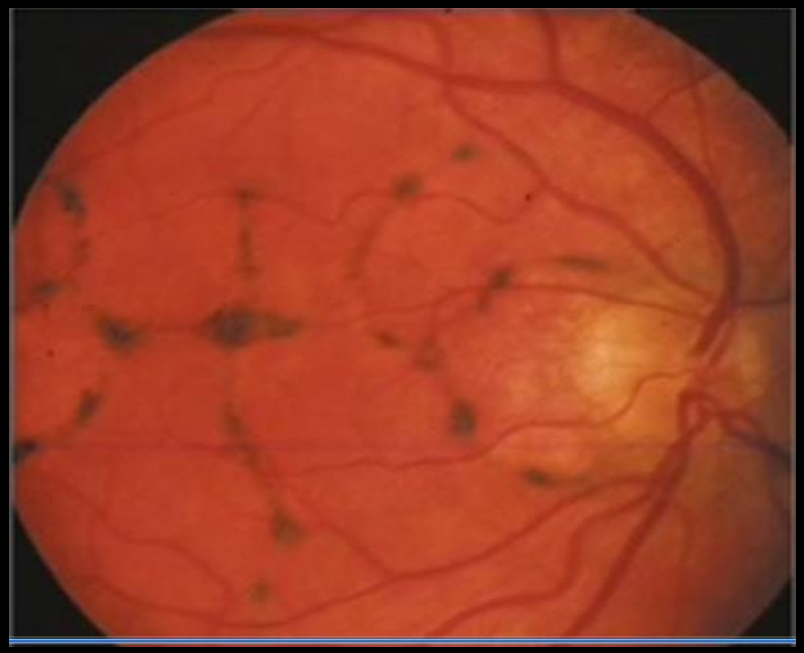


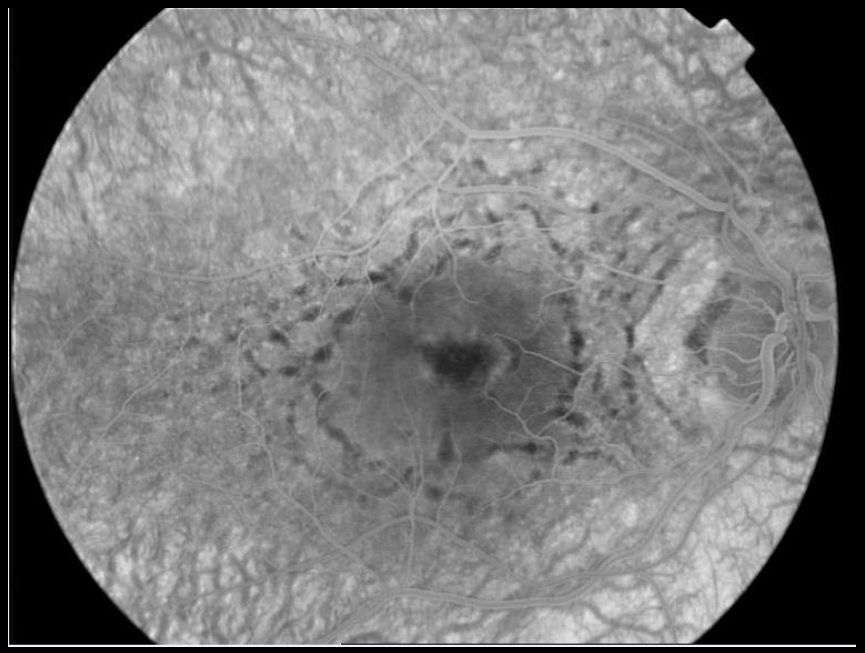


74 y E hasta Sağ CNVM nedeni ile takipli

# Retiküler distrofi

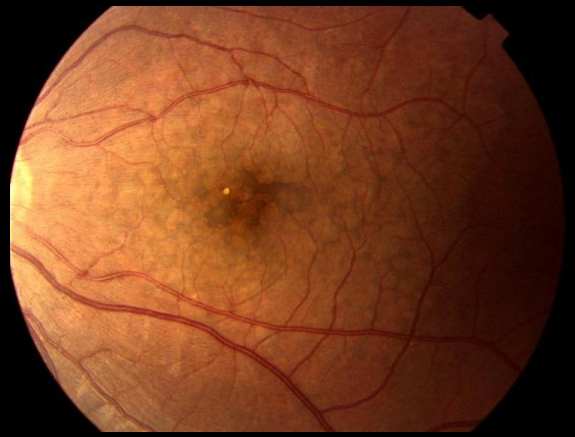
- 1950, Sjögren
- Balıkçı ağı görünümünde hiperpigmentasyon
- GK, ERG, EOG, Görme alanı, RG normal

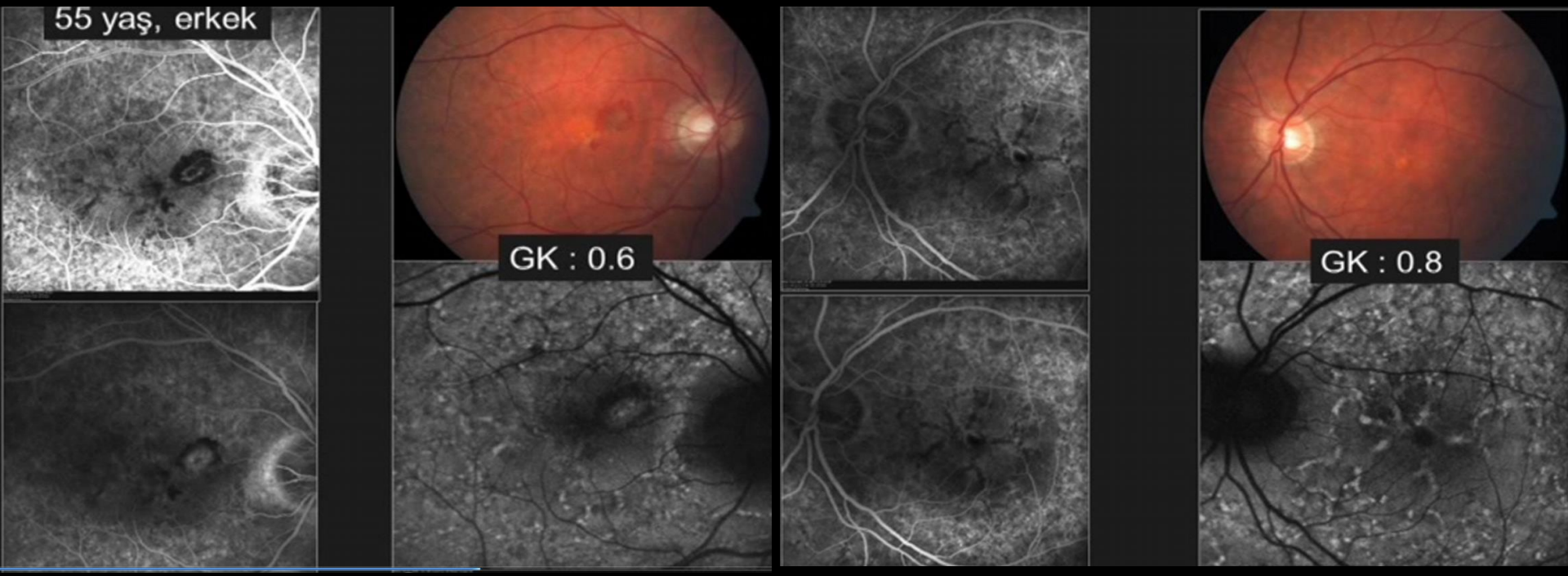


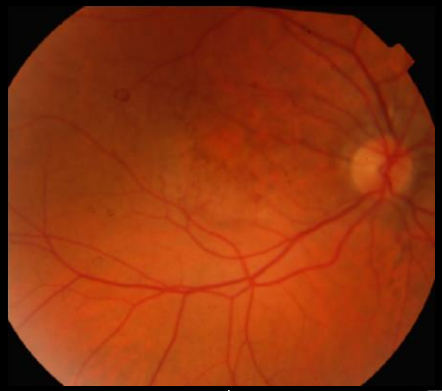
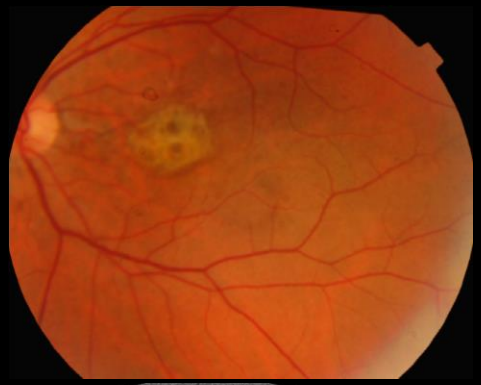
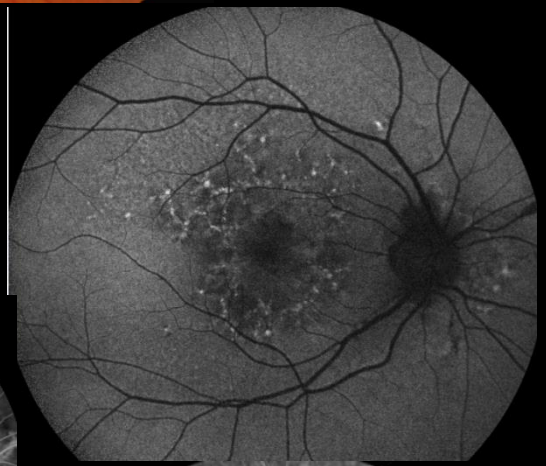
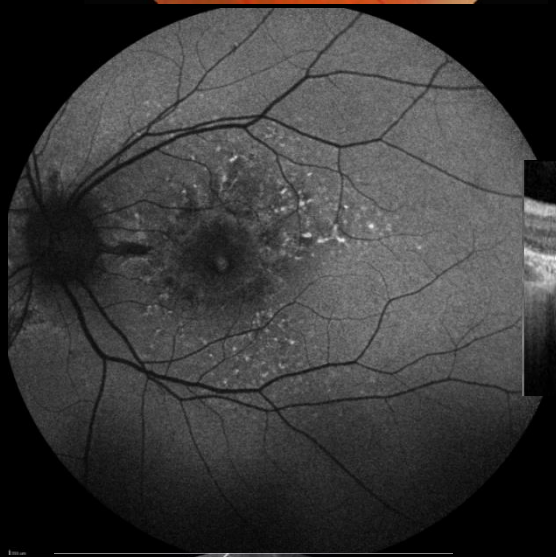
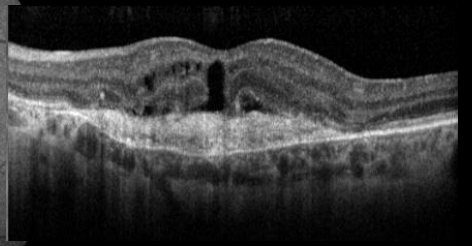
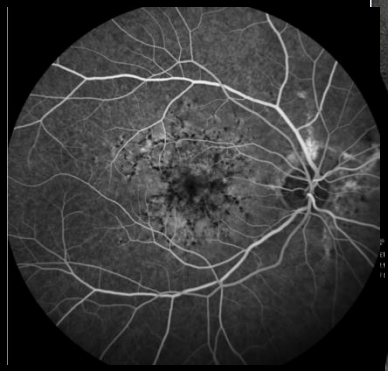
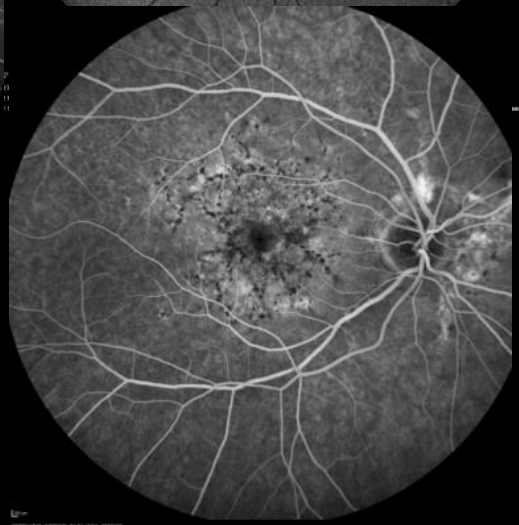
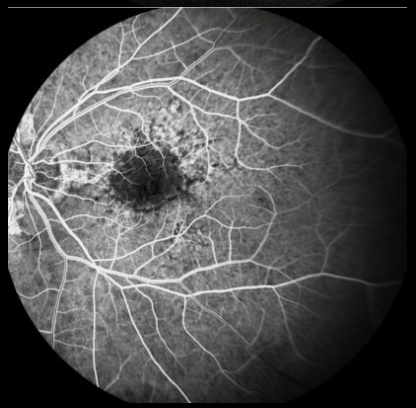
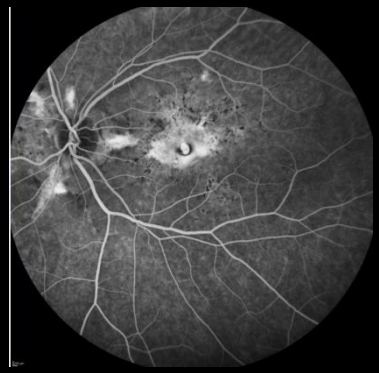


# FUNDUS PULVERULENTUS

- Makulada RPE düzeyinde kaba, noktasal pigment birikintileri
- Granüler fundus görünümü
- Diğer paternlere eşlik eder.



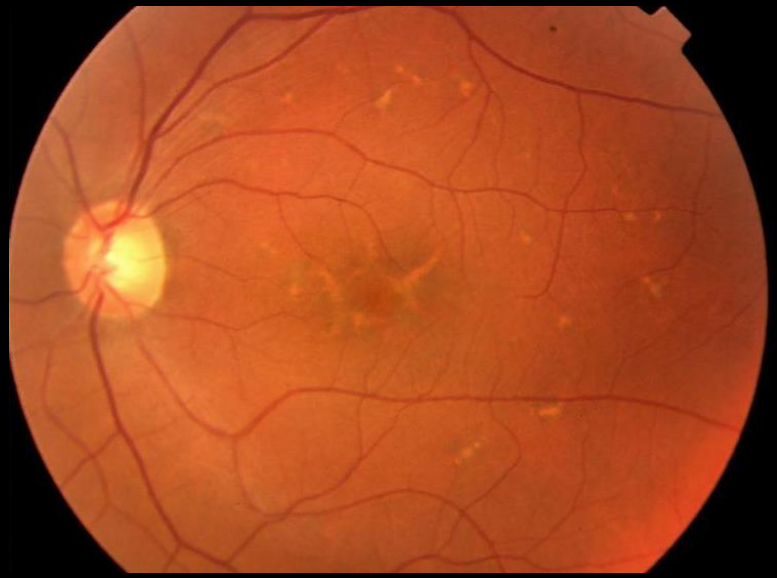


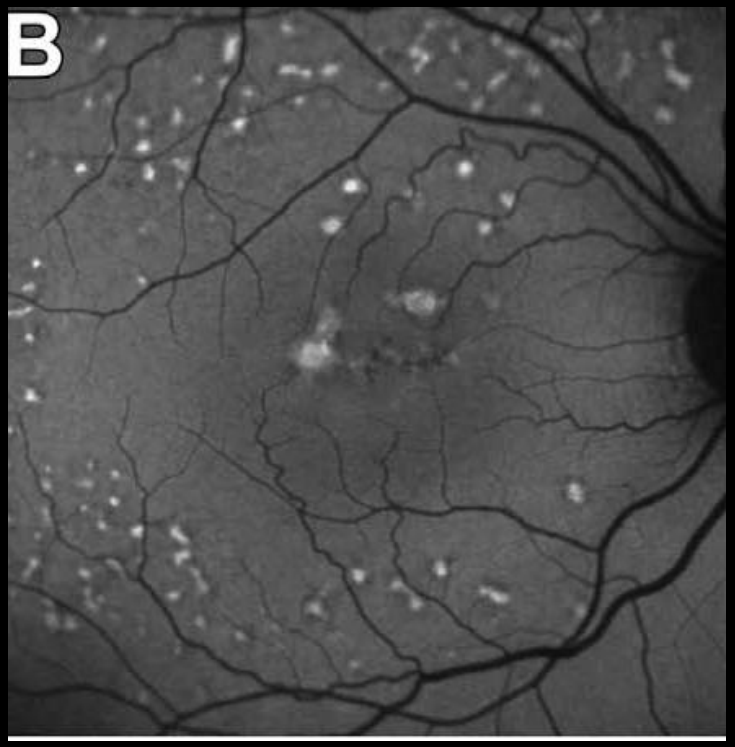










47 Y K
GK: 0.5/3 MPS

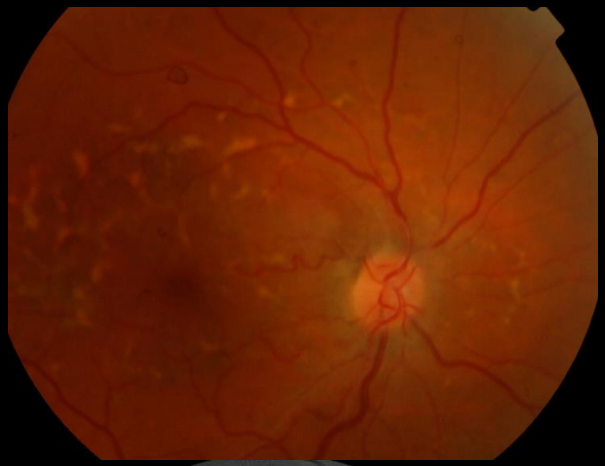
# MULTİFOKAL PATERN DİSTROFİ
# ( Stargardt/ fundus flavimaculatusu taklit eden form )

- Flek benzeri birikimler
- OD kalıtım
- Görsel prognoz iyi
- Stargardtta peripapiller tutulum yok!!!

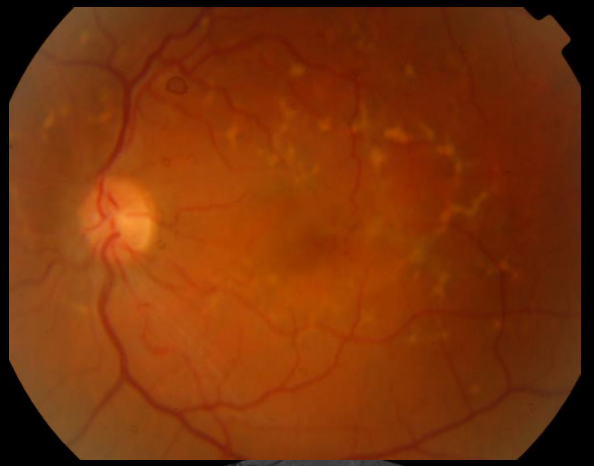


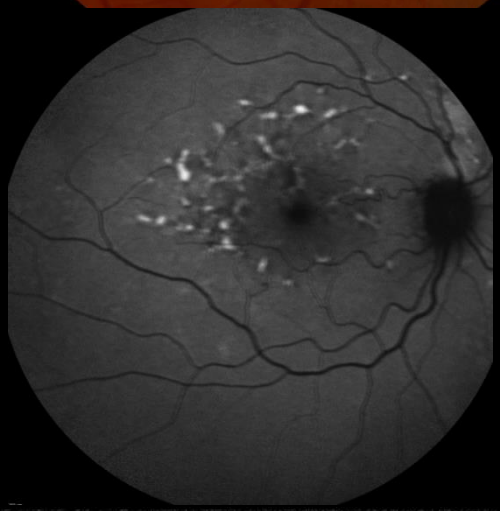


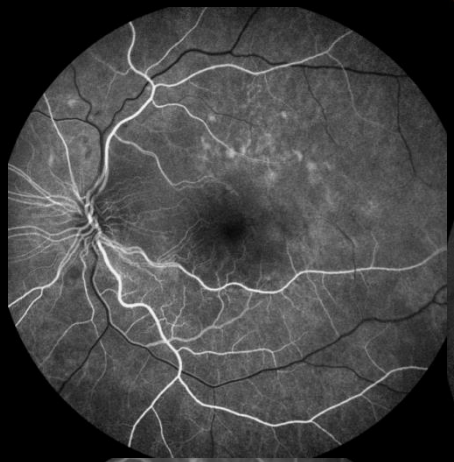

Fundus autofluorescence imaging of retinal dystrophies, Camiel J.F. Boon, B. Jeroen Klevering, Jan E.E. Keunen, Carel B. Hoyng, Thomas Theelen, Vision Research 48 (2008) 2569–2577

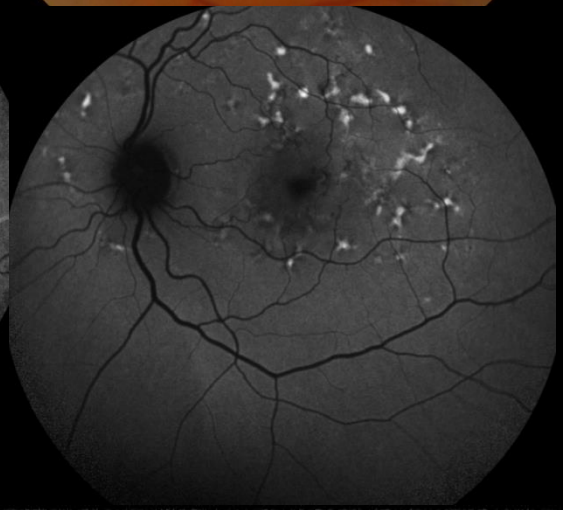


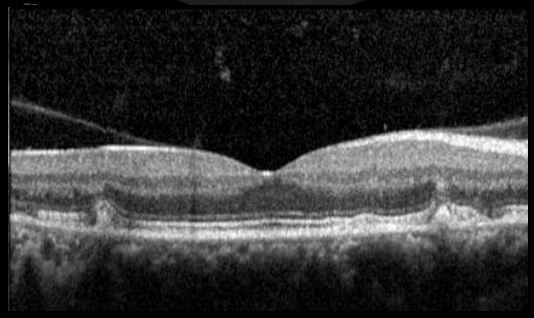
55 Y K
TAM/0.3

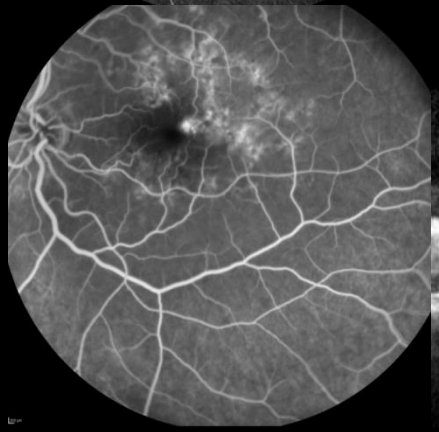


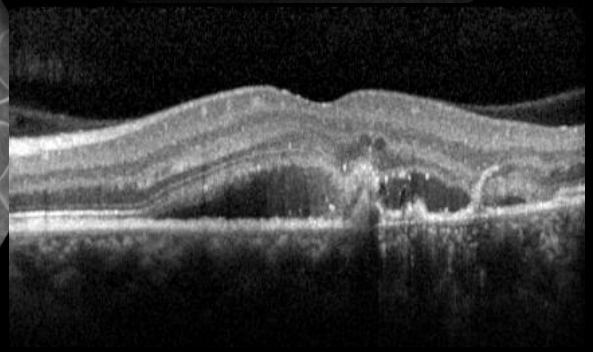


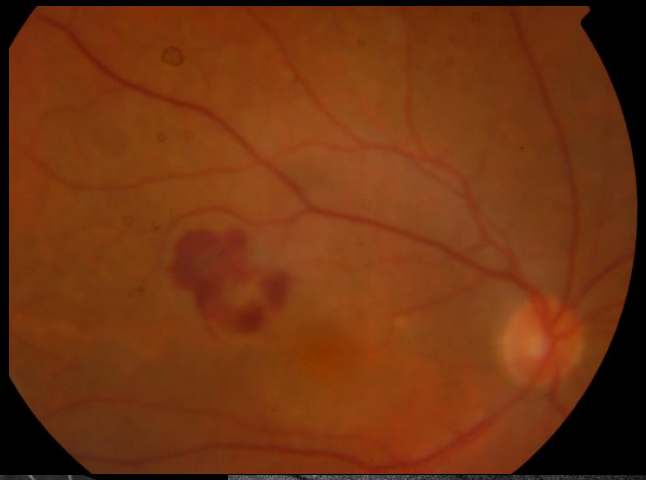
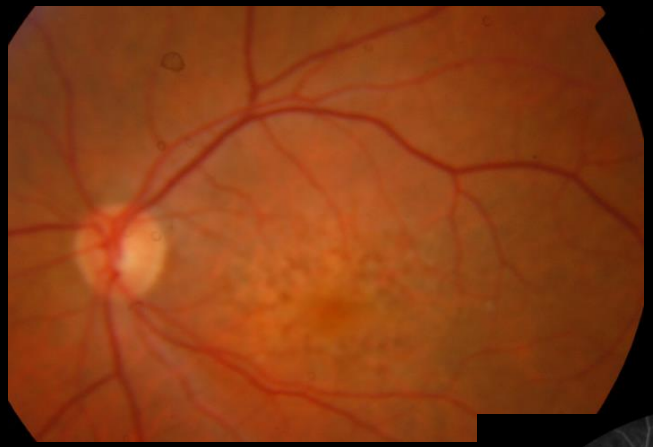




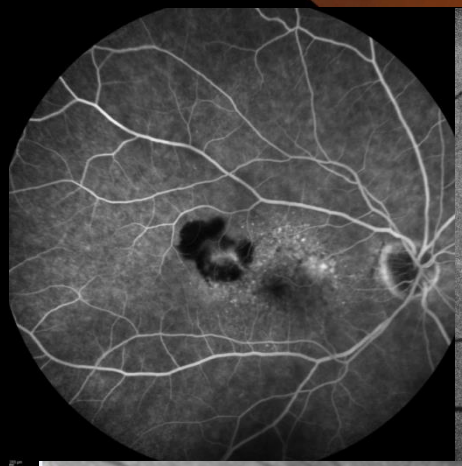
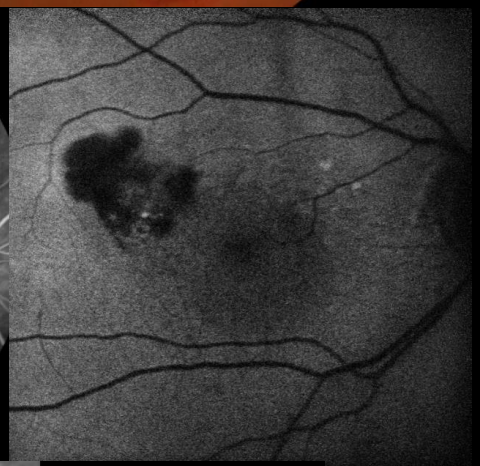
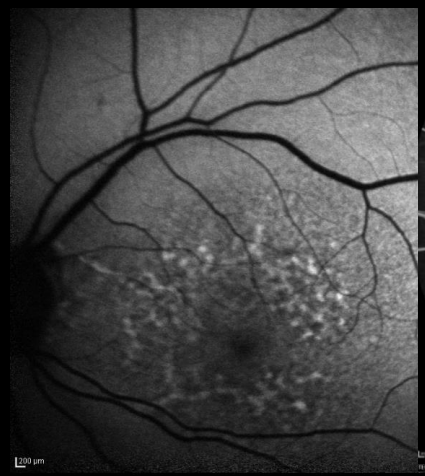
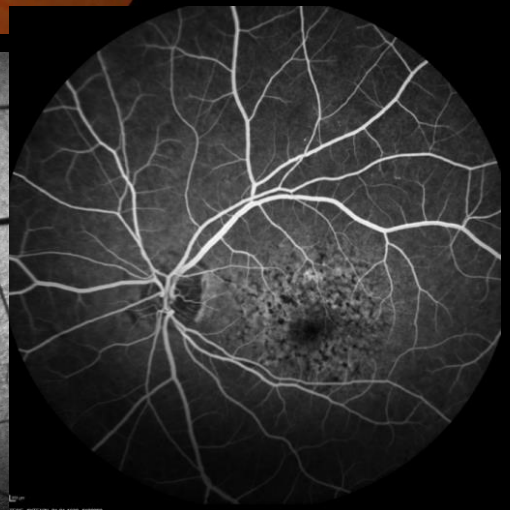
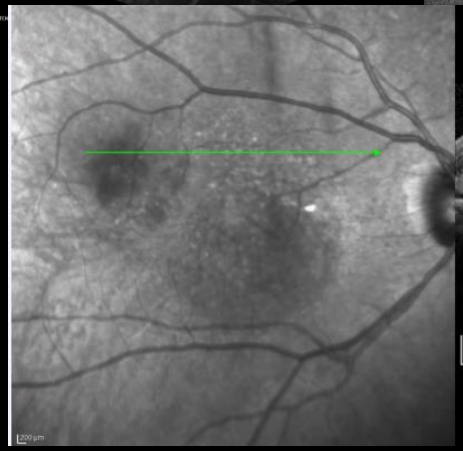
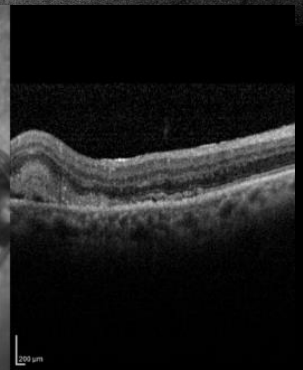
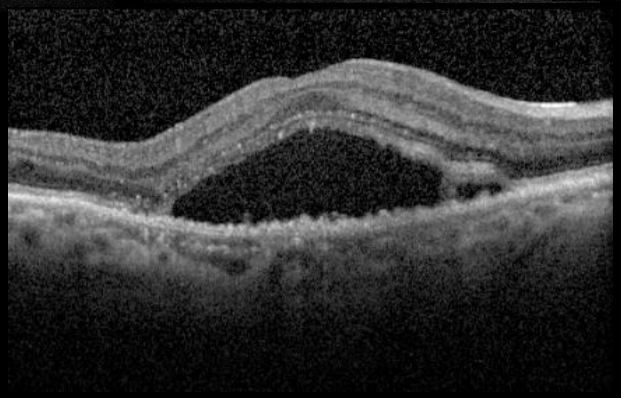


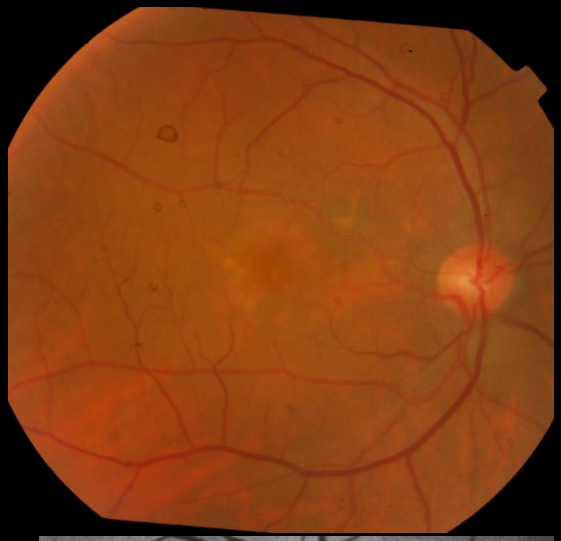


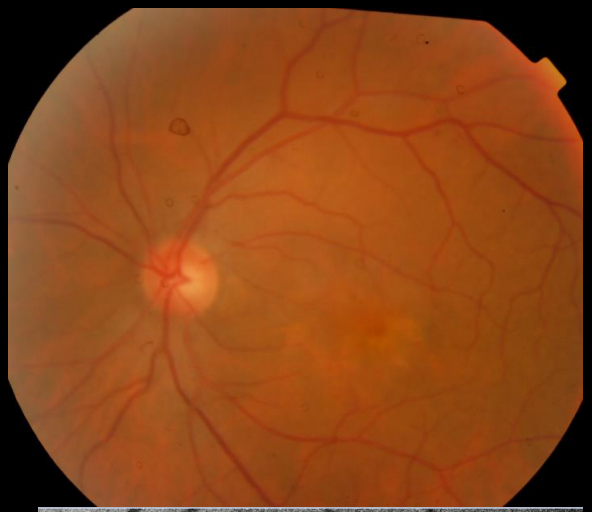


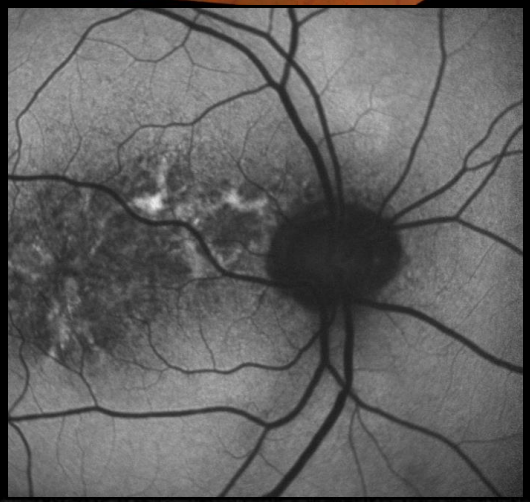
74 YE
GK: 0.4/0.7

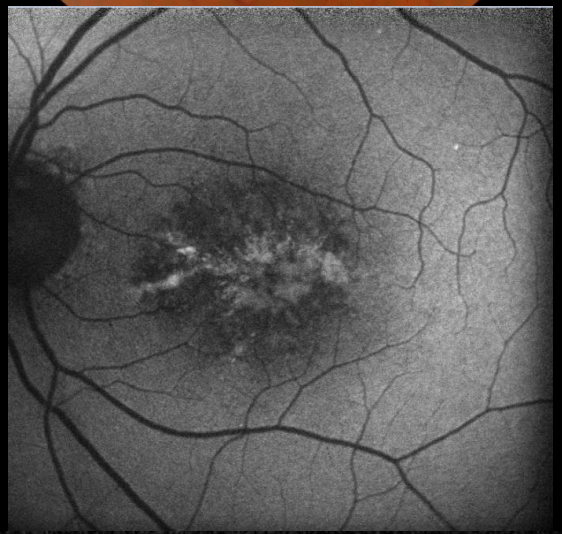








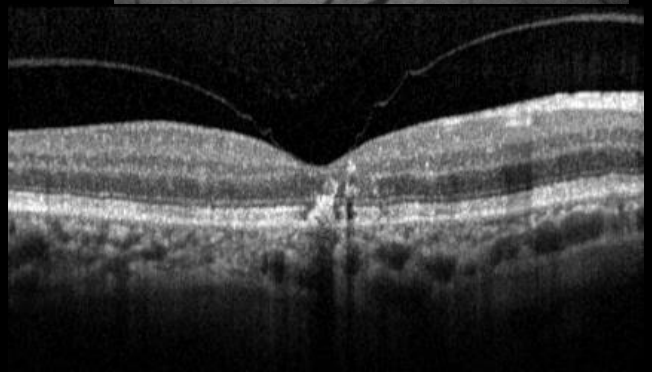


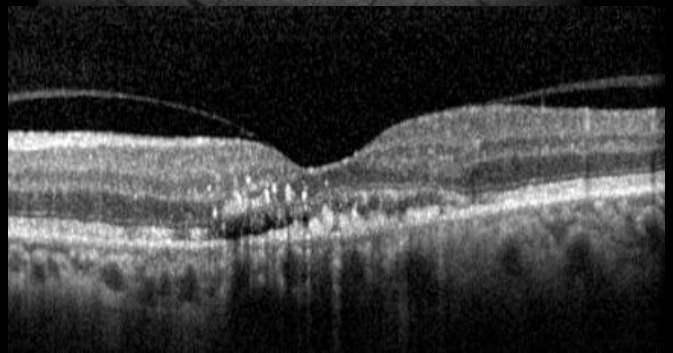


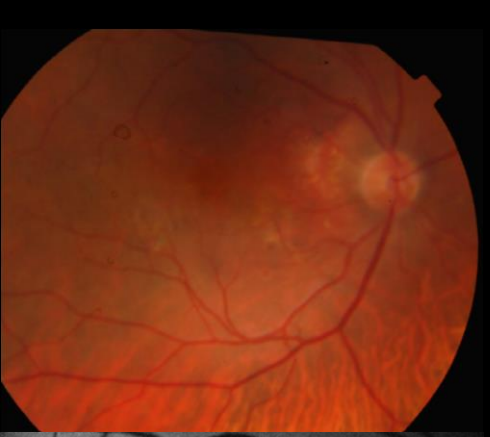
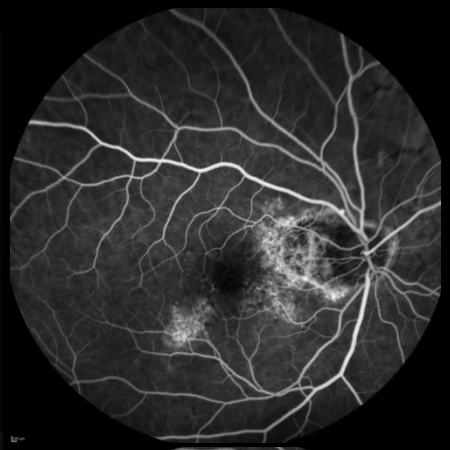
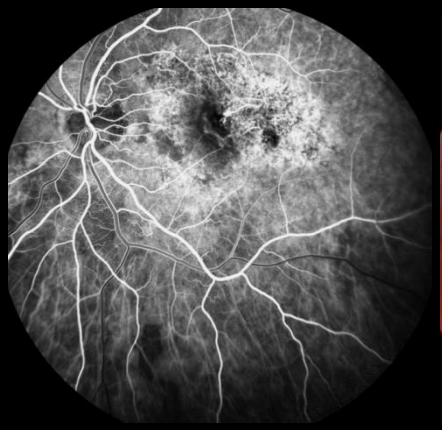
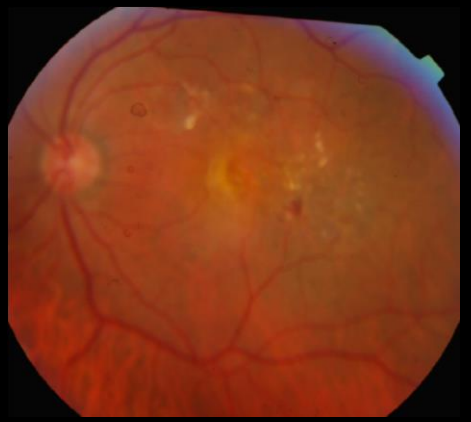
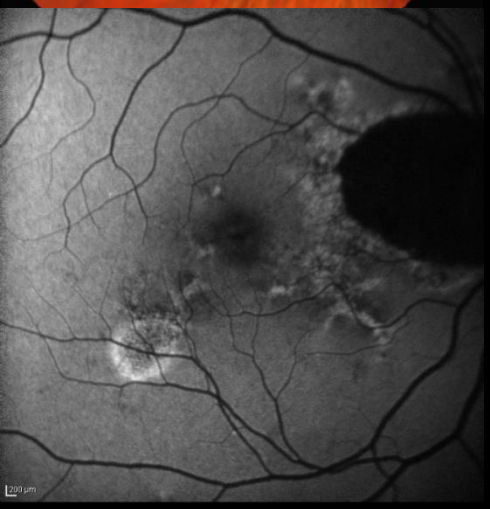
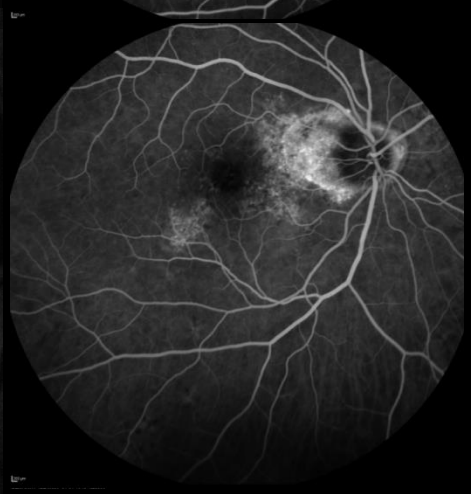
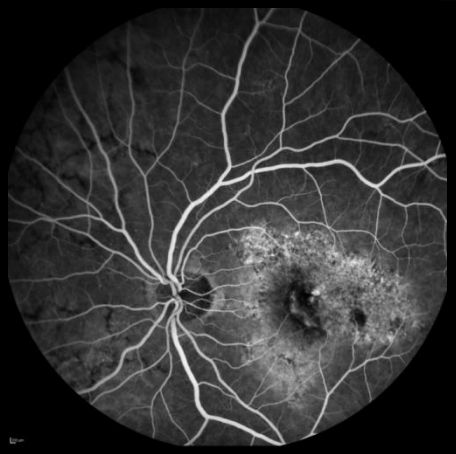
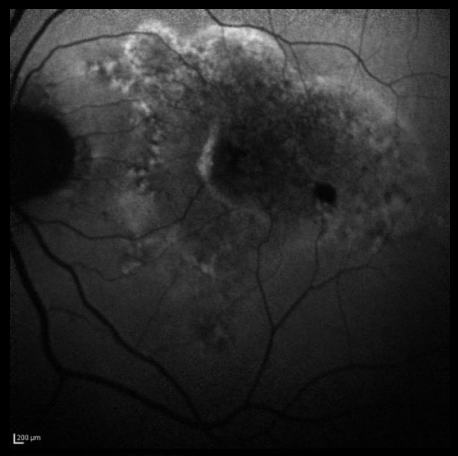
62 Y K HASTA
GK: 0.5/0.2
KNK +
CNVM
DÜŞÜNÜLMEMİŞ



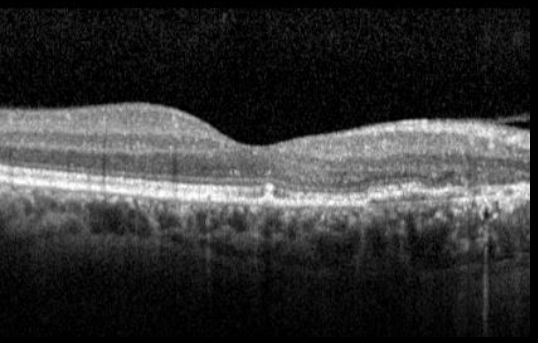
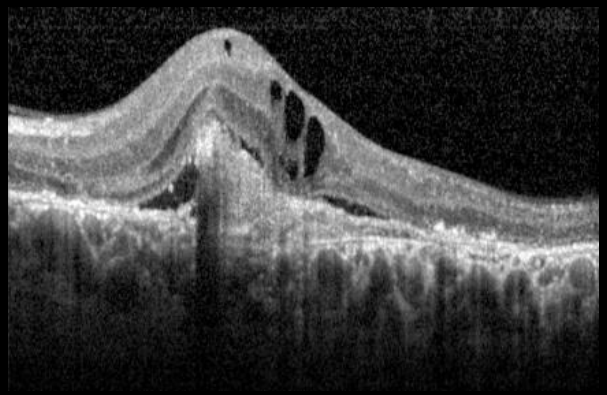


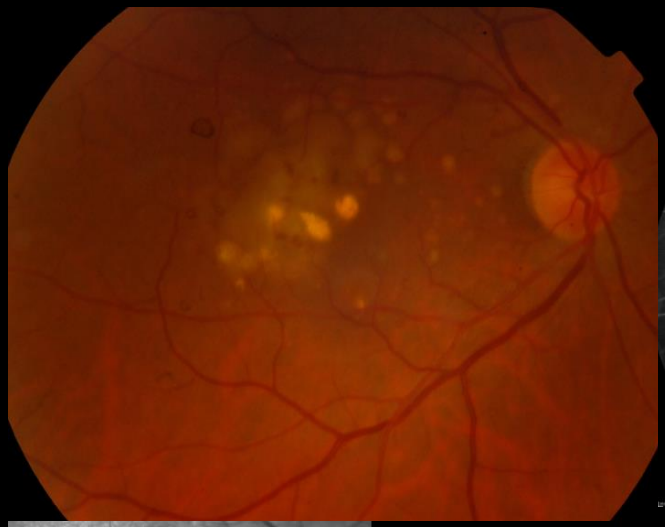


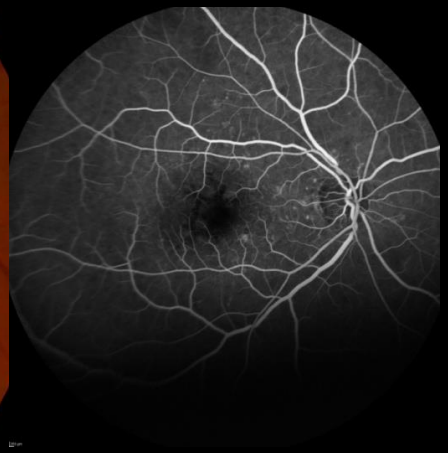


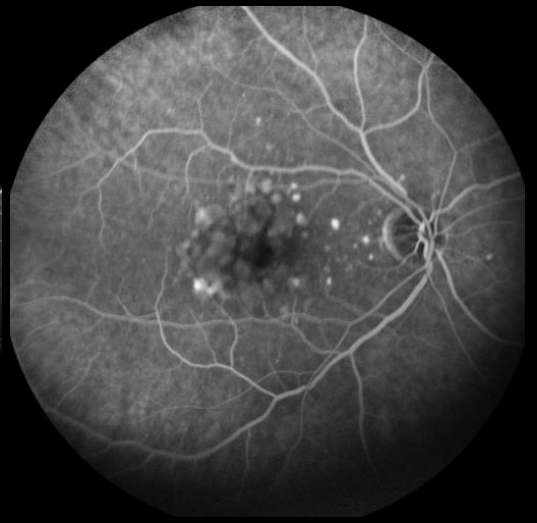









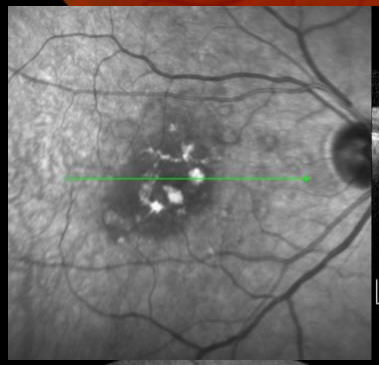

64 Y E HASTA
GK: TAM/0.05

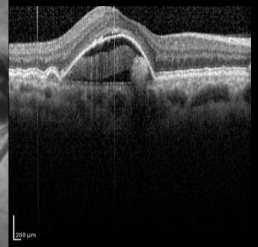





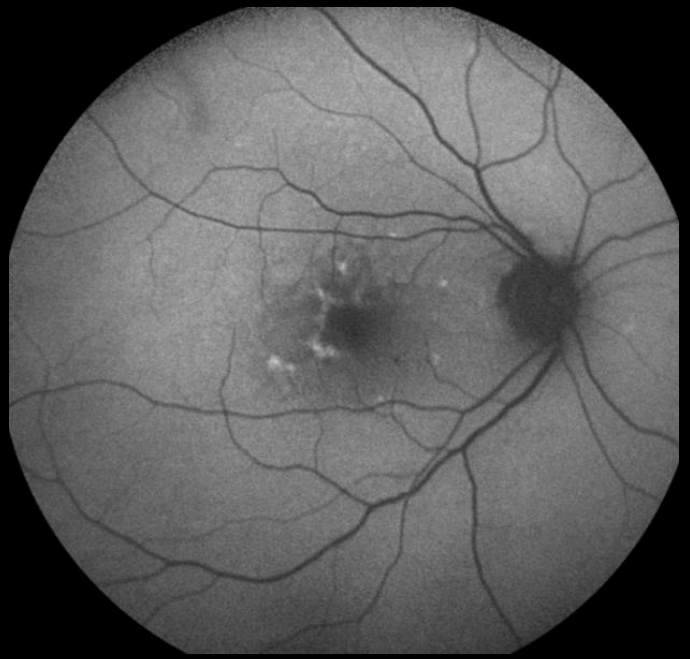


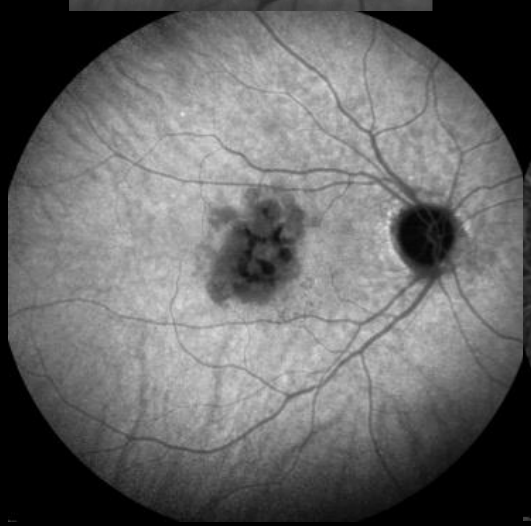


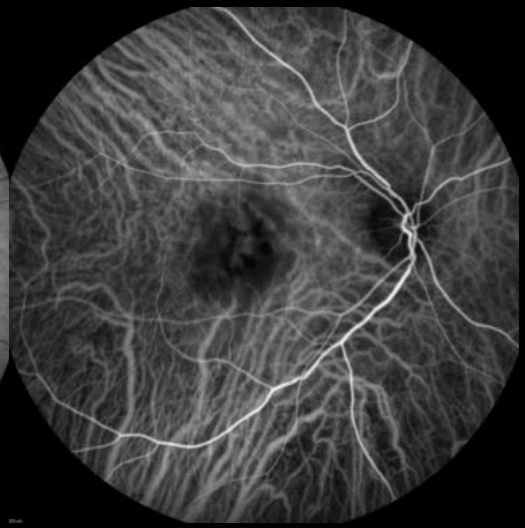


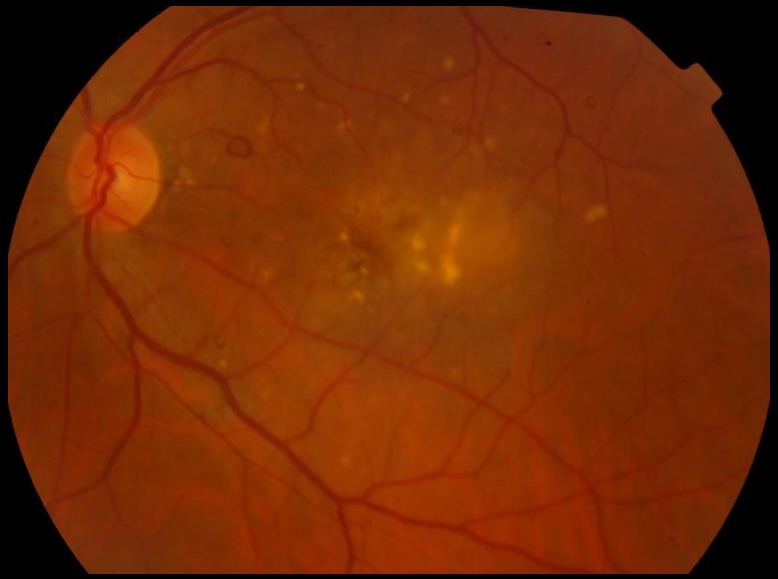


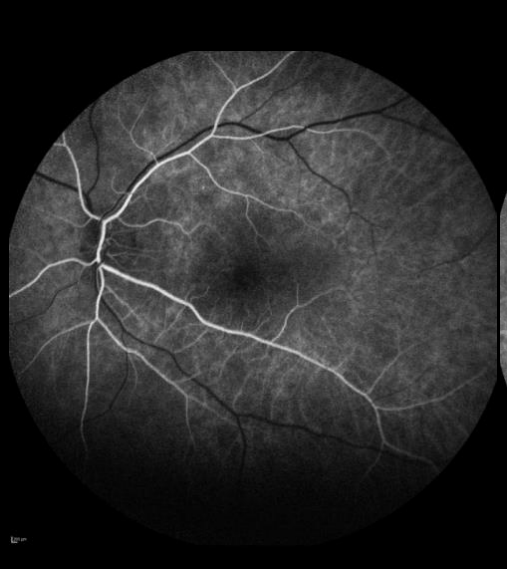
50 Y E HASTA
GK: 0.6/0.3 ( sağ)

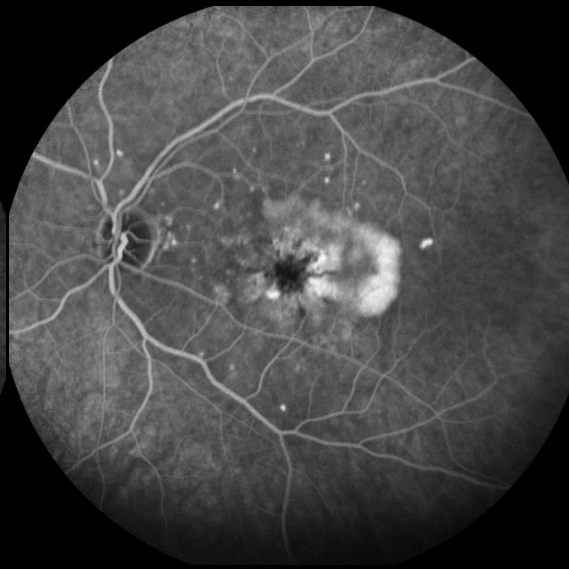


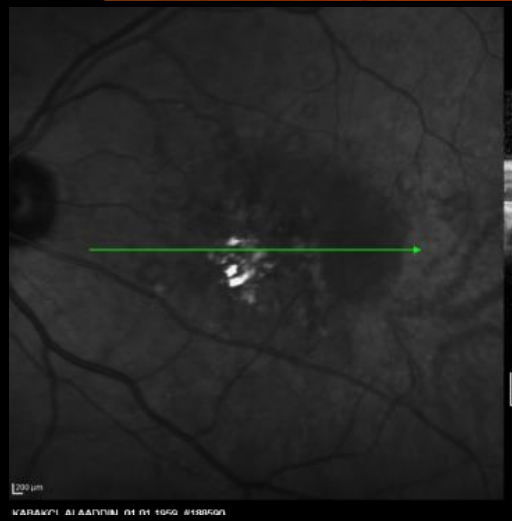


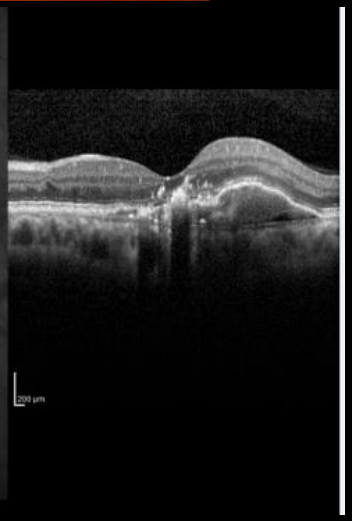


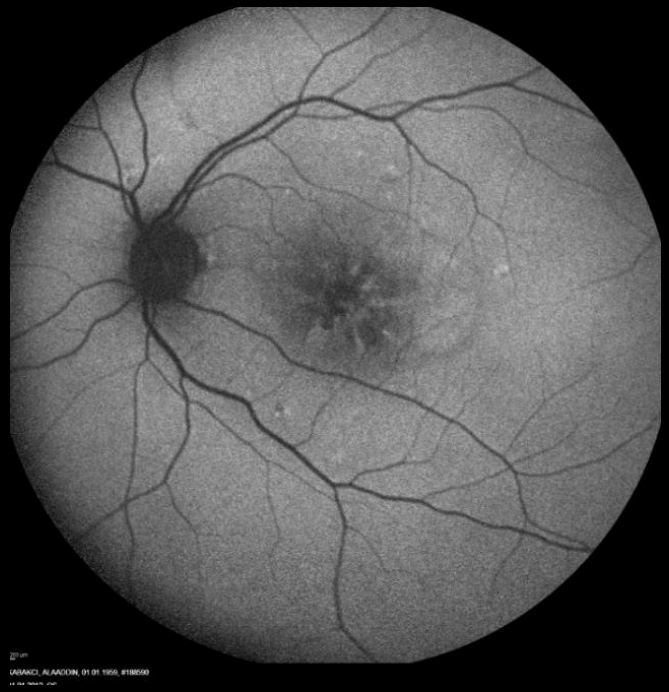








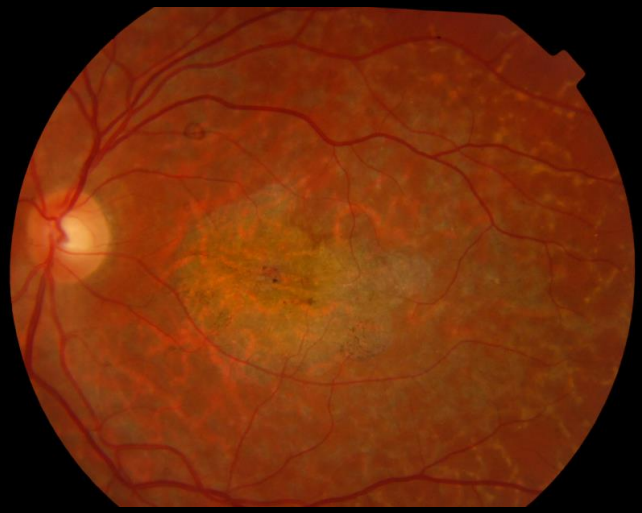


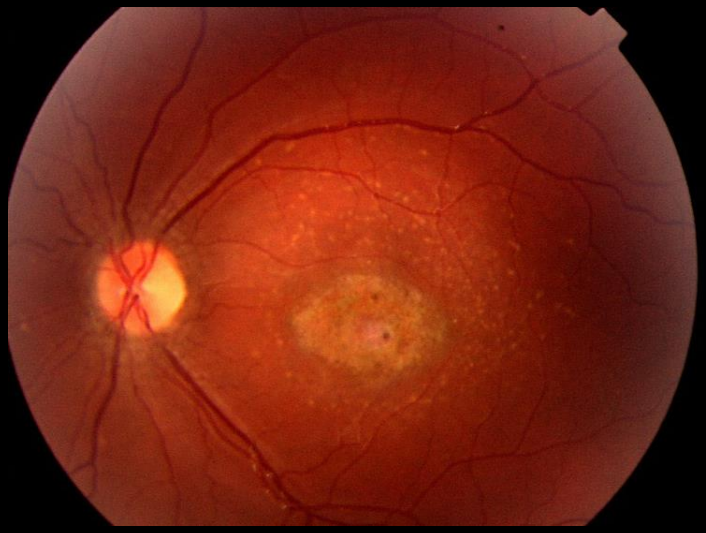


50 Y E HASTA
GK: 0.6/0.3 ( sol )

# Stargardt Makula Distrofisi-Fundus Flavimakulatus

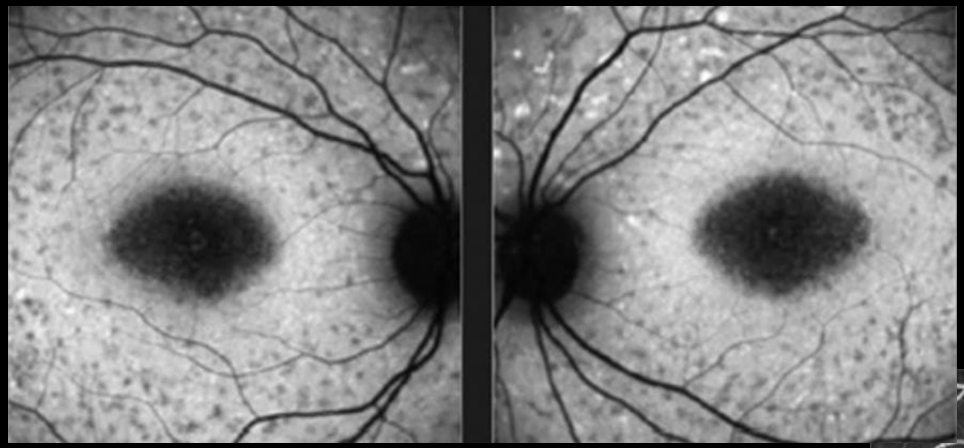
- Aynı hastalığın farklı tipleri
- Otozomal resesif (en sık) , ABCA4 sorumlu gen
- Erken dönemde bulgular silik
- Geç dönemde makulada dövülmüş bakır görünümü, atrofi
- Arka kutupta sarı-beyaz renkte ‘fleck’ olarak isimlendirilen derin retinal lezyonlar
- FA’da sessiz koroid görünümü (%62) : RPEde lipofusin birikimi



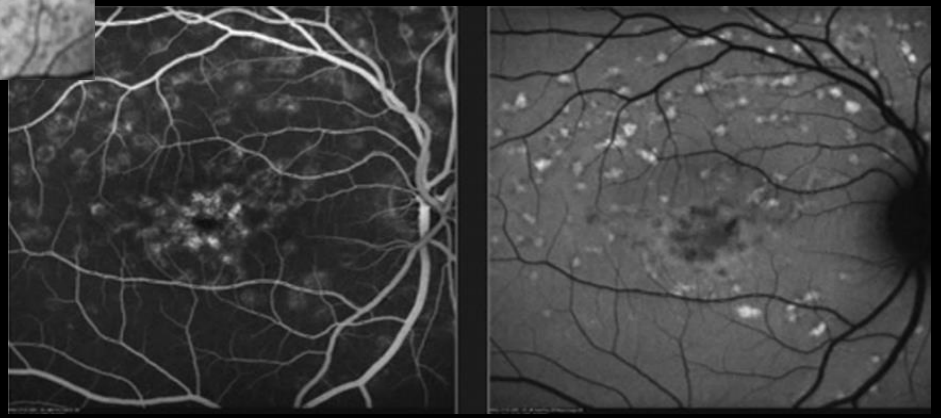


# Fundus otofloresans

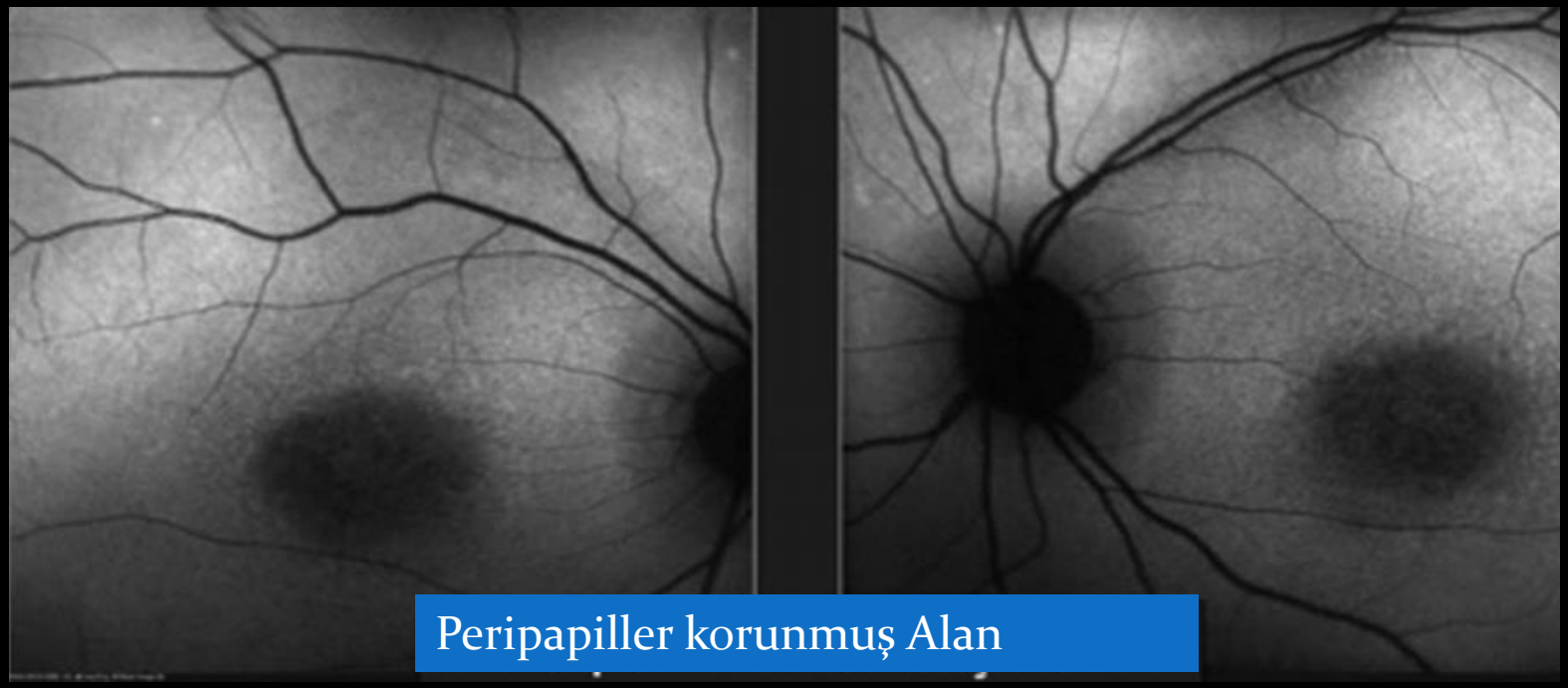
- Aktif flek( RPE'de lipofusin birikimi): hiperotofloresan
- İnaktif flek  (RPE atrofisi): hipootofloresan
- Periferde iyi sınırlı hipootofloresan alanlar: azalmış kon-rod fonksiyonu: kötü prognoz
- Klinik olarak izlenmeyen, diffüz hiperotofloresans: hızlı progresyon, atrofi riski!!



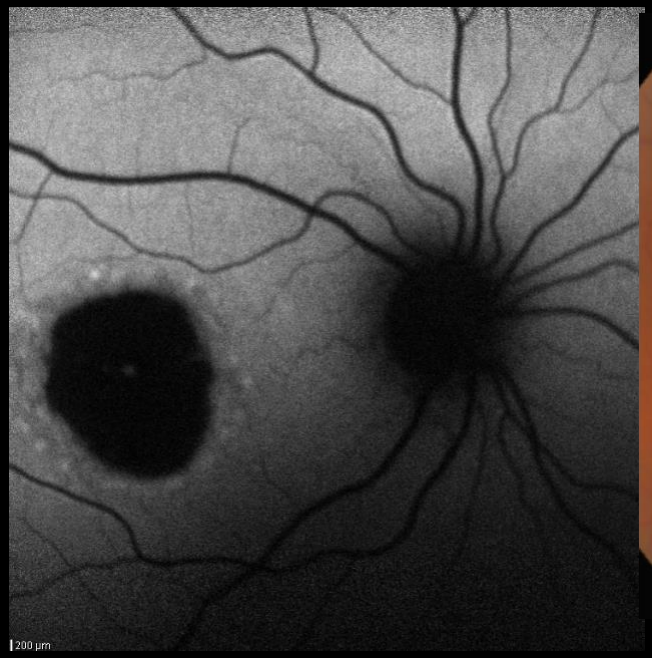
İnaktif flek

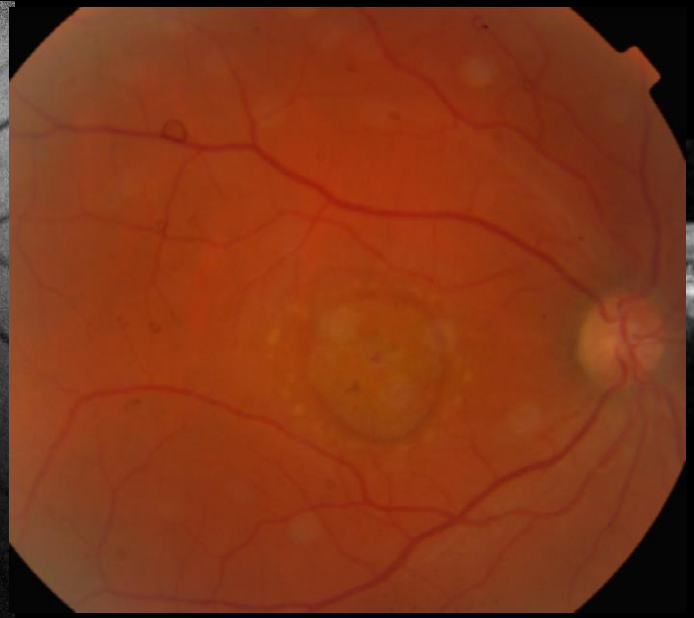


Aktif flek

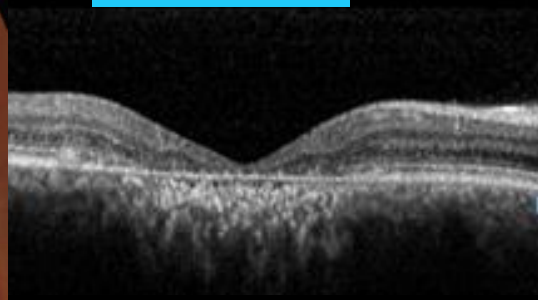


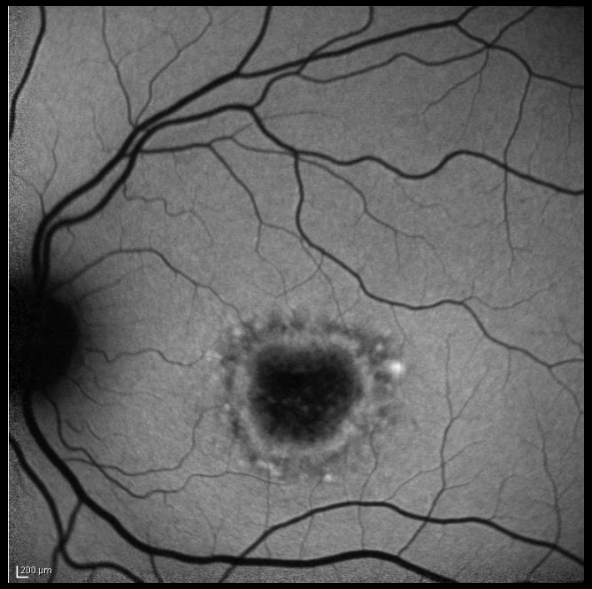

- Makulada oval şekilli hipootofloresans

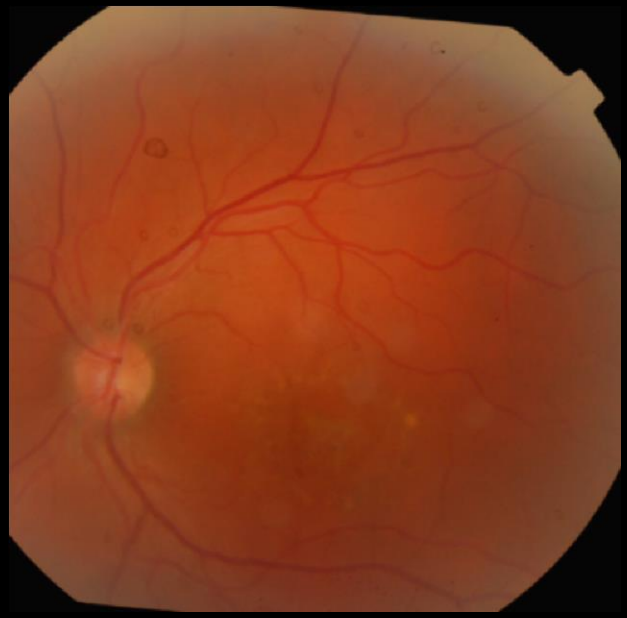


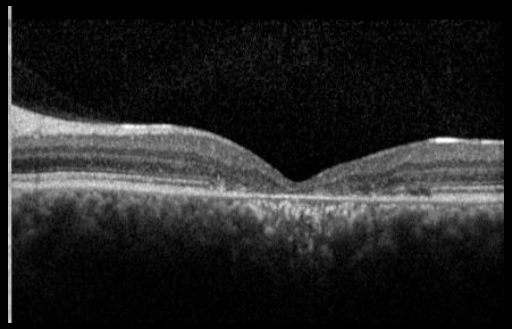



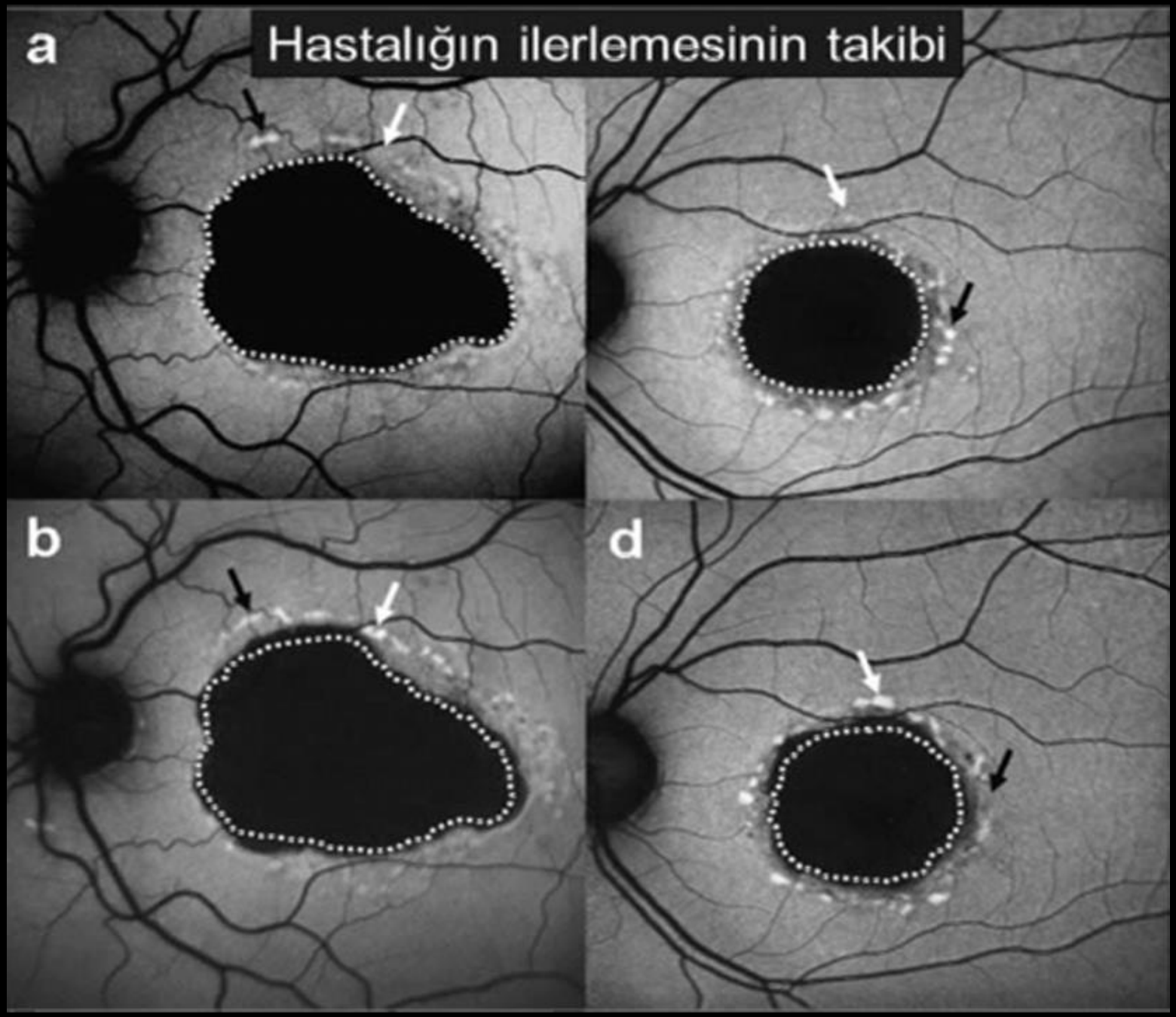
34 Y K
0.16/0.16





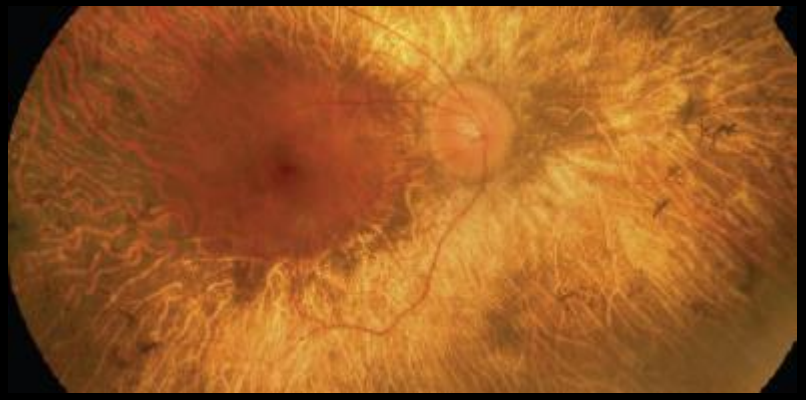








Naomi Lois , John V. Forrester , fundus aoutofluorescence , chapter 11G : 212

# RETİNİTİS PİGMENTOSA



- Farklı genetik  orjinli retina dejenerasyonlarından oluşan farklı bir hastalık grubu
- Rod-kon distrofisi
- Kemik spikülü pigmentasyon, damarlarda incelme, OD solukluğu
- RLBP defekti (retinalaldehit bağlayan protein geni)
- RPE 65 geni( 11 cis retinol metabolizmasında rol alır.)

# RETİNİTİS PİGMENTOSA

## Fundus otofloresans

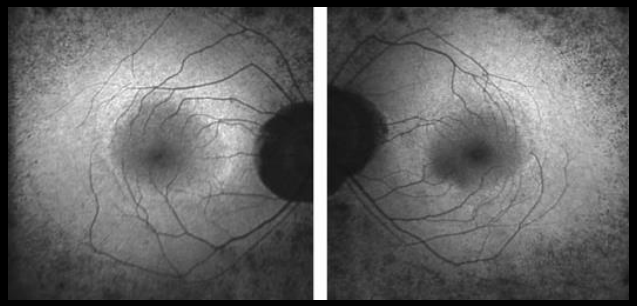
Perifoveal halka şeklinde hiperotofloresans (yetişkin hastalarda)

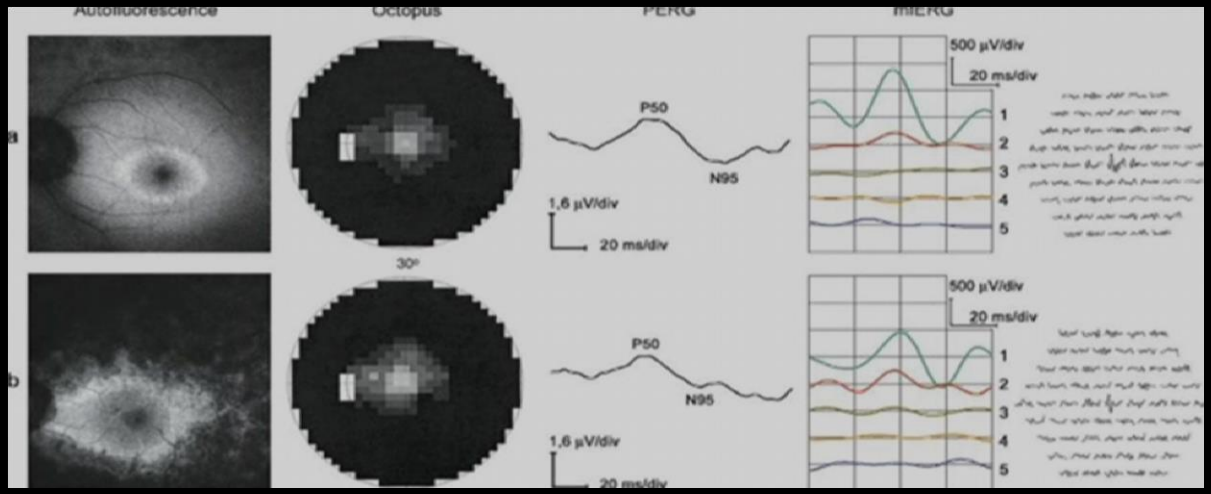
Simetrik

Korunmuş santral fotopik fonksiyonun sınırları

Halka daraldıkça: merkezi görmede azalma

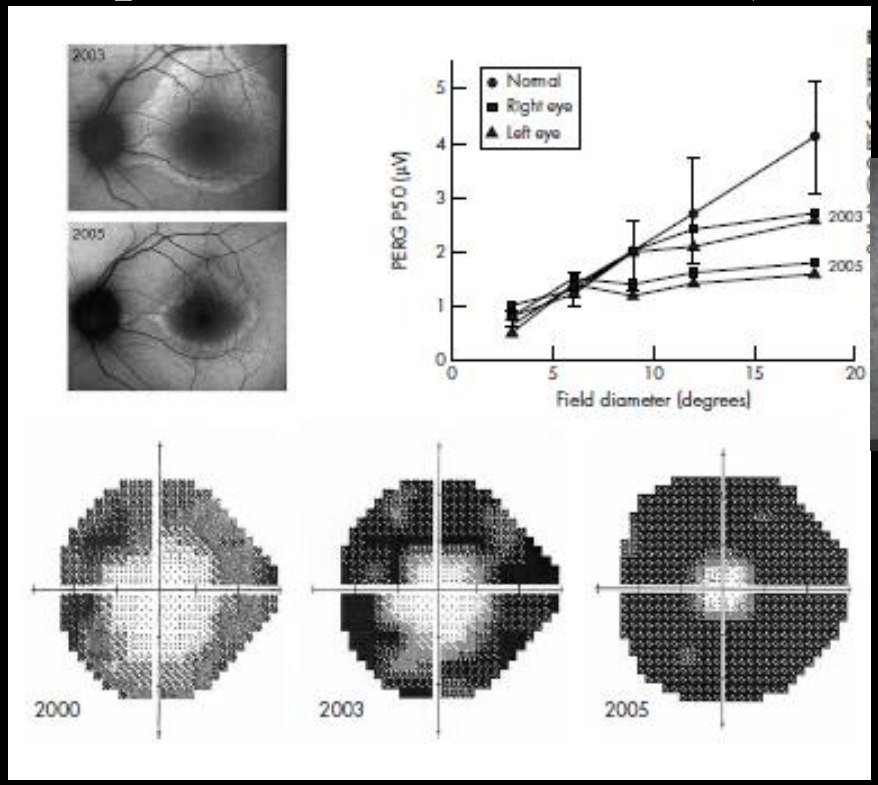
Periferde hipootofloresans

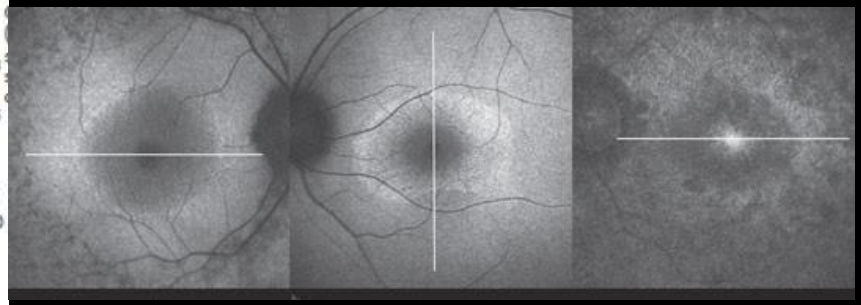





Halka dışındaki alan normal görünse dahi nonfonksiyonel

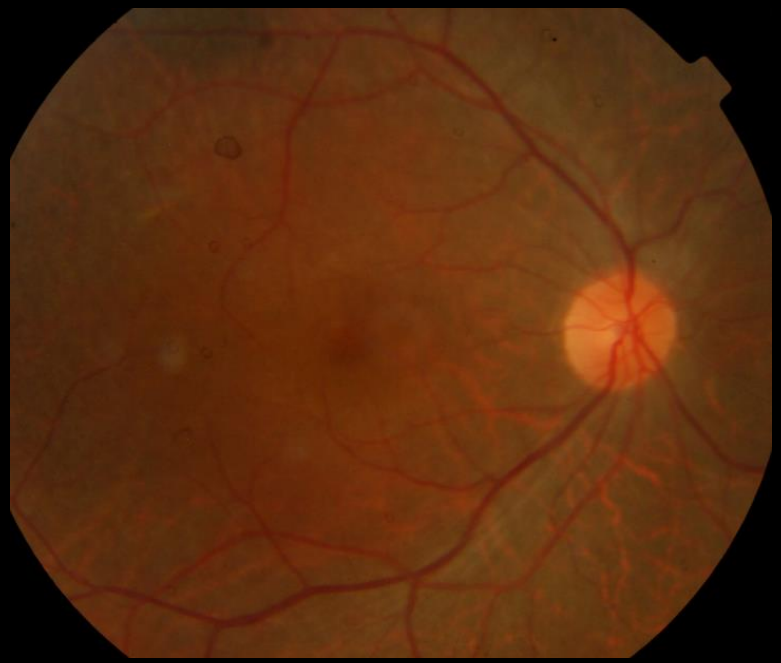
- Hiperotofloresan halkanın büyüklüğü psikofiziksel ve elektrofizyolojik testlerin sonuçları ile uyumlu bulunmuş*
- Rpda hastalık ilerledikçe halka daralır.

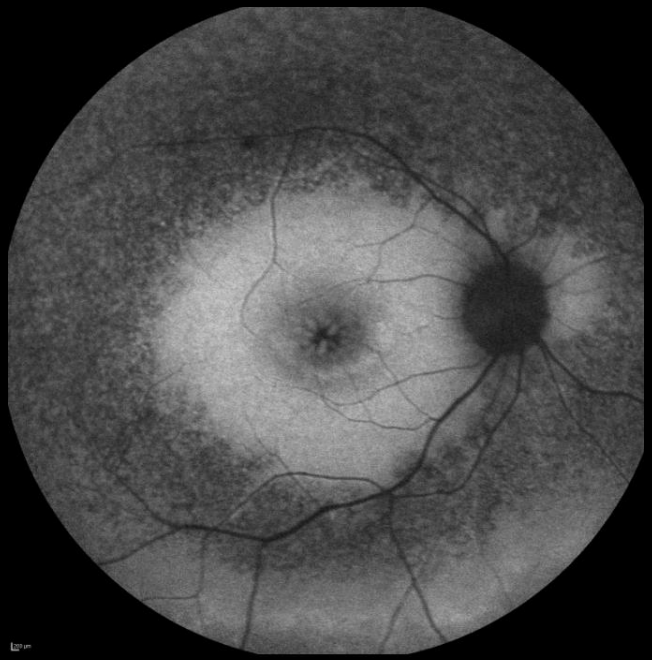


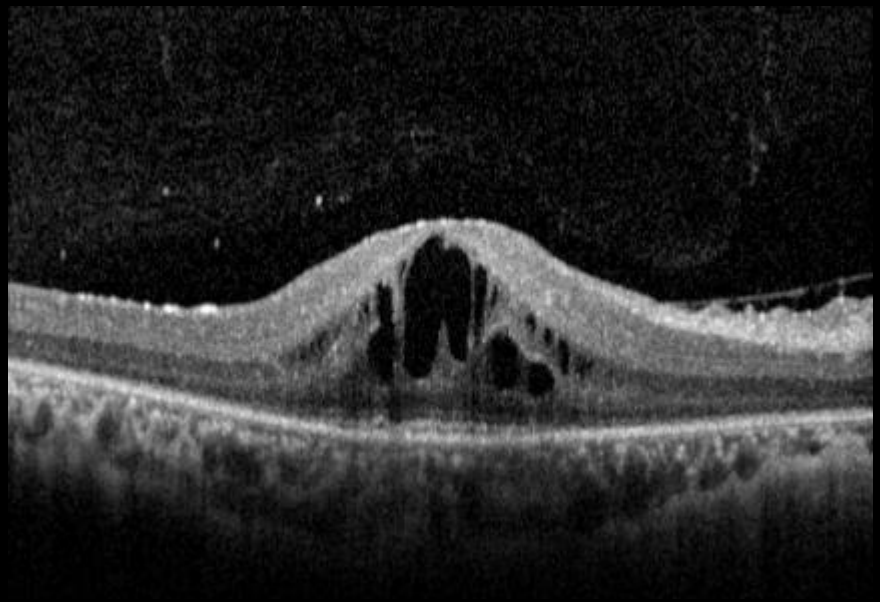



**Functional characterisation and serial imaging of abnormal fundus autofluorescence in patients with retinitis pigmentosa and normal visual acuity,** Br J Ophthalmol. 2006 Apr;90(4):472-9. Robson AG, Saihan Z, Jenkins SA, Fitzke FW, Bird AC, Webster AR, Holder GE.

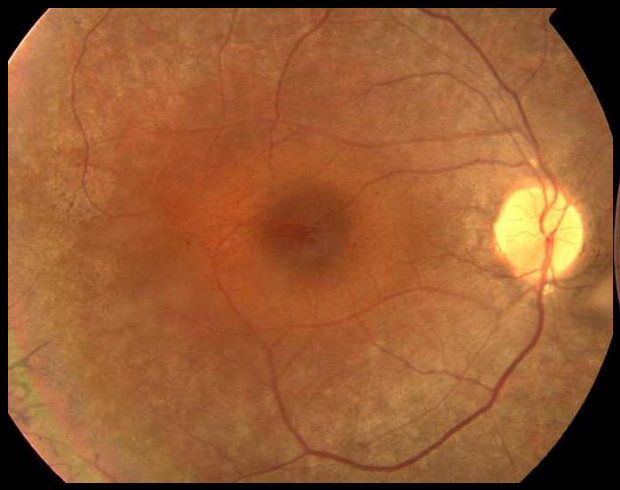
**Abnormal fundus autofluorescence in relation to retinal function in patients with retinitis pigmentosa.,** Popović P, Jarc-Vidmar M, Hawlina M., Graefes Arch Clin Exp Ophthalmol. 2005 Oct;243(10):1018-27

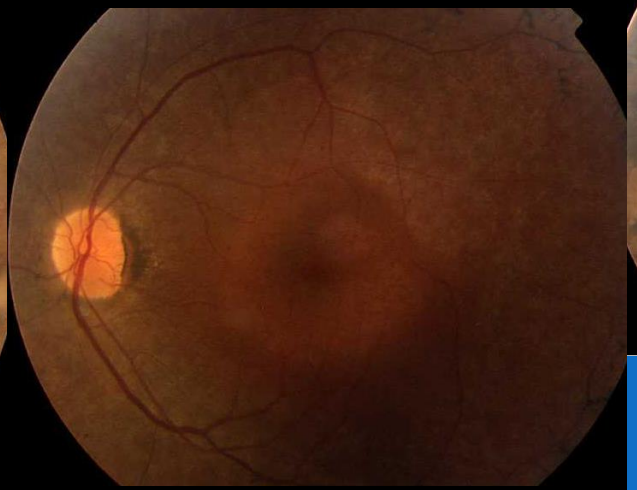


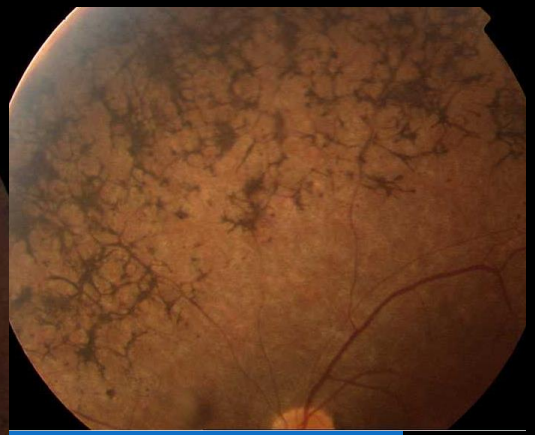




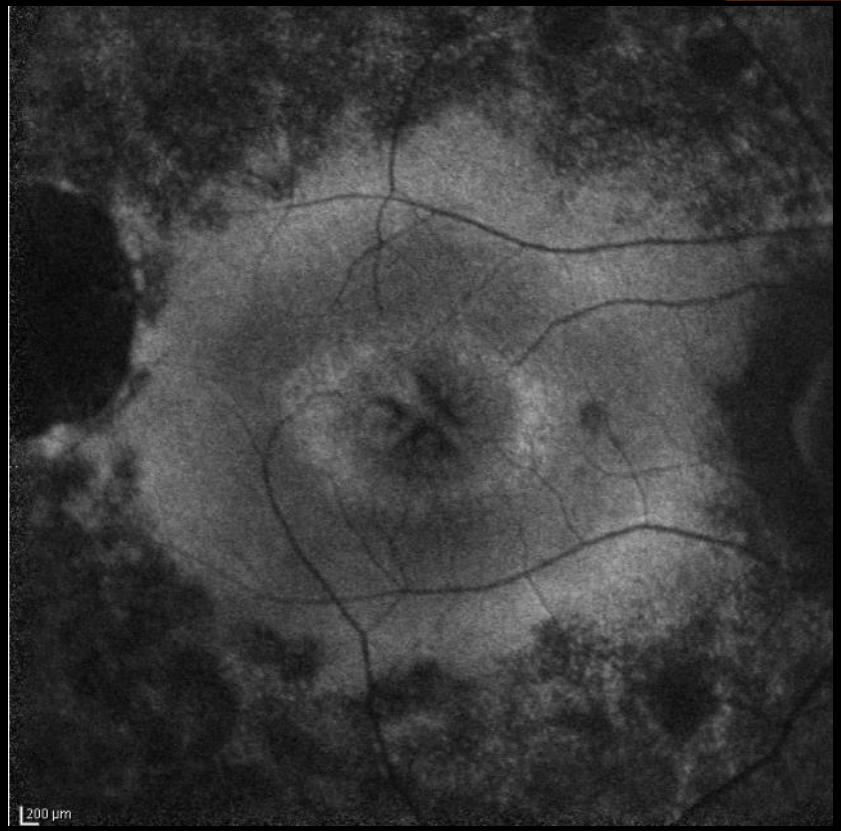
27 Y E hasta
GK: 0.2 /P- ( TRAVMA)

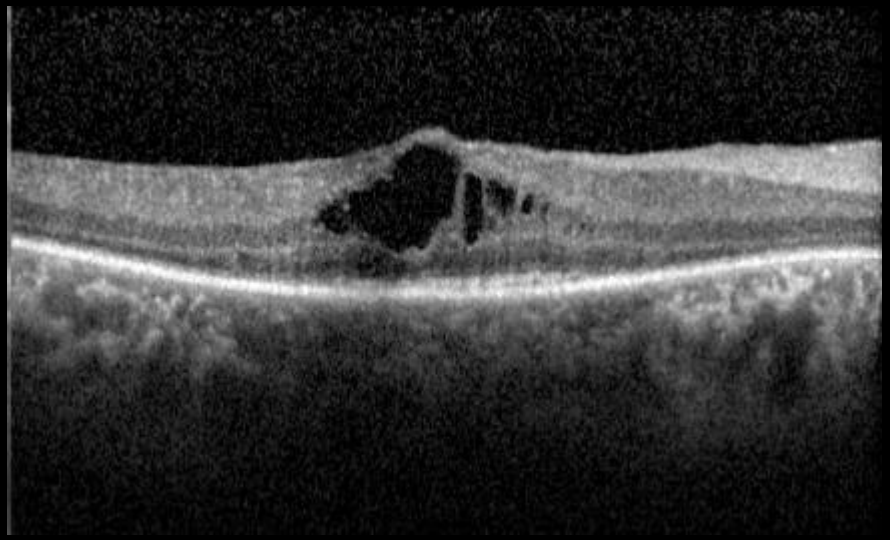






29 y E hasta
GK: 0.3/0.3



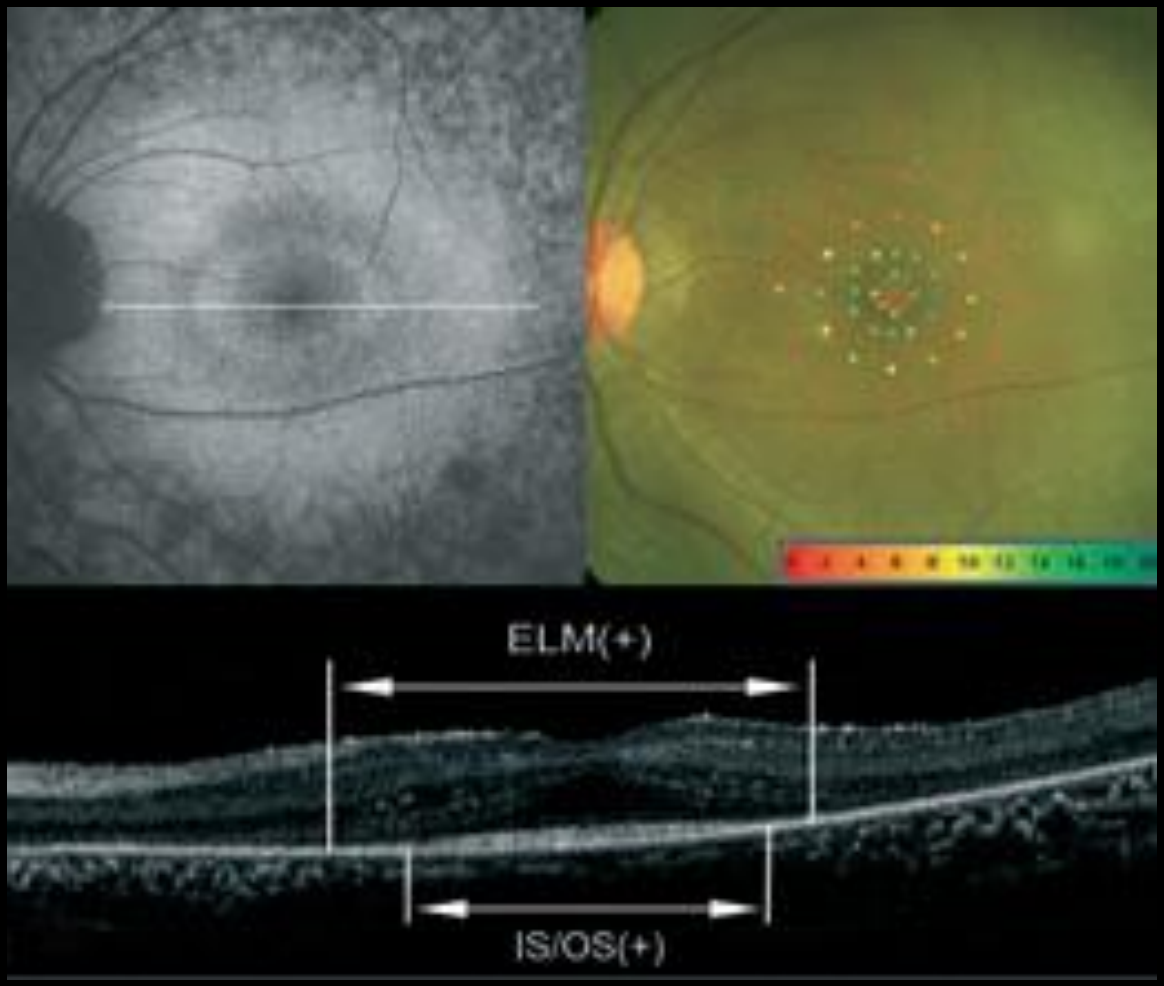



Kmö'sü olan hastalarda foveada yuvarlak/oval şekilde artmış hiperotofloresan alanlar saptanabilir.
Kronik kmö= atrofi= hipootofloresans

# Parafoveal hiperotofloresan halka

- Leber'in konjenital amarozisi
- Kon-rod distrofi (makulopati ilerledikçe genişler)
- Best hastalığı
- X –linked retinoskizis

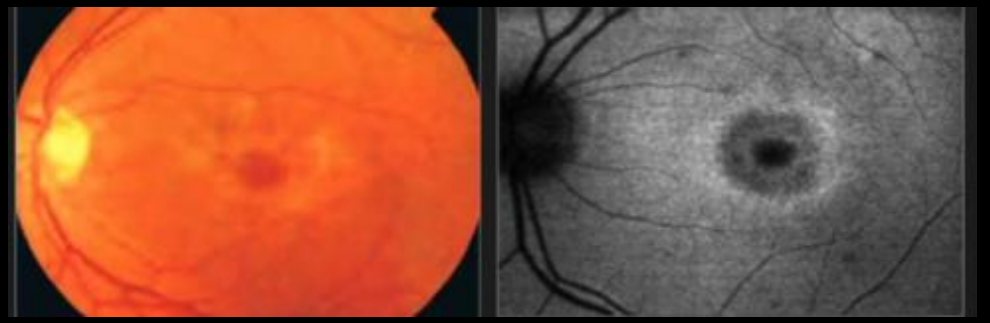
# RPDA FAF- FOTORESEPTÖR BÜTÜNLÜĞÜ İLİŞKİSİ

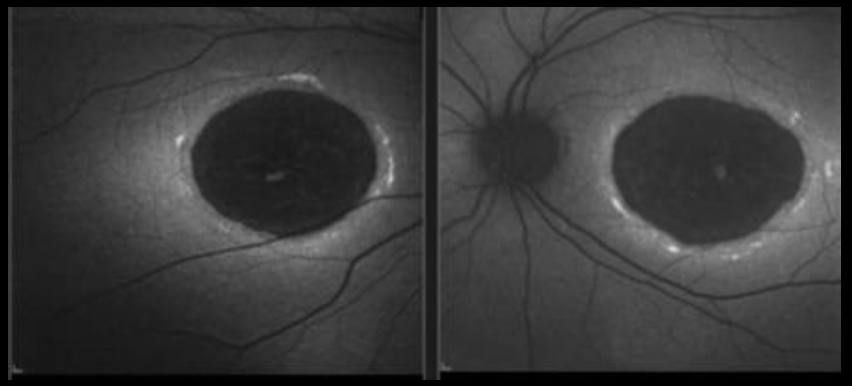


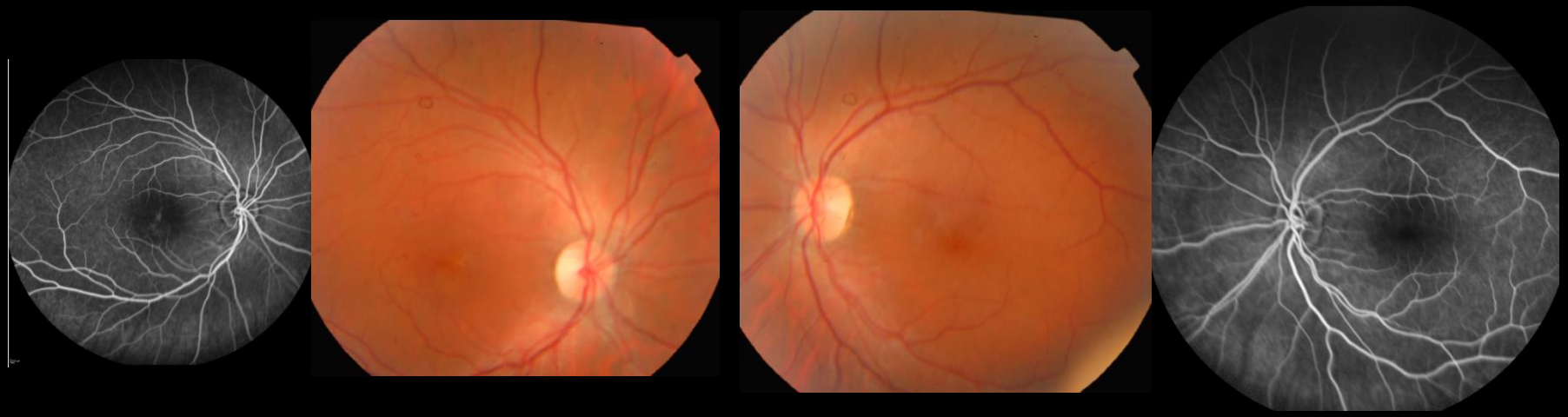

Wakabayashi T, et al. Acta Ophthalmol 2010;87:177-83

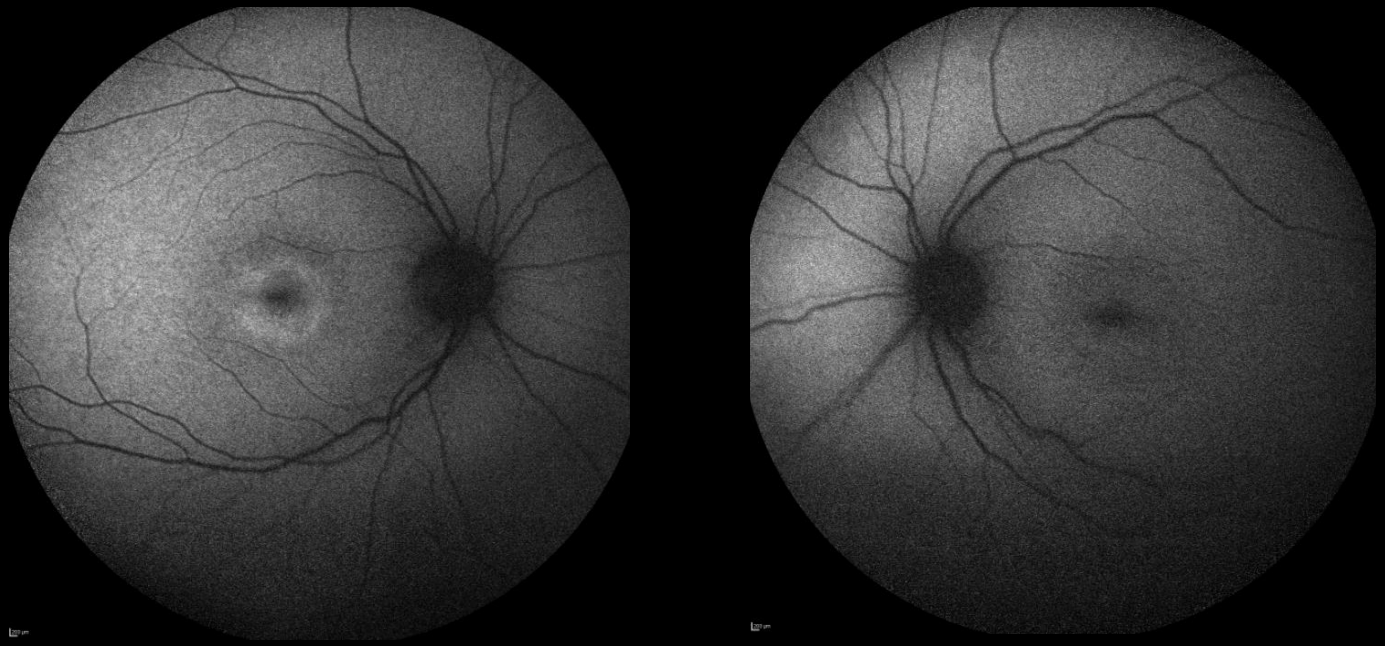
# KON ROD DİSTROFİSİ

- Heterojen hastalık grubu
- 14 mutasyon
- İlk bulgu AF'de artış: başlangıç disfonksiyon
- Fotoreseptör kaybı= makula atrofisi= azalmış FAF
- İlerleyen evrelerde atrofik makulayı çevreleyen hiperfloresan halka
- Makulopati ilerledikçe halka genişler.

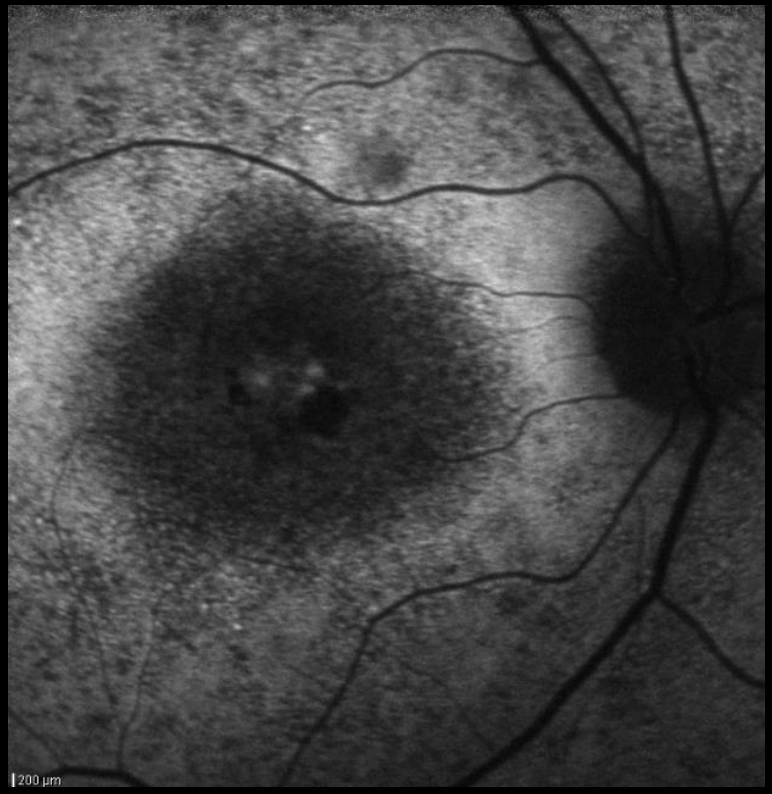


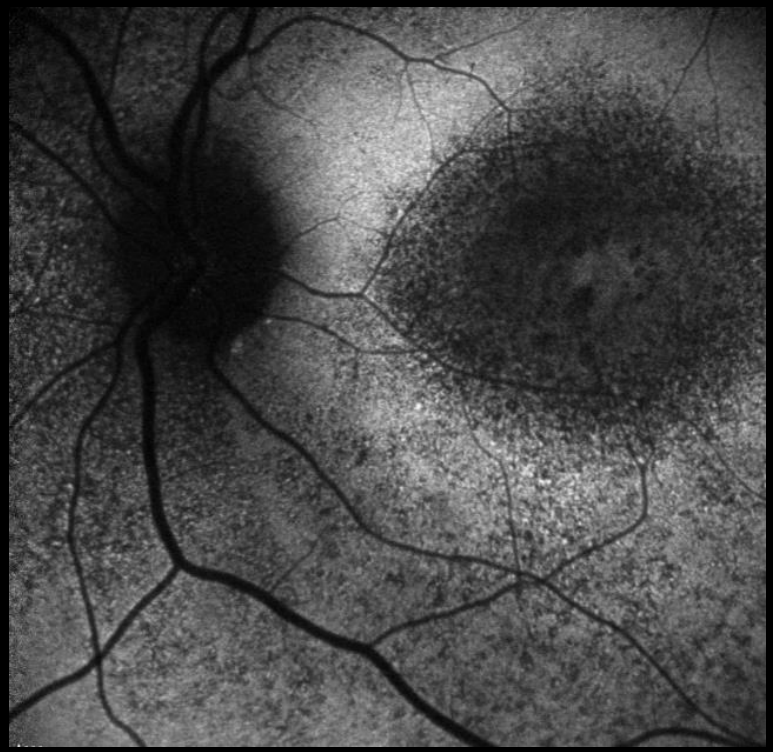




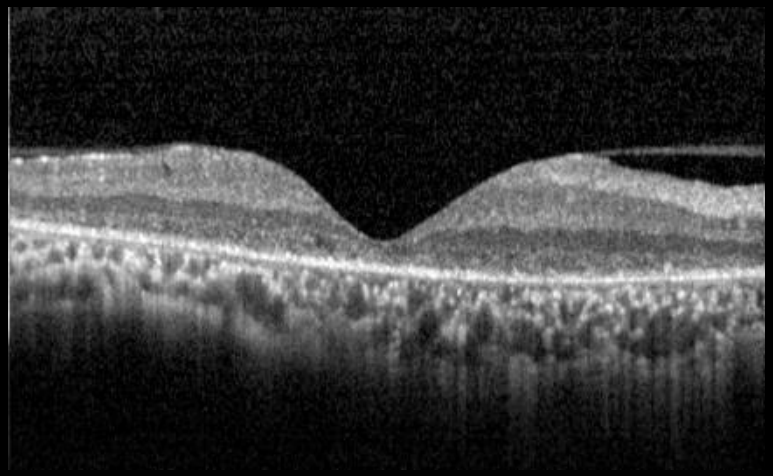


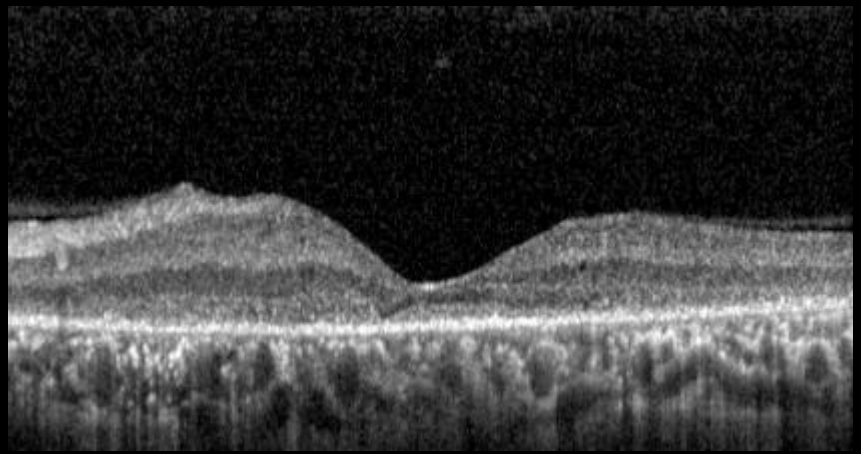
22 Y K HASTA
GK: 0.2/0.2



45 y k
hasta
1 mps/ 0.4

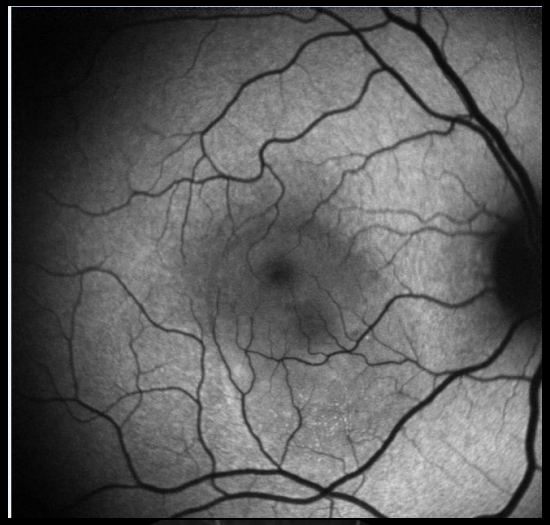


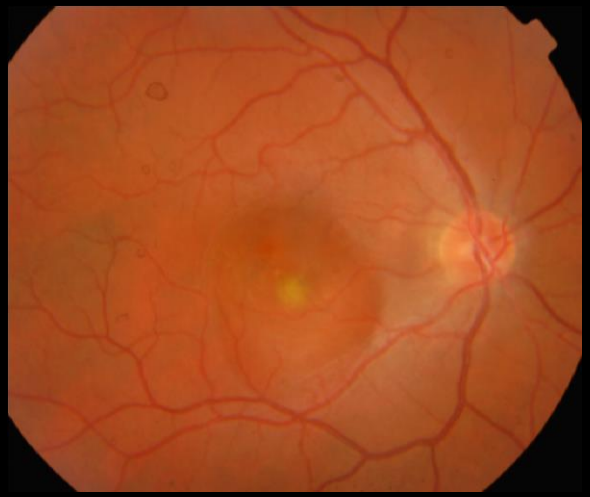


# SANTRAL SERÖZ KORYORETİNOPATİ

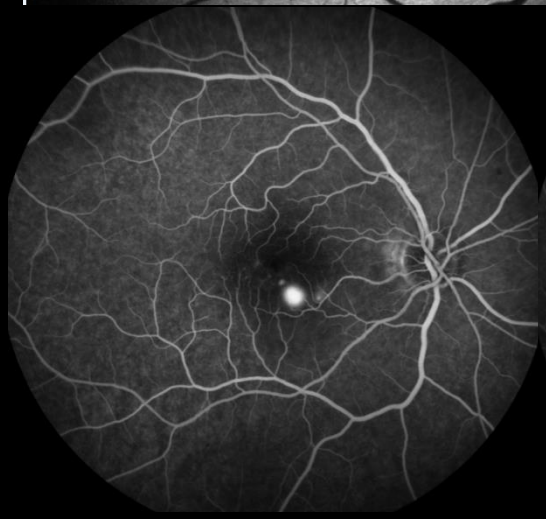
- Duyu retina veya RPE'nin seröz dekolmanı
- 20-50 yaş, erkek, tip A kişilik yapısı olanlarda daha sık
- Endojen hiperkortizolizm, sistemik kortikosteroidler, vazokonstriktif ajanlar
- Görme azlığı, santral/parasantral skotom, mikropsi, metamorfopsi
- Uzun süreli prognoz iyi, çoğunlukla tedavi gerektirmeden düzelir.
- %20-30 tekrarlar, %5 inde KNV veya kronik SSKR gelişebilir.

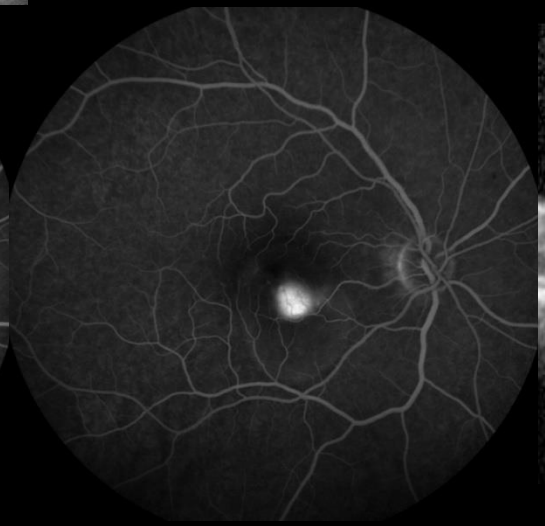
- AKUT SSKR: Fokal RPE sızıntı noktası normal/hafif hipofloresan (RPE hasarı)
- Seröz dekolman alanı keskin sınırlı hipofloresan

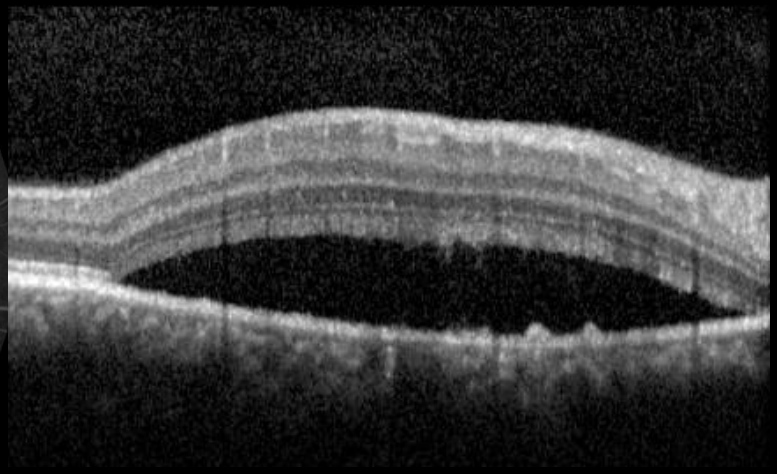




34 Y E
GK: 0.6





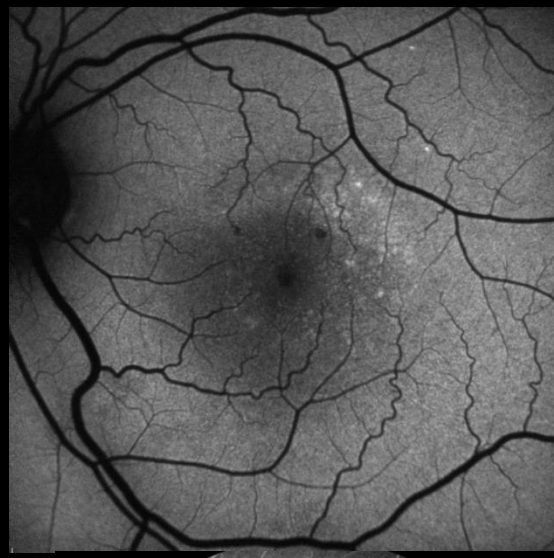


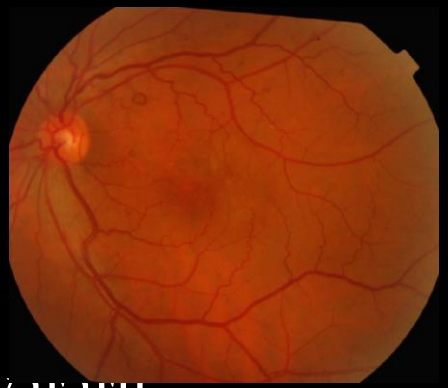
# KRONİK SSKR

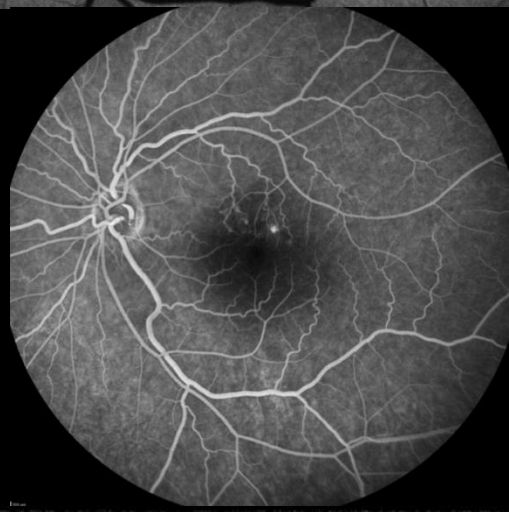
- Sıvı azalması, subfoveal madde birikimi
- Sızıntı noktası hipofloresan ( RPE atrofisi)
- Rezidü dekolman alanı: benekli hiperotofloresans
- Multipl benekli FAF:

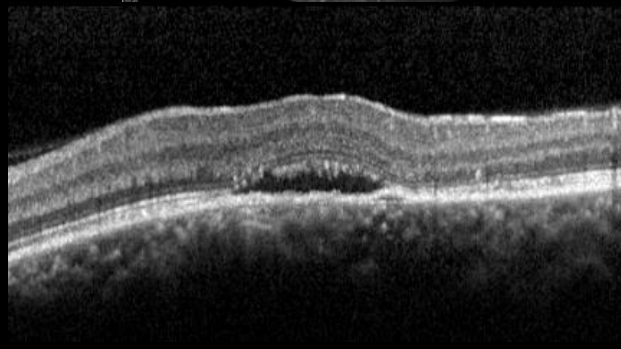
-Sızıntı noktaları, RPE atrofisi, fotoreseptör atrofisi: siyah nokta

- Artmış RPE aktivitesi, seröz sıvıda floroforlar :beyaz nokta
- Akut-kronik SSKR ayrımında FAF yararlı
- OCT'de sıvı yoksa kronik SSKR tanısı zor, eski dekolman alanında benekli FAF

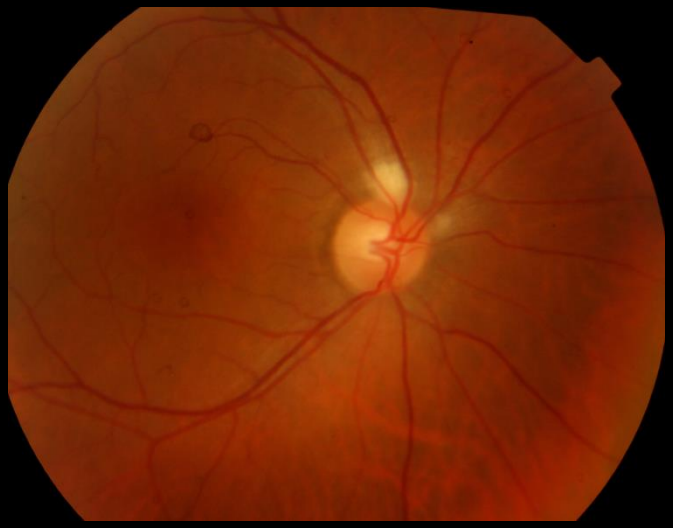


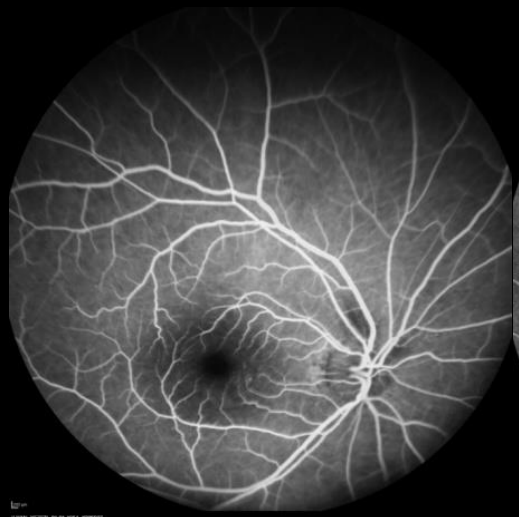


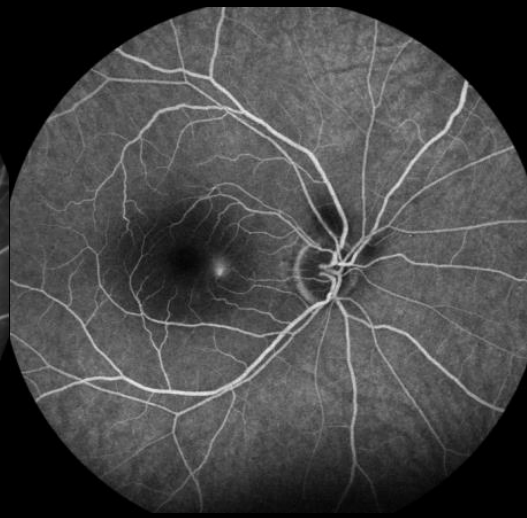


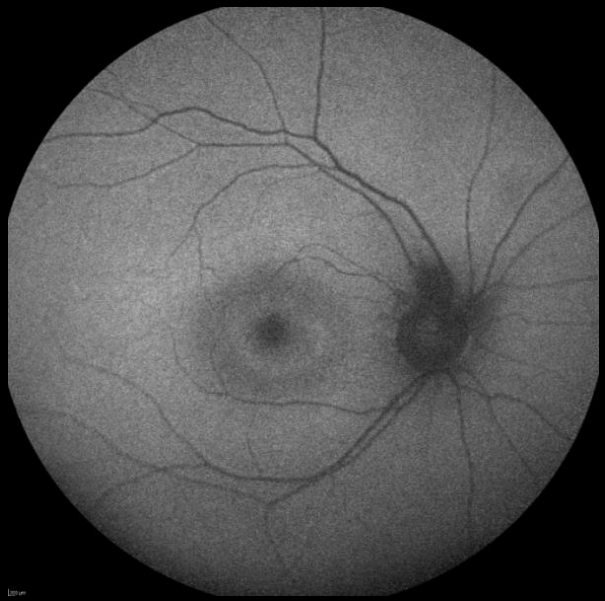


36 Y E hasta
Tam/tam

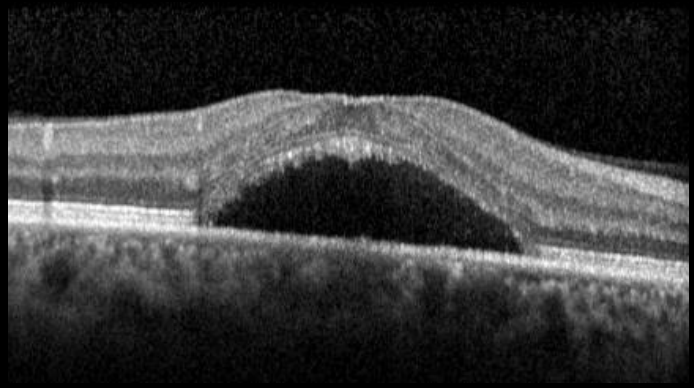


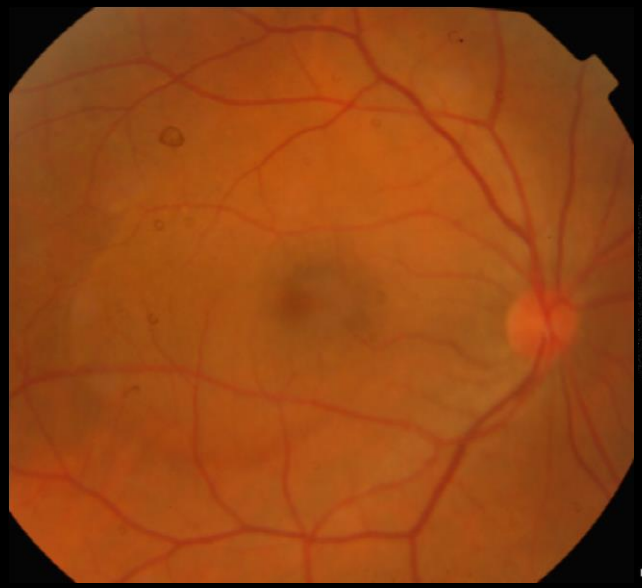


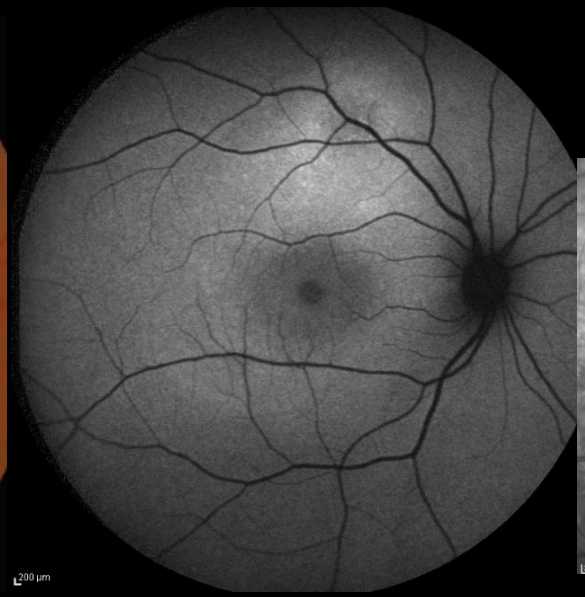


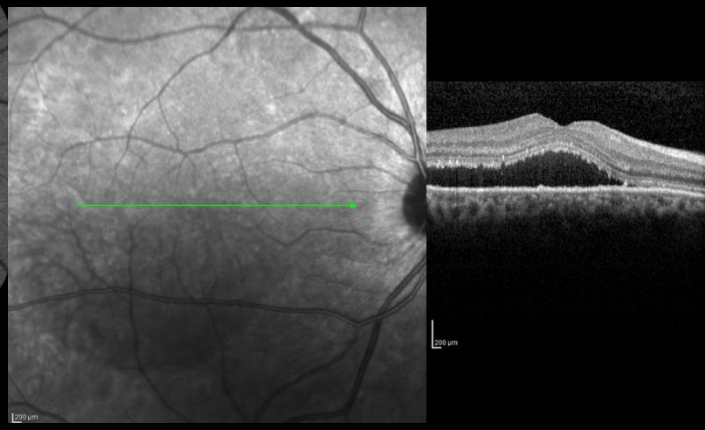


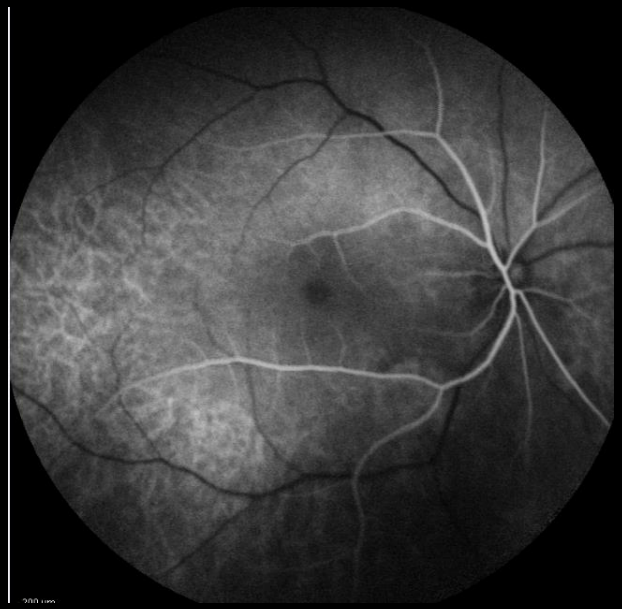
58 Y K HASTA
0.2/0.8

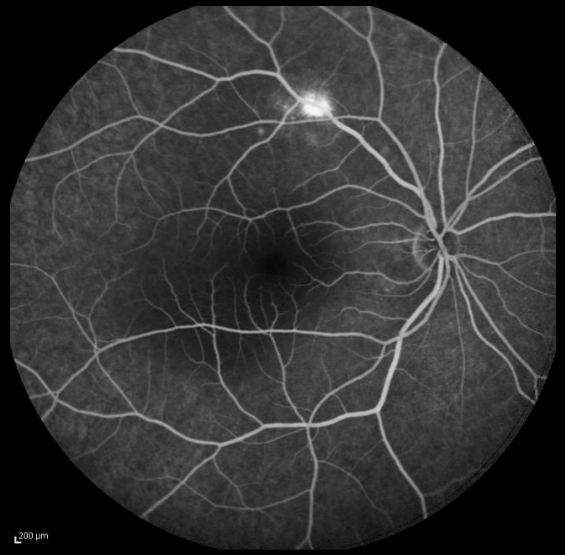




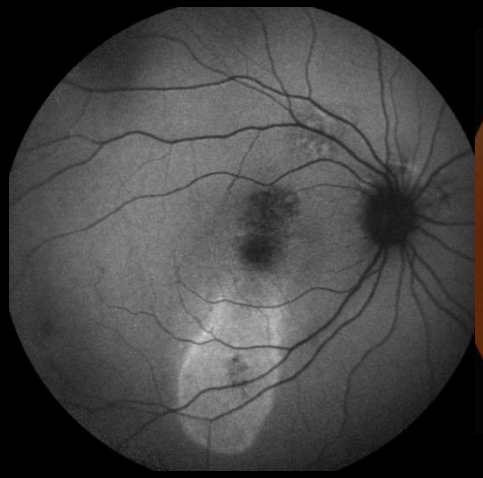
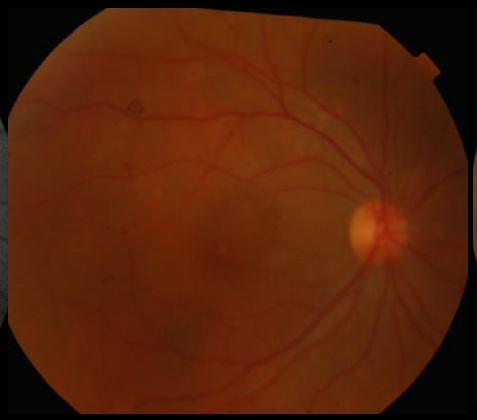
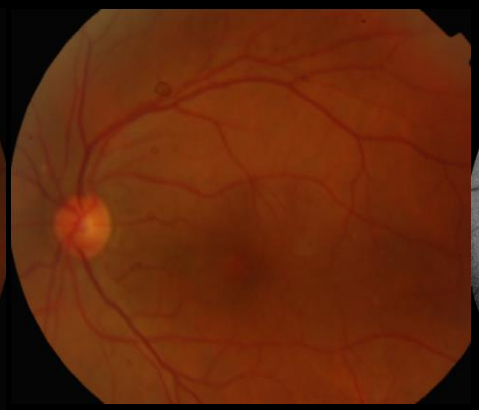
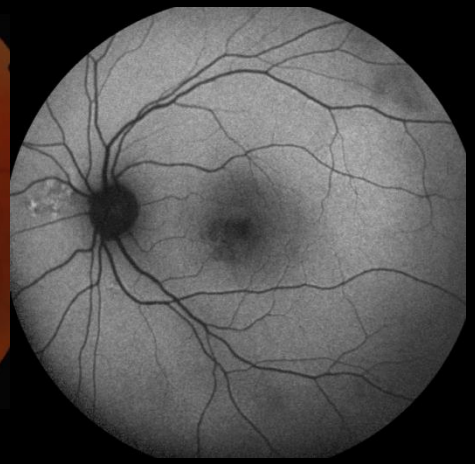
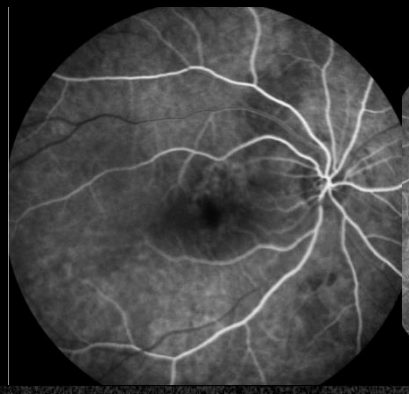
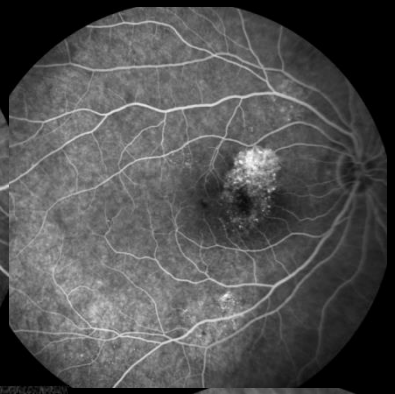
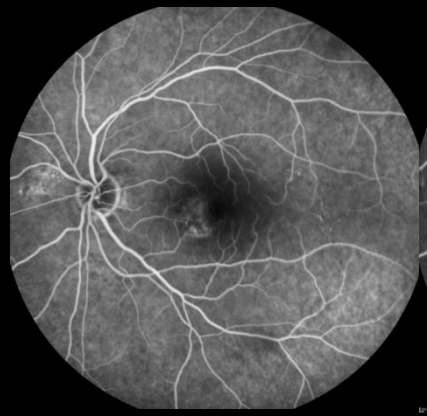
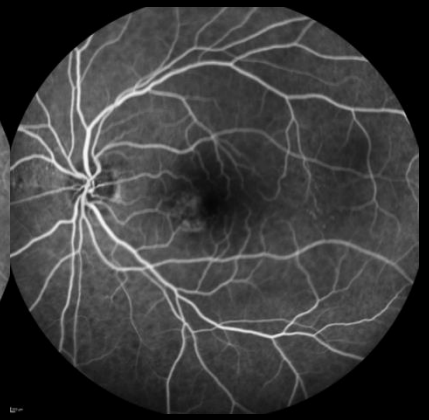
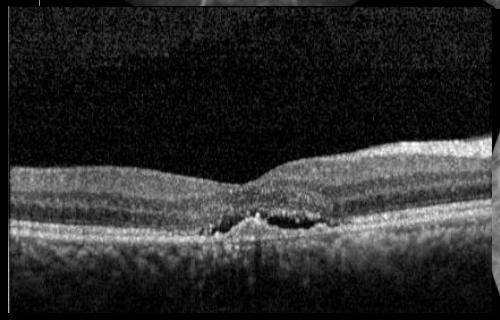
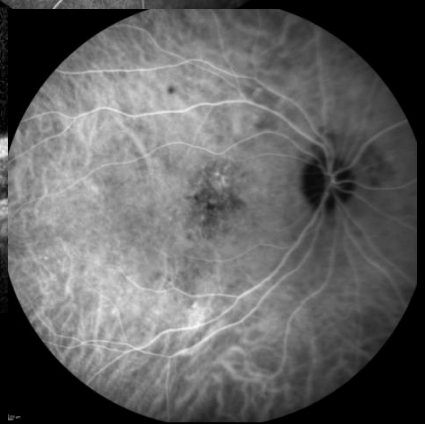


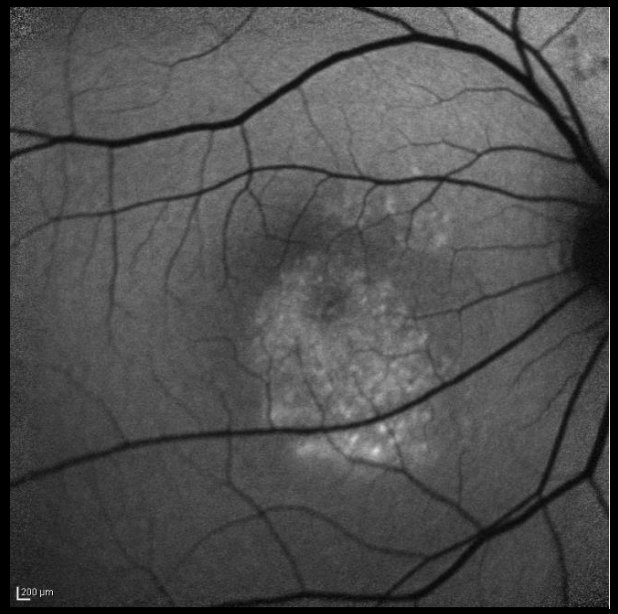



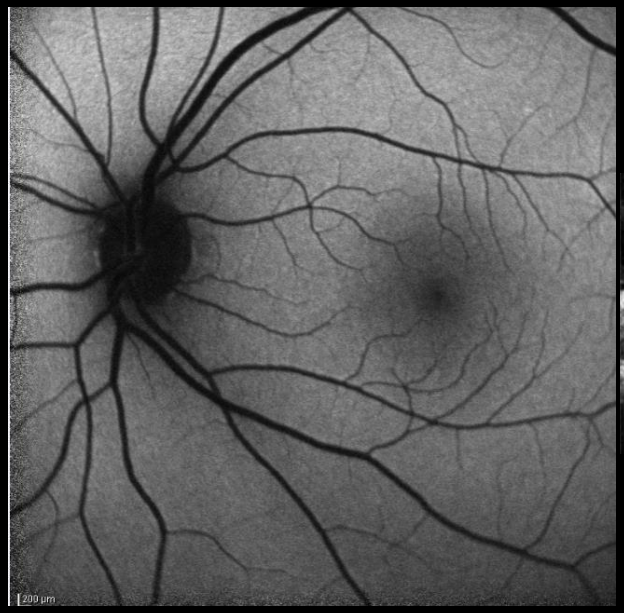


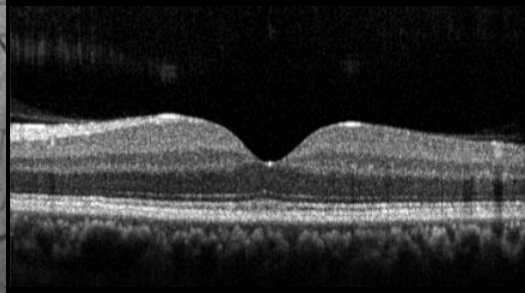

46 Y E hasta
GK: 0.7/TAM

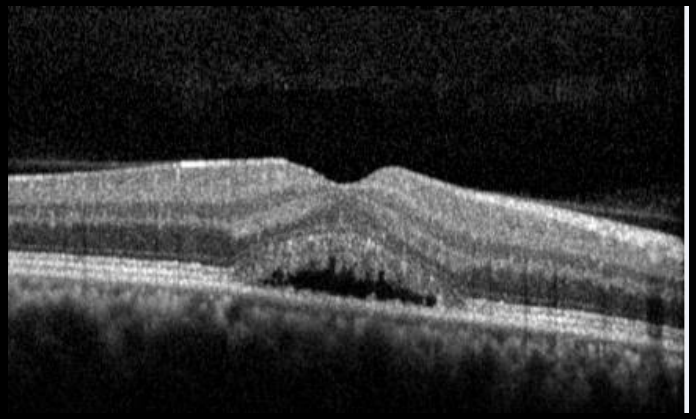











63 y k hasta
Gk: 0.2/0.6
Sağ anti vegf

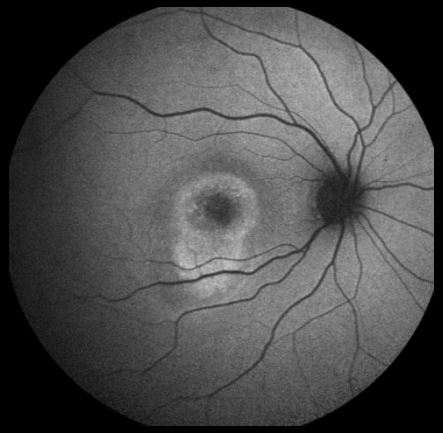
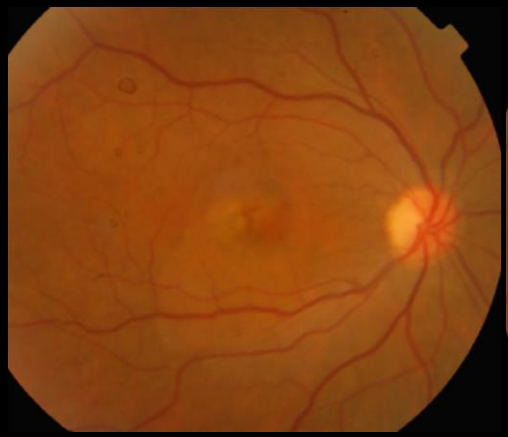
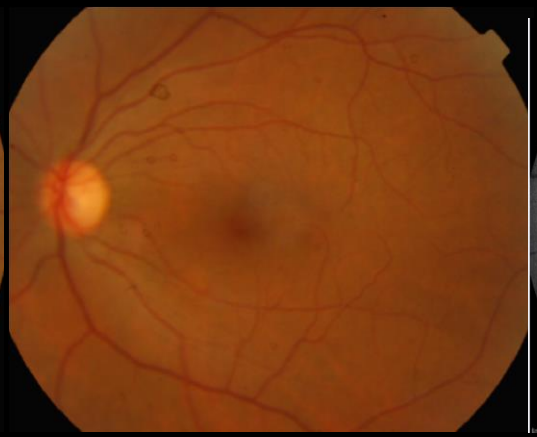
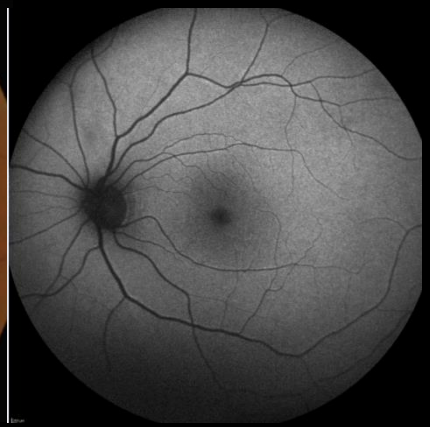
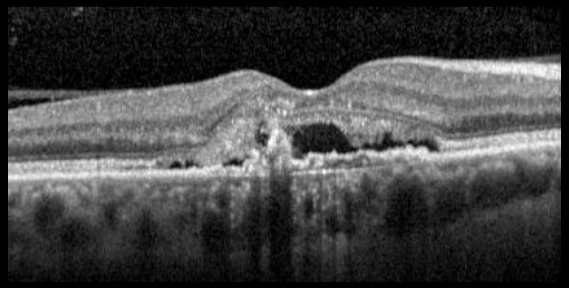


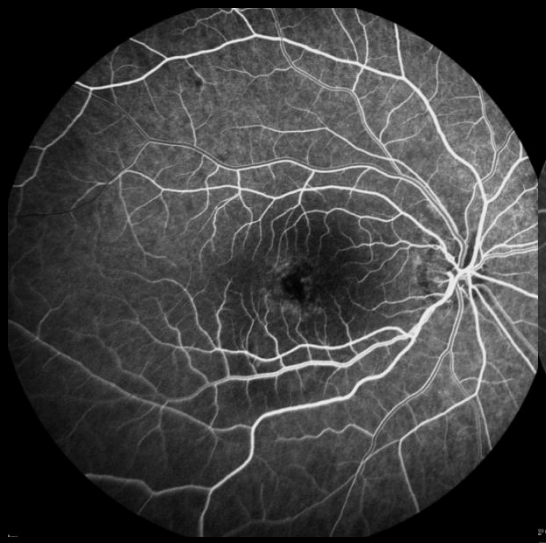
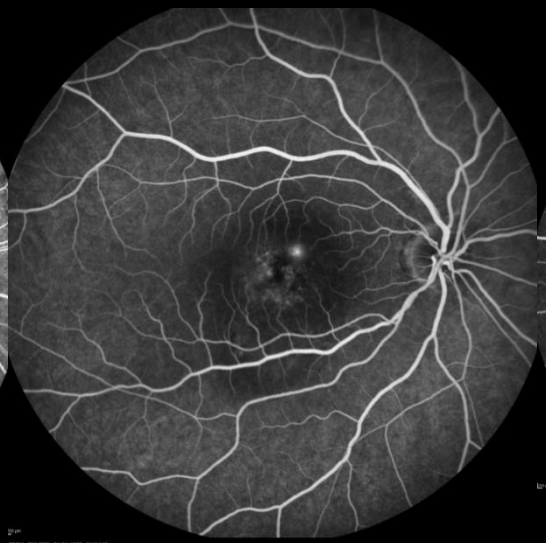
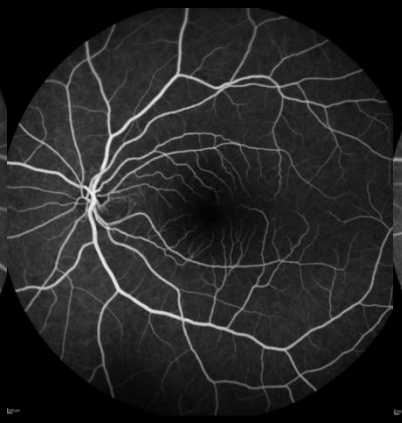
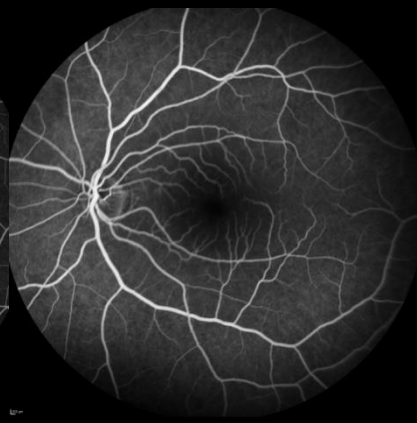





38 Y E HASTA 0.7/TAM

58 Y K HASTA
SSKR YE SEKONDER
CNVM

# İDİOPATİK JUKSTAFOVEAL TELENJEKTAZİ

- Unilateral/bilateral
- GK çok azalmaz
- 6. dekat ,cinsiyet seçmez
- Fovea temporalinde parafoveal/ jukstafoveal retinal kapiller yetersizliği, endotel değişimi,ektazi
- Subfoveal intraretinal siyah boşluk

Müller +fotoreseptör atrofisi

Üstünde İLM korunması (drapping)

- Retina içine RPE proliferasyonu

# İDİOPATİK JUKSTAFOVEAL TELENJEKTAZİ

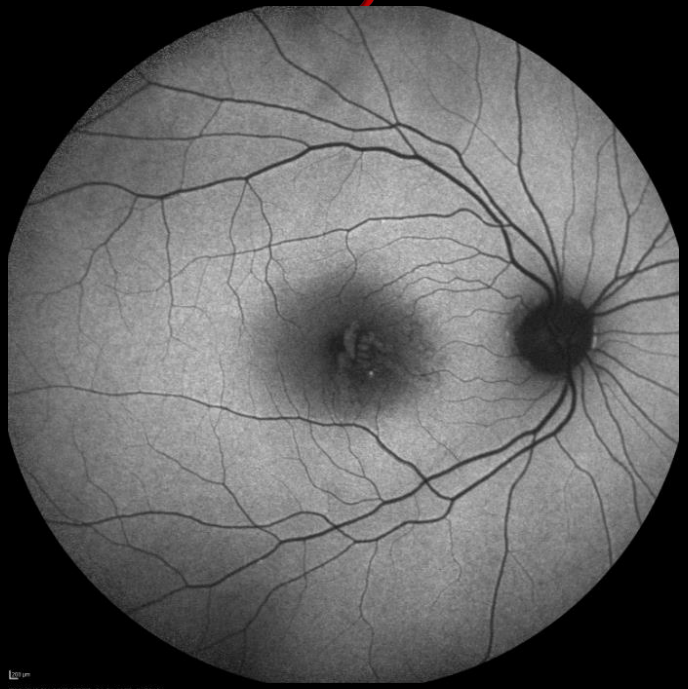
- Tip 1 (eksudatif)
- Unilateral
- Erkekleri tutar
- Biomikroskopide anevrizmalar, sert eksudalar ,makula ödemi
- Tip 2 (occult,noneksudatif)
- Bilateral
- Her iki cinsiyeti de tutar
- Makulada az kalınlaşma, grileşme
- Okkult telenjektazi, yüzeyel sarı kristal birikintileri
- Retina içine RPEmigrasyonu
- Subfoveal cnvm (%5)
- Tip 3 (bilateral perifoveal kapiller tıkanması )

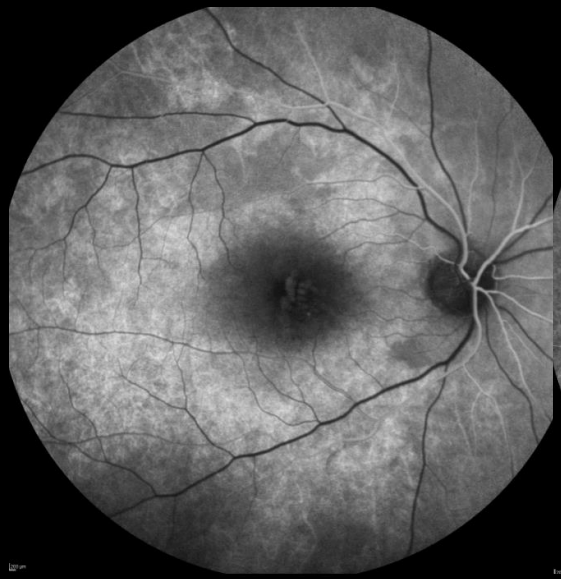
- FFAda hiperfloresansın nedeni damar geçirgenliğindeki artış değil, dejenere dokuların boyanması
- Sızıntı miktarı ile GK uyumlu değil
- FFA' da hiperfloresans OCTde normal foveal kontur

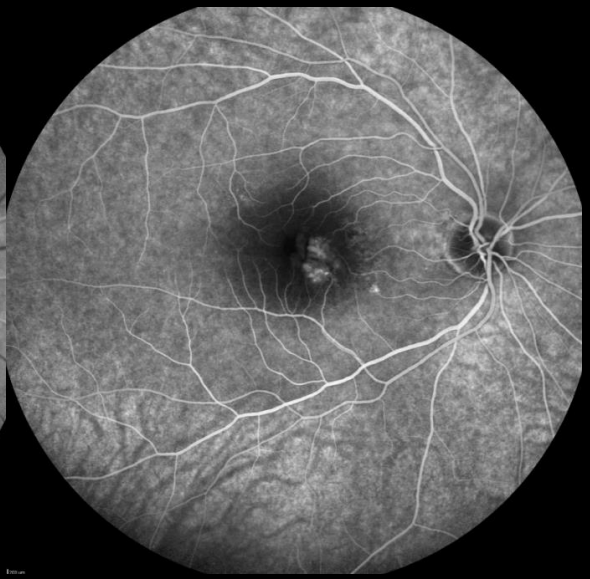
FAF BULGULARI:
TİP 1: makula lutein miktarı normal –KMÖ = FAF taç yaprağı şeklinde ARTAR
TİP2 : Lutein, zeaksantin alımında bozukluk, azlık = hücre disfonksiyonu= kapiller değişiklikler
Makula ödemi yok
Retinal atrofi var: FAF diffüz/homojen artar
İntraretinal pigment göçü: siyah blokaj

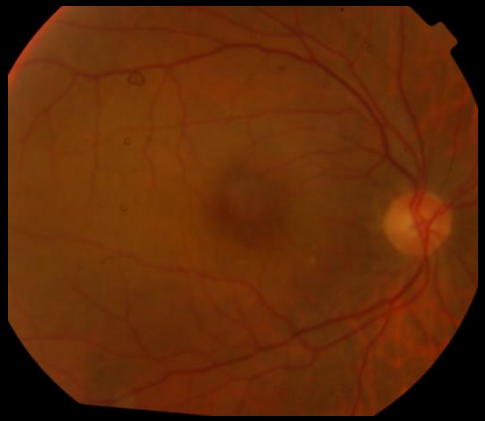
# İDİOPATİK JUKSTAFOVEAL TELENJEKTAZİ

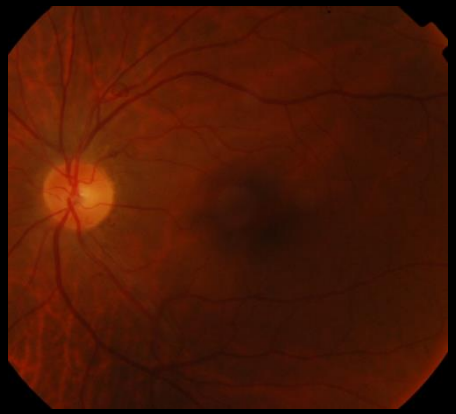
55 Y K HASTA

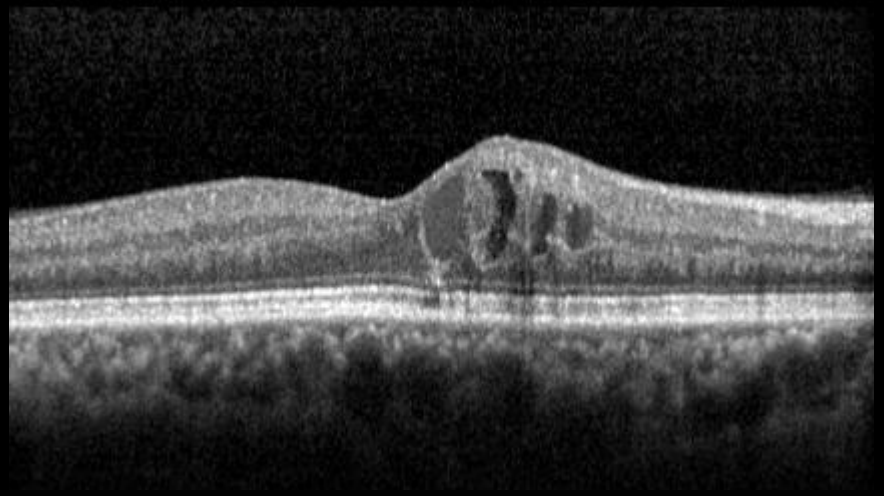


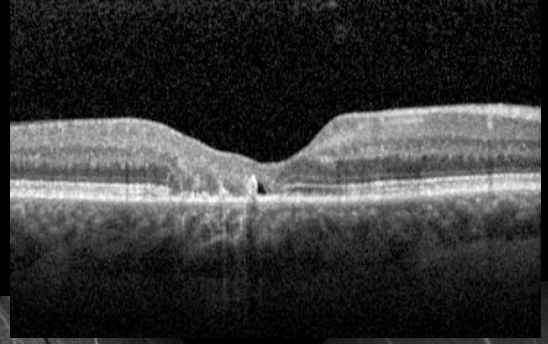
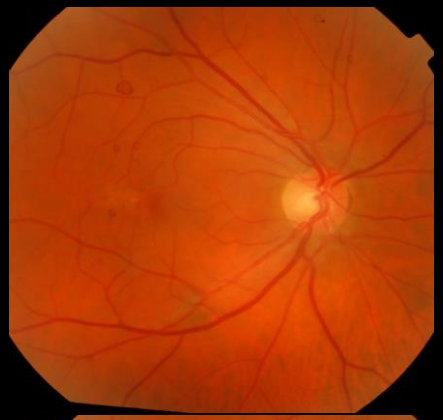
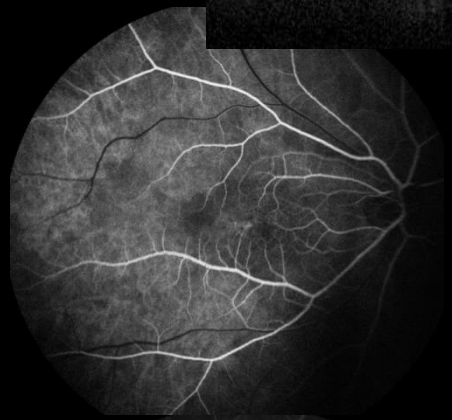
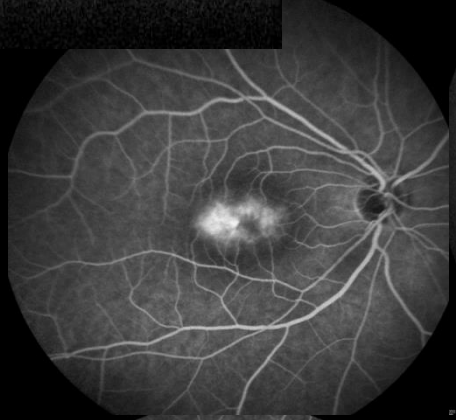
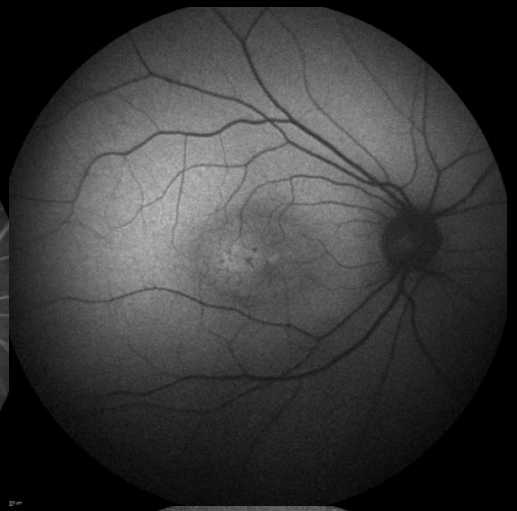
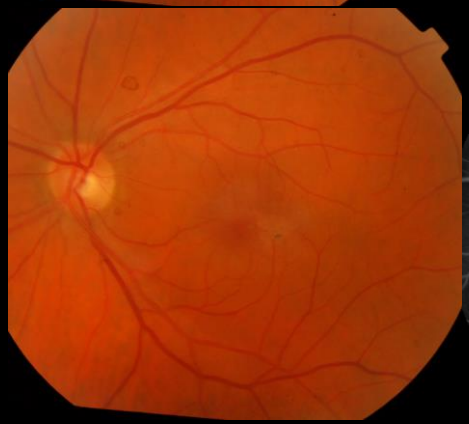
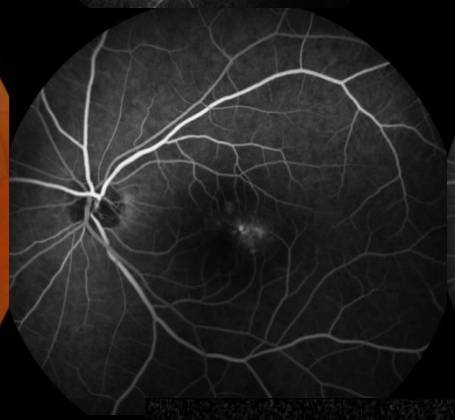
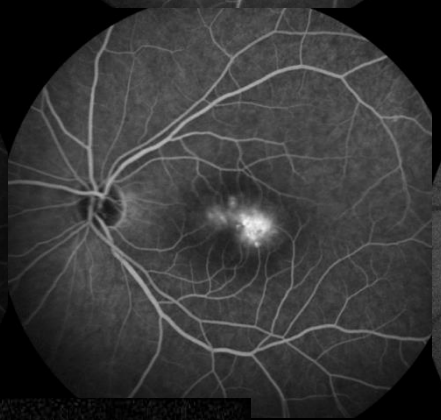
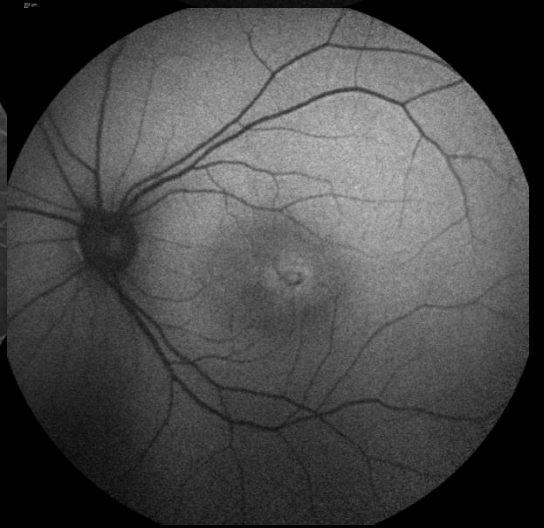
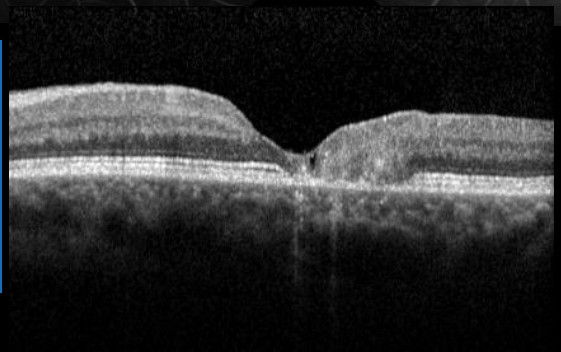










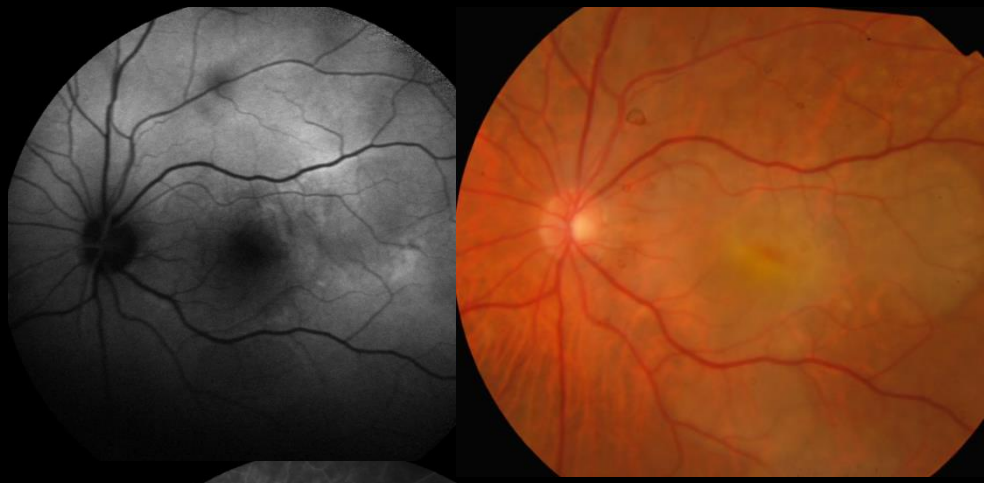











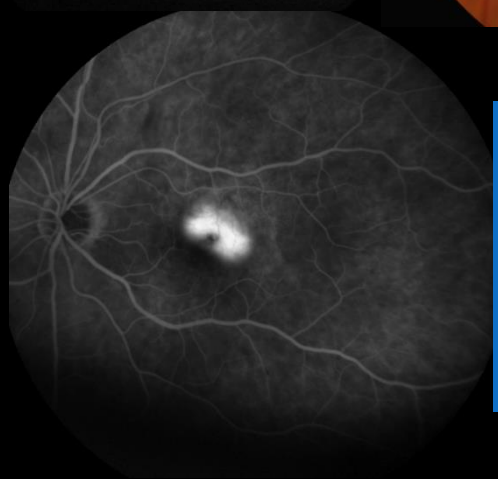
60 Y E HASTA
0.4/0.63
2007 DEN BERİ TDVSİZ
TAKİP

# YAŞ TİP YAŞA BAĞLI MAKULA DEJENERASYONU -CNVM

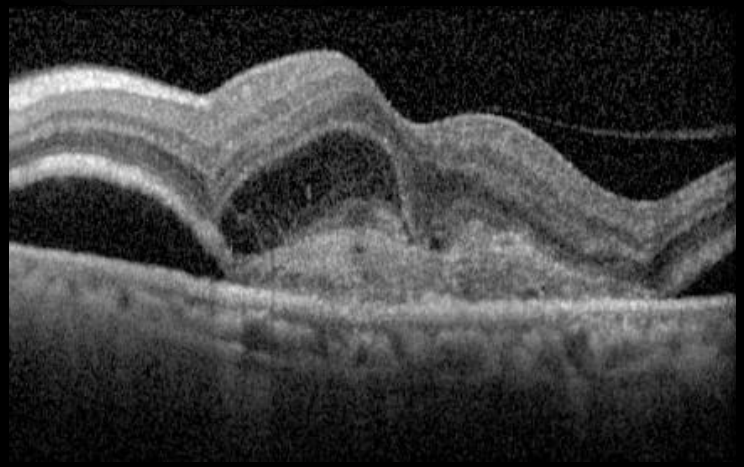
- Retina pigment epitel dekolmanı
- Subretinal/subRPE koroidal neovaskülarizasyon (CNV)
- Epiretinal/subretinal/sub RPE /intraretinal skar/glial doku
- Subretinal hemoraji
- Sert eksuda

- Yeni tanı CNVM de normal FAF saptanır.
- 1 ay sonra FAF azalır. (%79-90)
- Occult membranlar için bu durum : RPE hastalık başlangıcında hala sağlam???
- Klasik lezyonlarda FAF azalması daha sık, blokaja bağlı
- FFA'DA CNVM+ FAF N = tedaviye cevap şansı daha yüksek
- FAF da lezyon çapı FFA'dan daha fazla
- FAF daki değişiklikler GK, lezyon boyutu ile daha iyi korele
- Korunmuş FAF daha iyi GK ile korele,prognostik bir faktör..



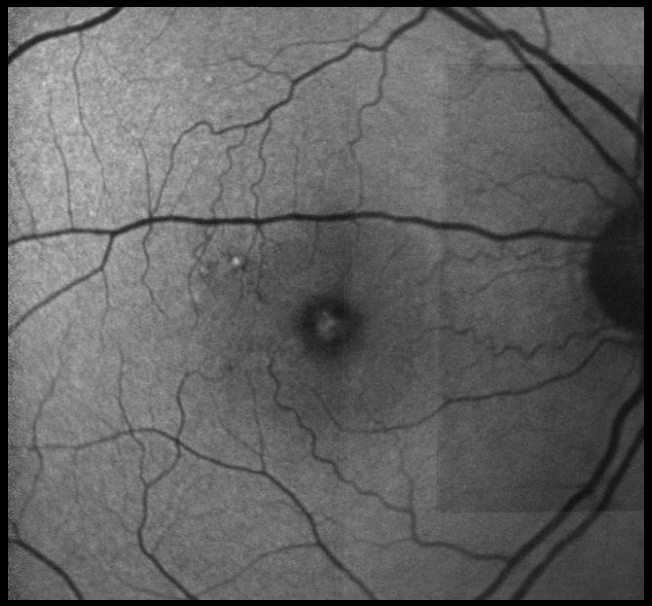


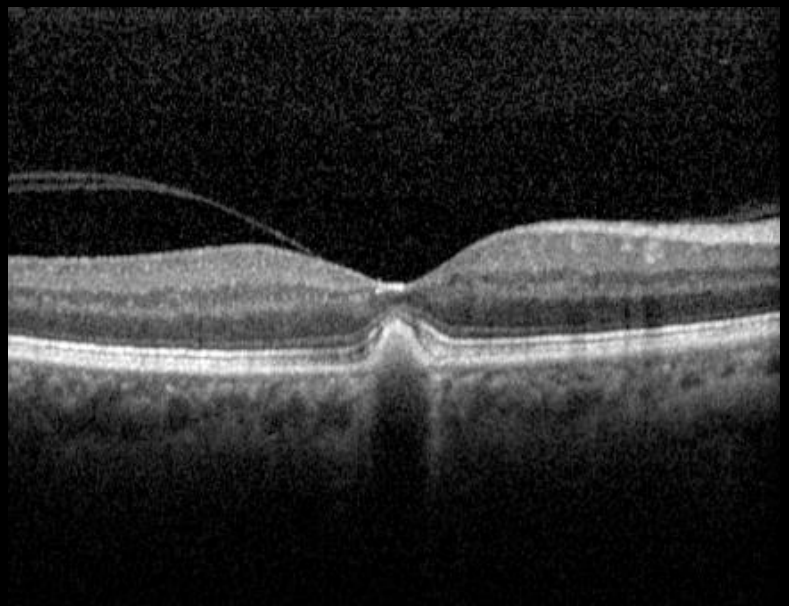
75 Y E HASTA
GK: 0.8/0.1
1 AYDIR GK AZALMIŞ

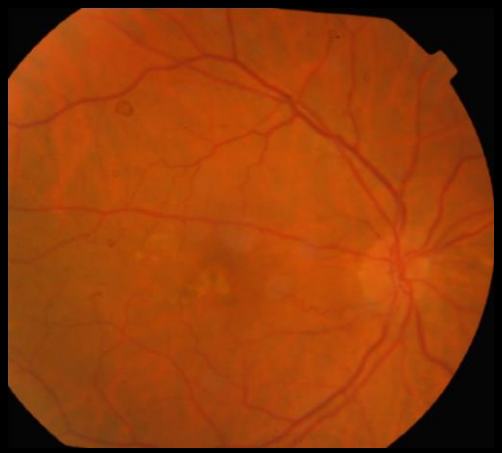


# PED ( PİGMENT EPİTEL DEKOLMANI )

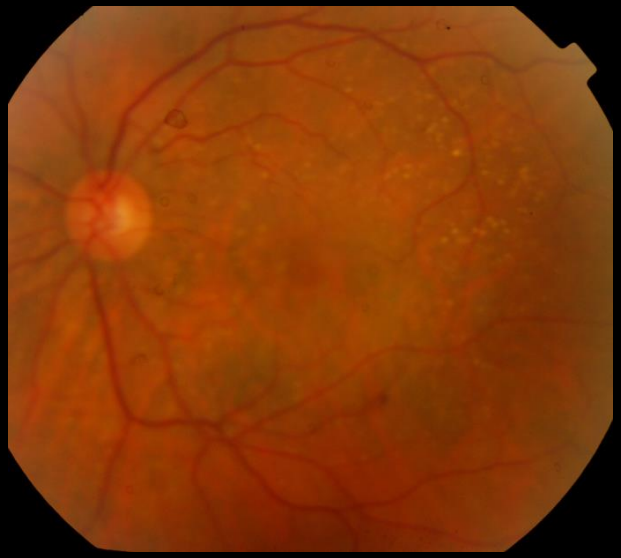
64 yaş
GK: 0.2

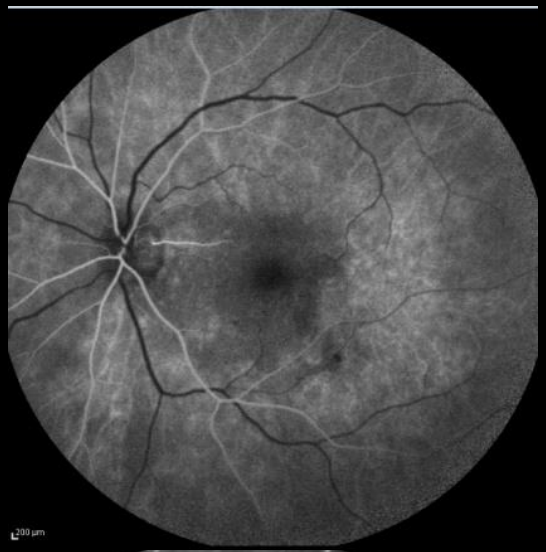


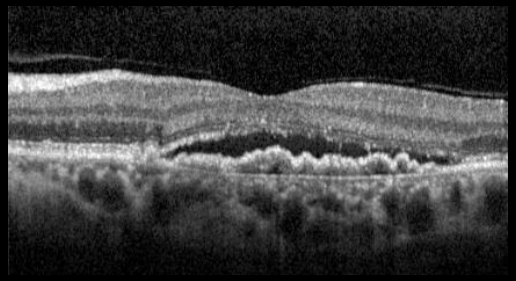


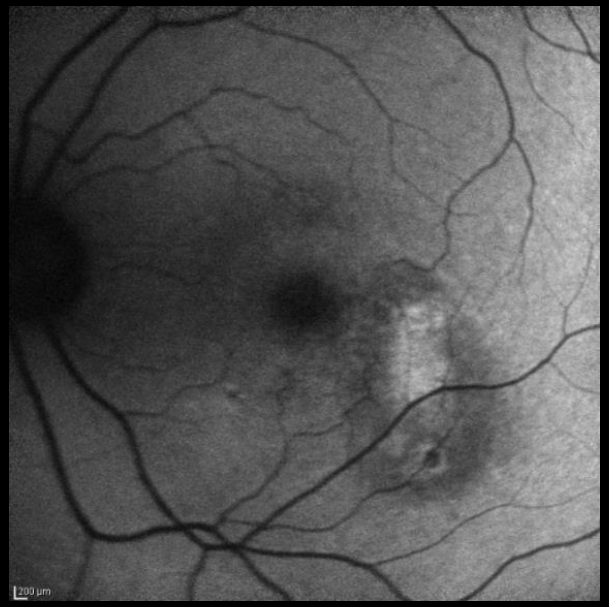


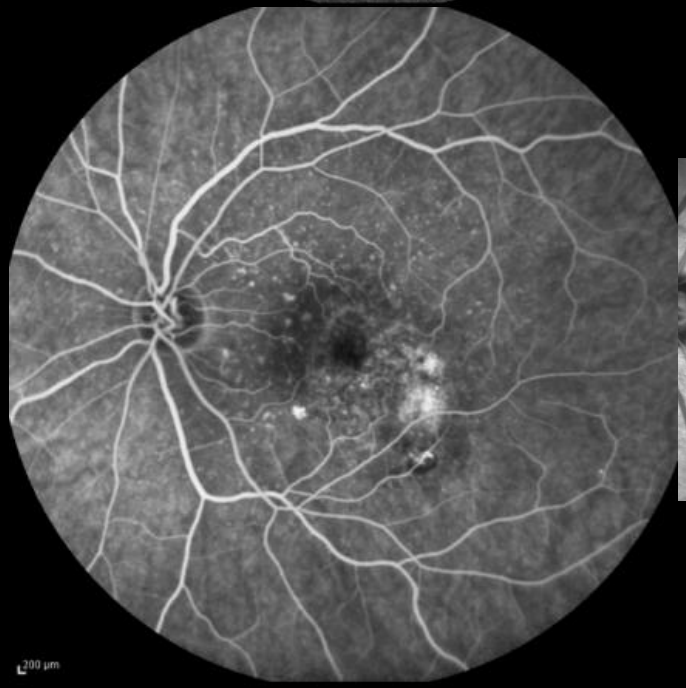
DİFFÜZ, ARTMIŞ FAF
KAYNAK: SIVI- FLOROFOR İÇEREN PARÇALANMIŞ FOTORESEPTÖRLER
PED ETRAFINDA HALKA ŞEKLİNDE AZALMIŞ FAF (SUBRETİNAL SIVI)
PED yüksekliğinin azalması, skar oluşumu, atrofi oluşumu ,RPE yırtığı gelişimi = AZALMIŞ FAF

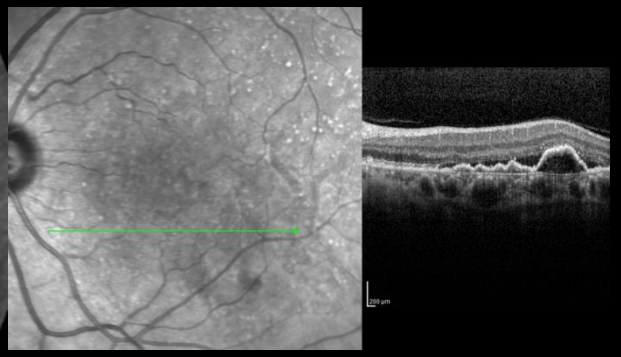




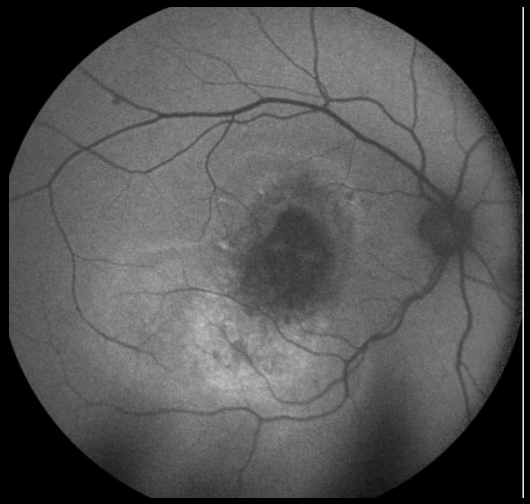


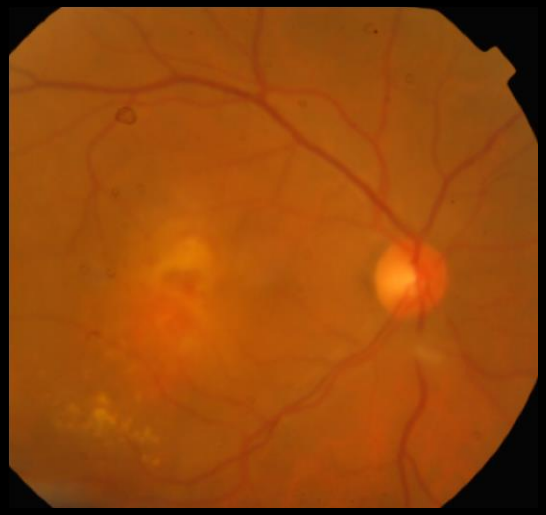




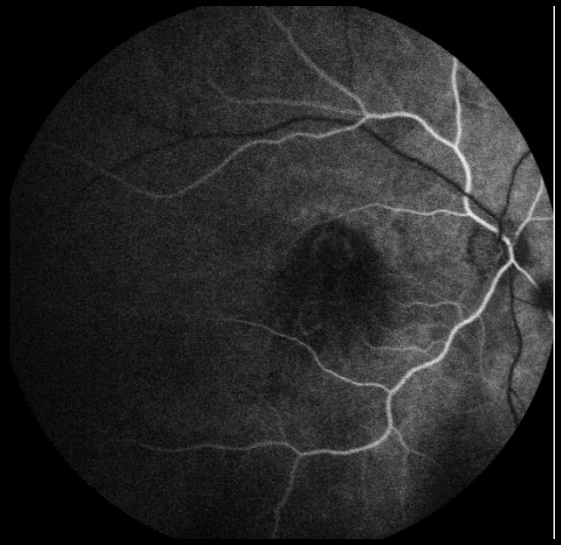


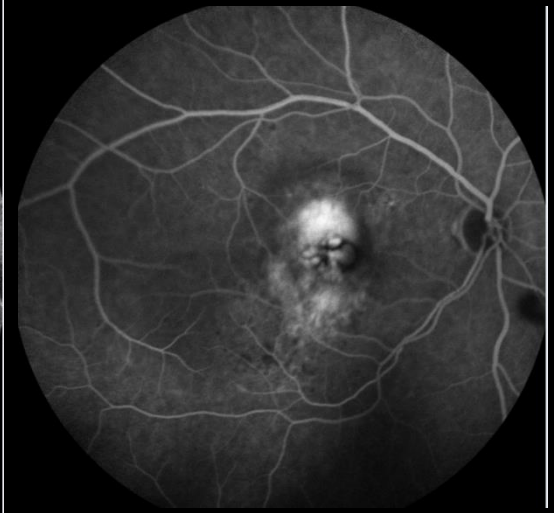
79 Y K
HASTA

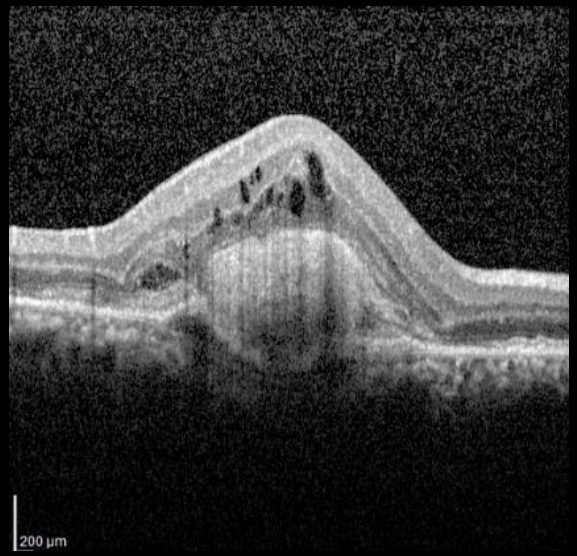


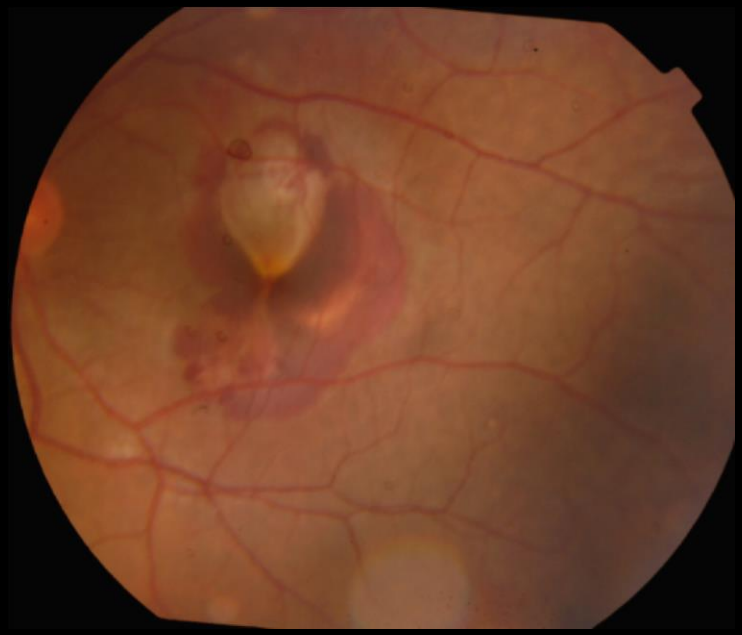


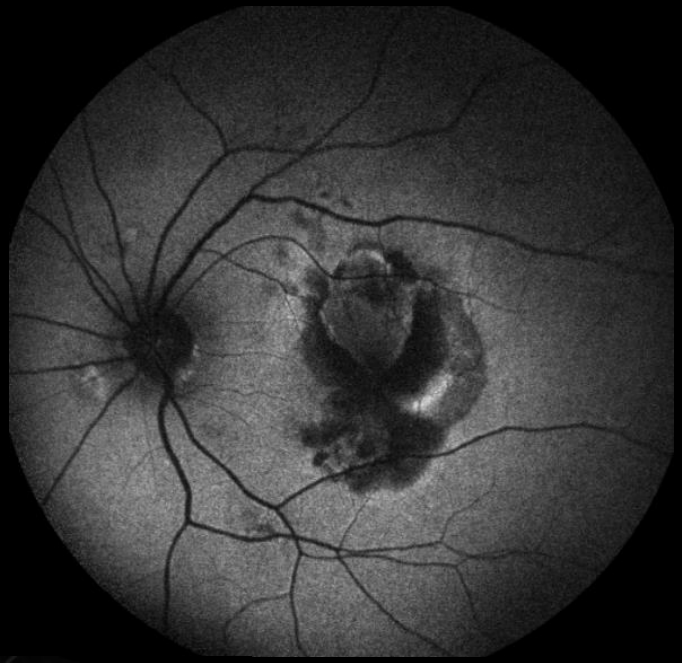
72 y E hasta
GK: 0.1



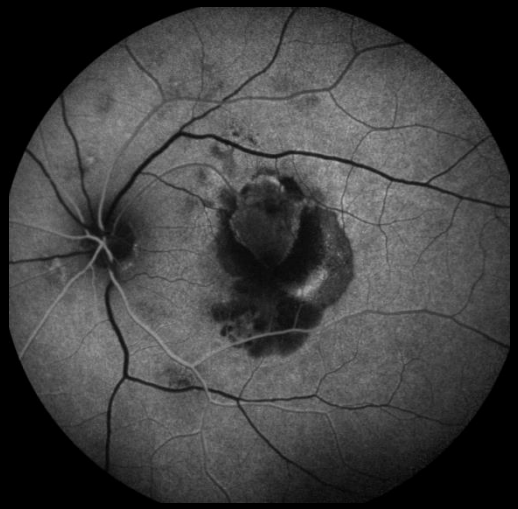


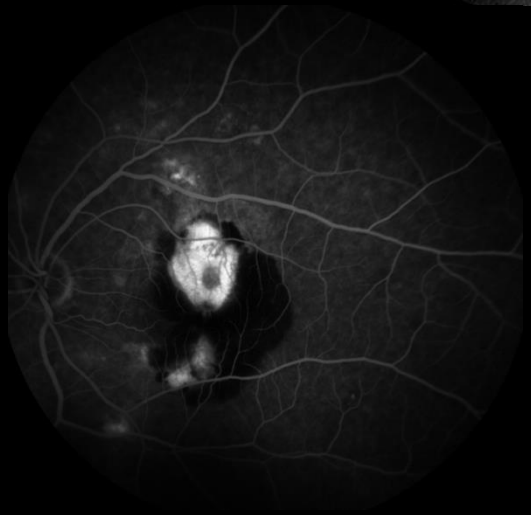


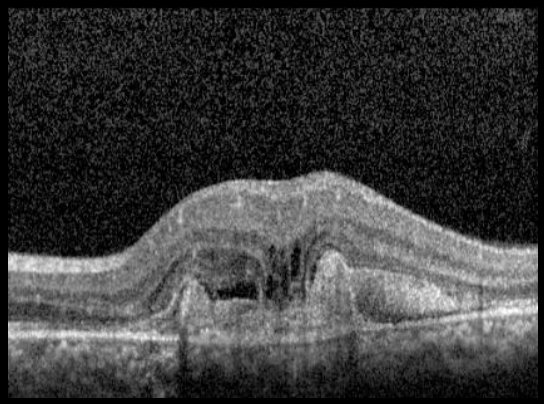


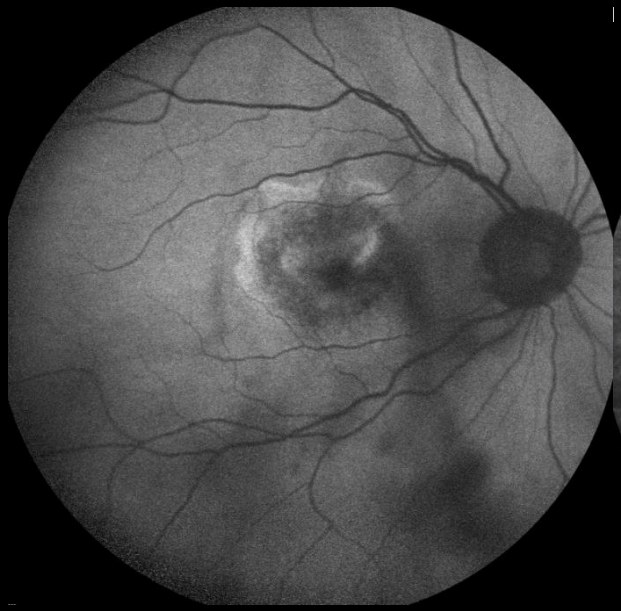


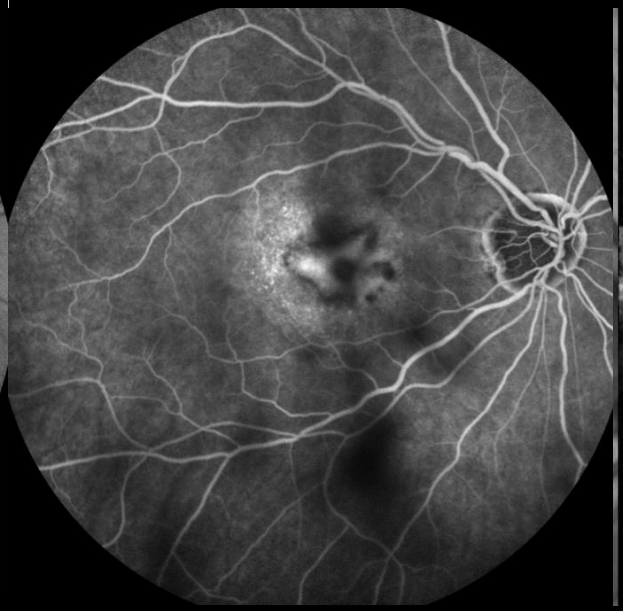
75 Y E
HASTA

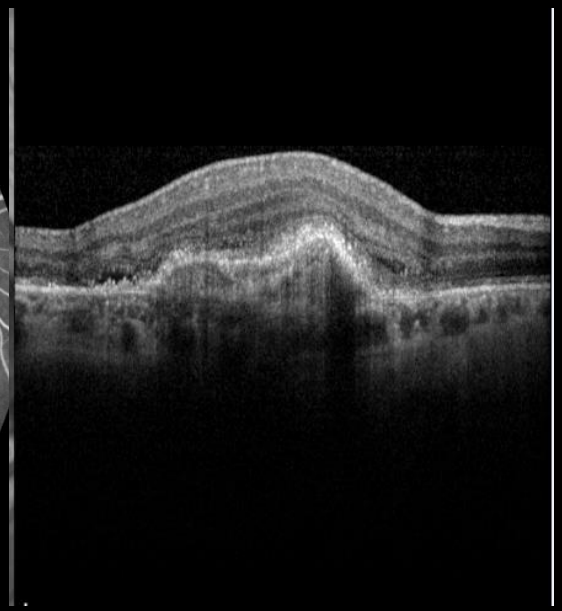


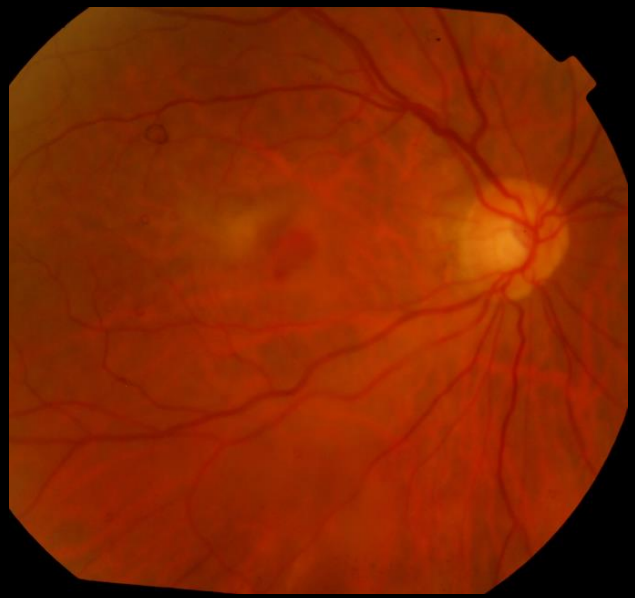




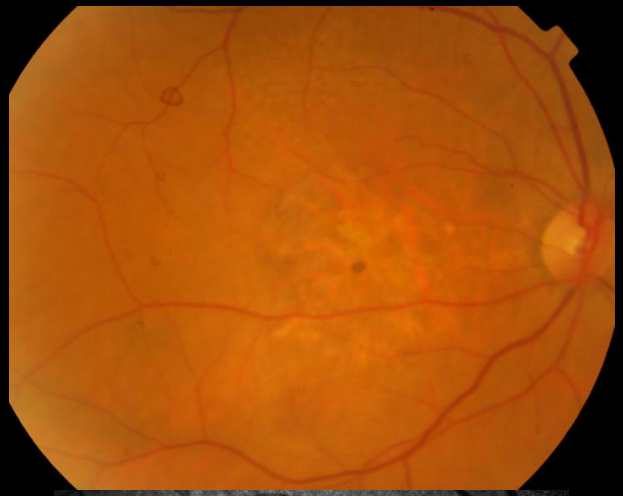


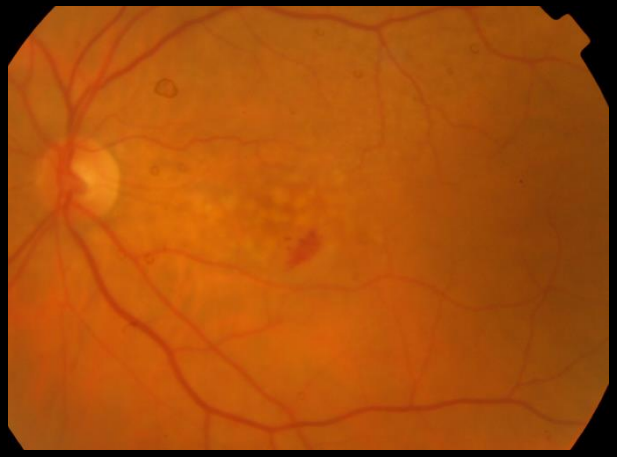


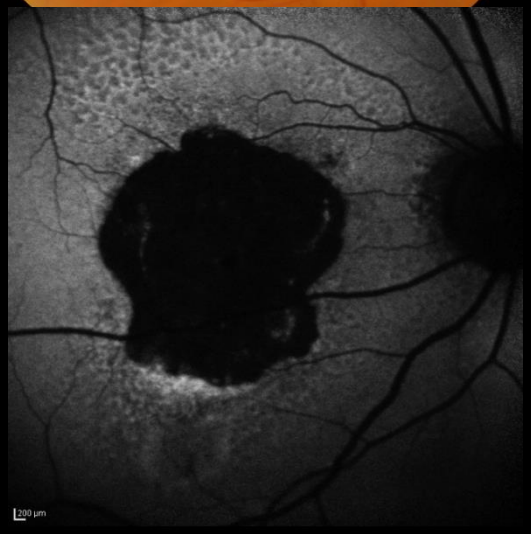


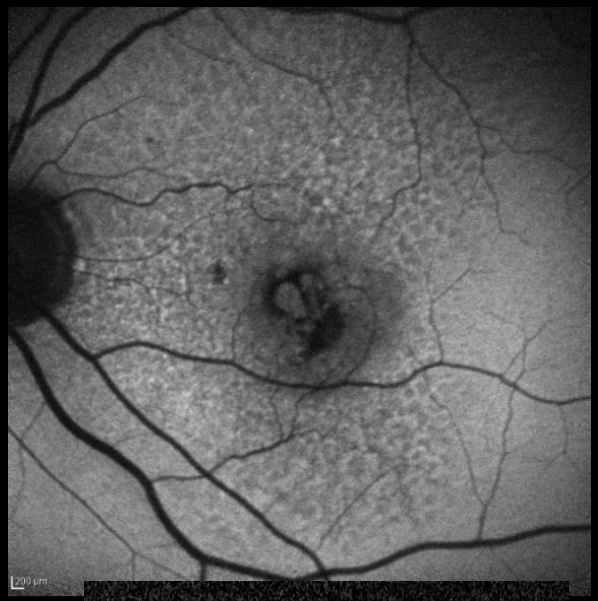


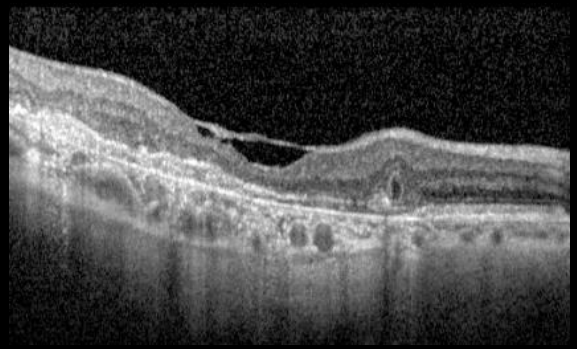
72 Y K HASTA
GK: 0.2/0.8

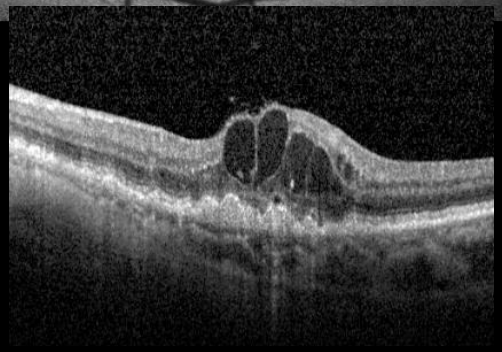






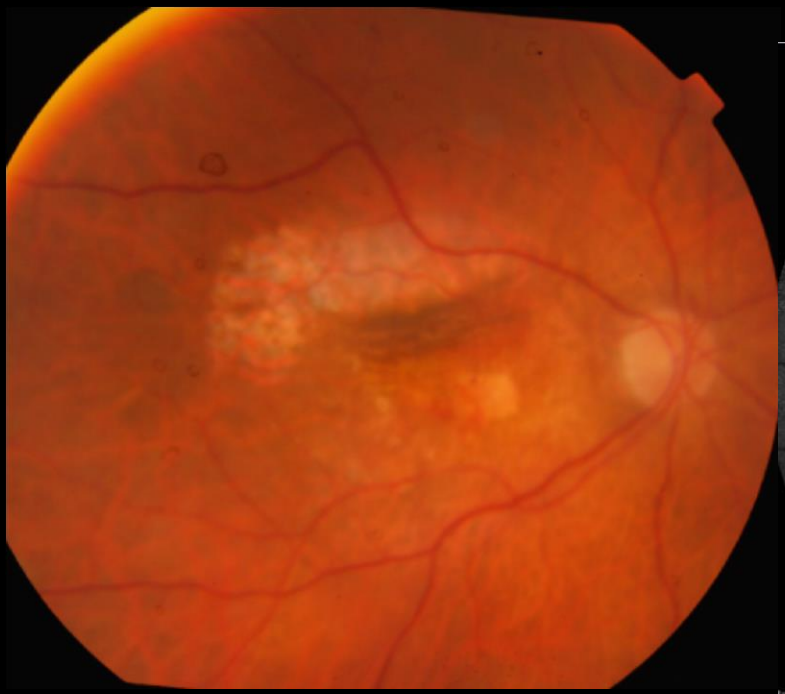


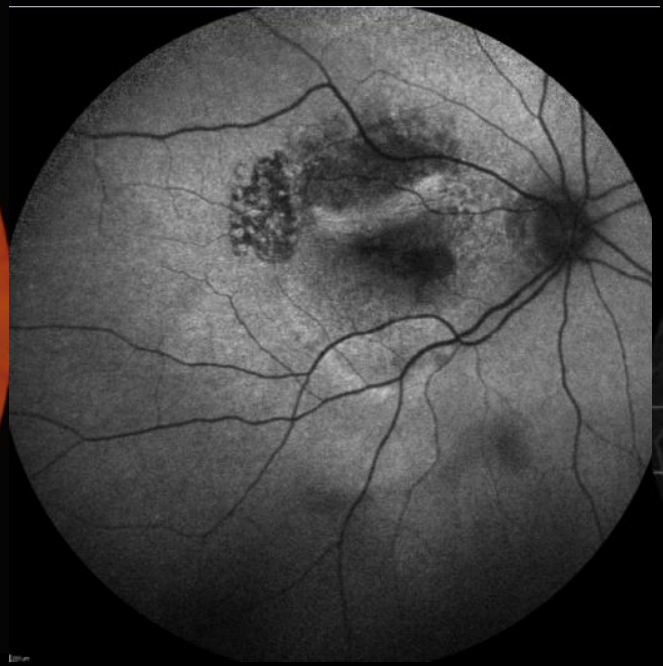
80 Y K HASTA
1MPS/ 0.3

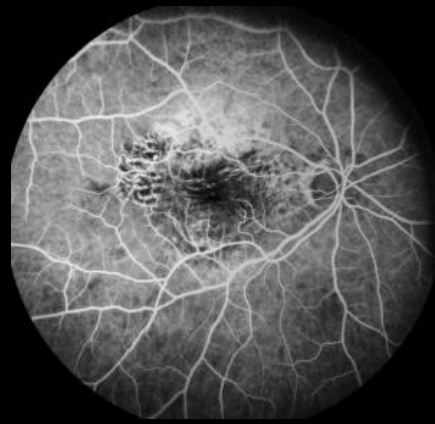
# RPE YIRTIĞI

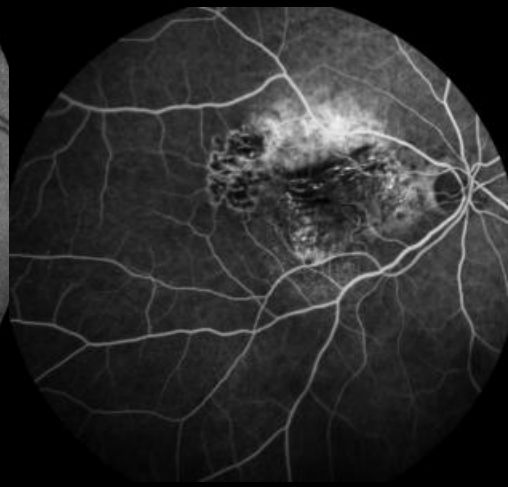
- PED varlığında spontan/tedavi ile
- RPE kaybı olan alanda azalmış FAF
- RPE'nin ikiye katlandığı alanda artmış FAF

85 Y E
0.2/2 MPS
6 DOZ LUC,
4 İVB
SONRASI..



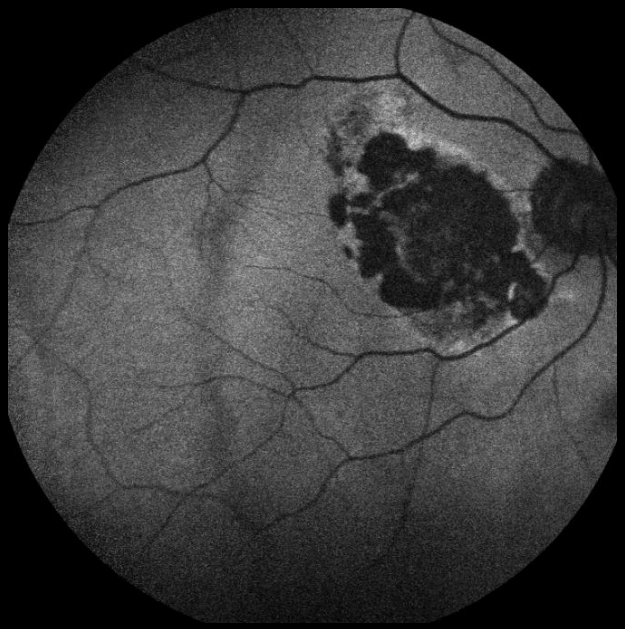


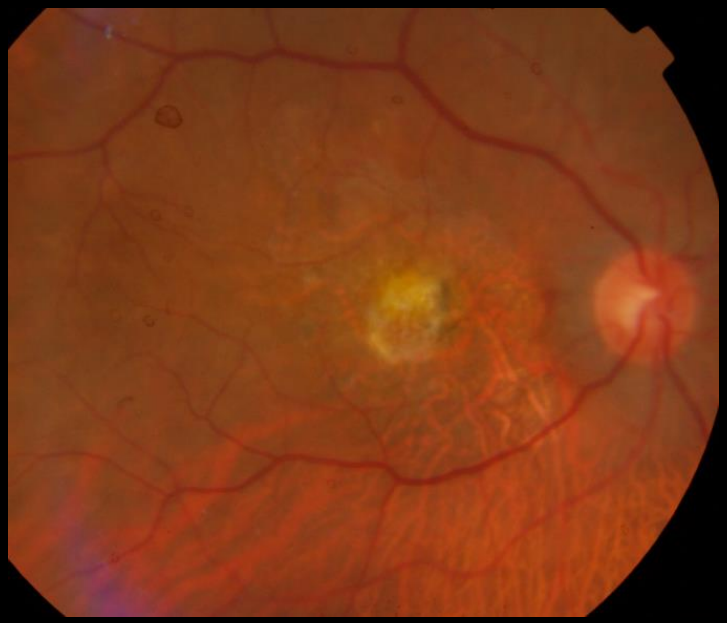




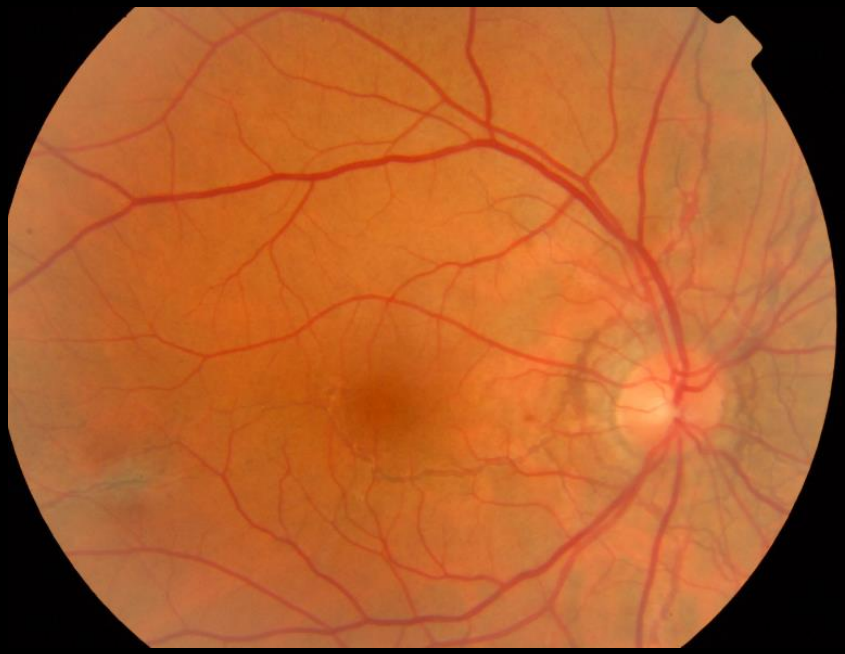
# DİSKİFORM SKAR

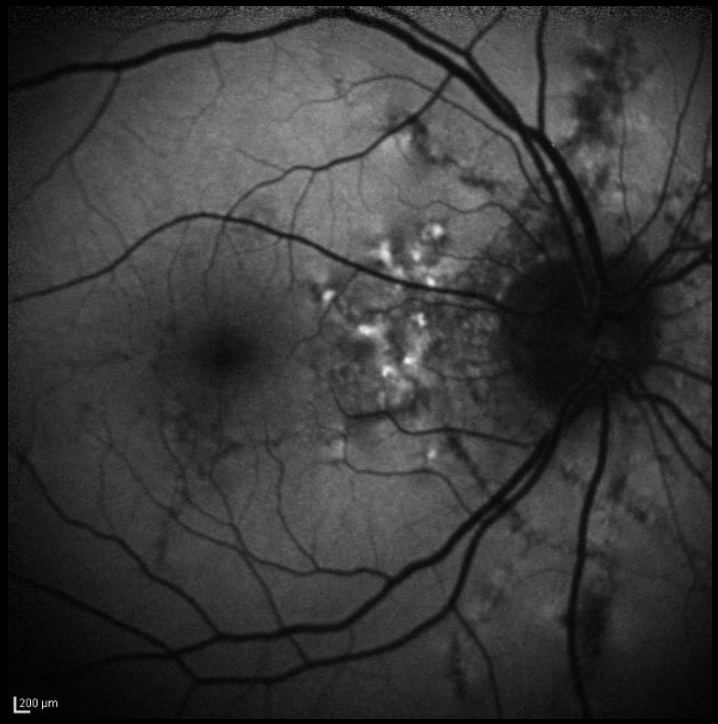
- Genellikle azalmış FAF
- Von Ruckmann ve ark %50 hastada skar kenarında artmış otofloresans : irreguler pigmentasyon, çok katlı RPE

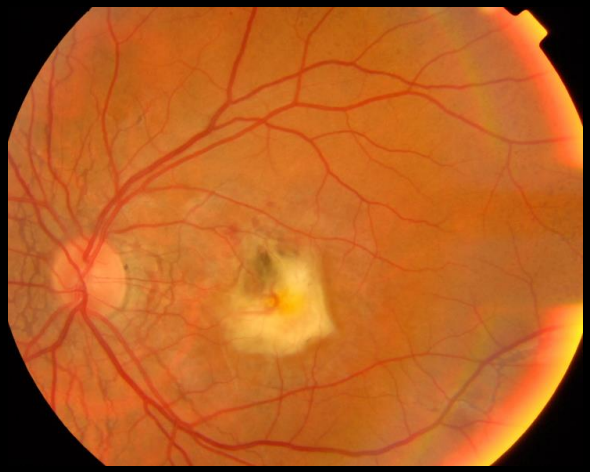




# ANGİOİD STREAKS

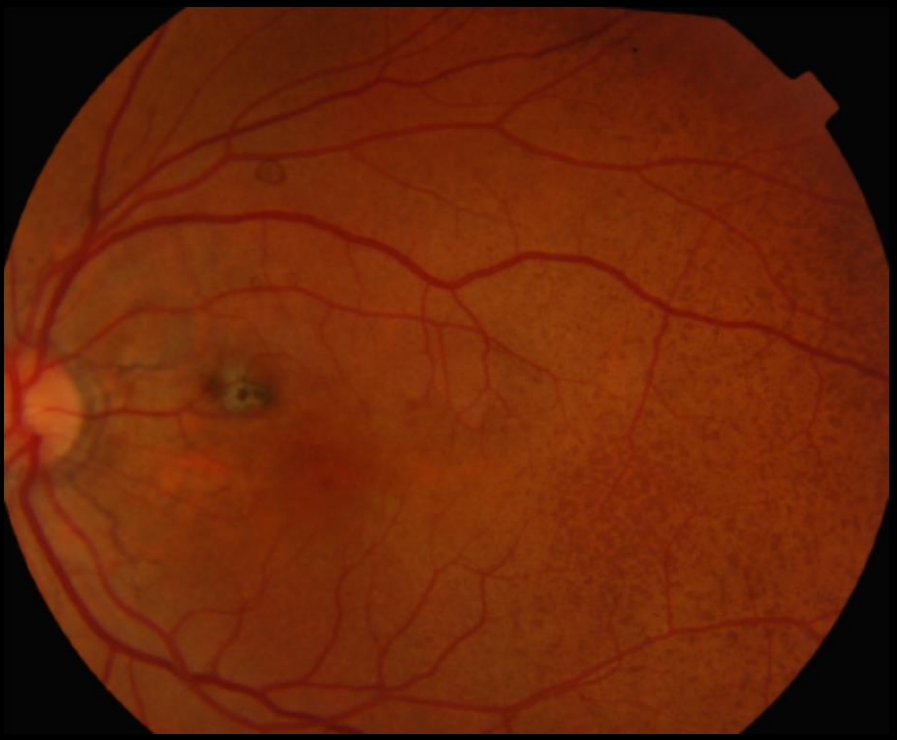


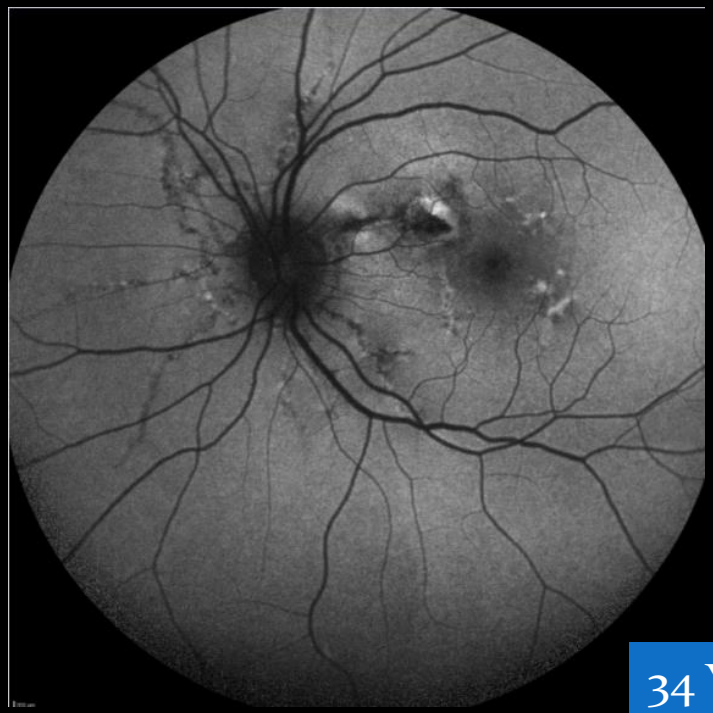


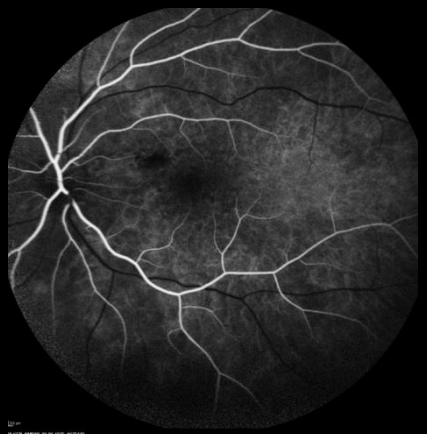
47 Y E
TAM/ 2 MPS

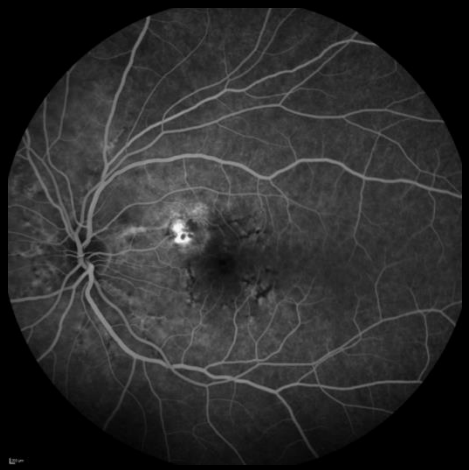
# ANGİOİD STREAKS –CNVM

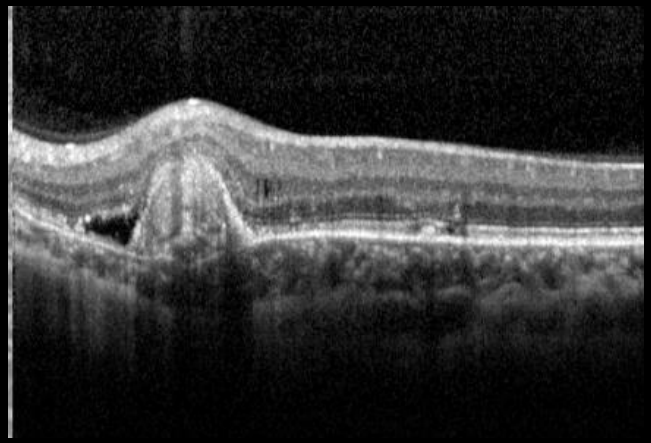




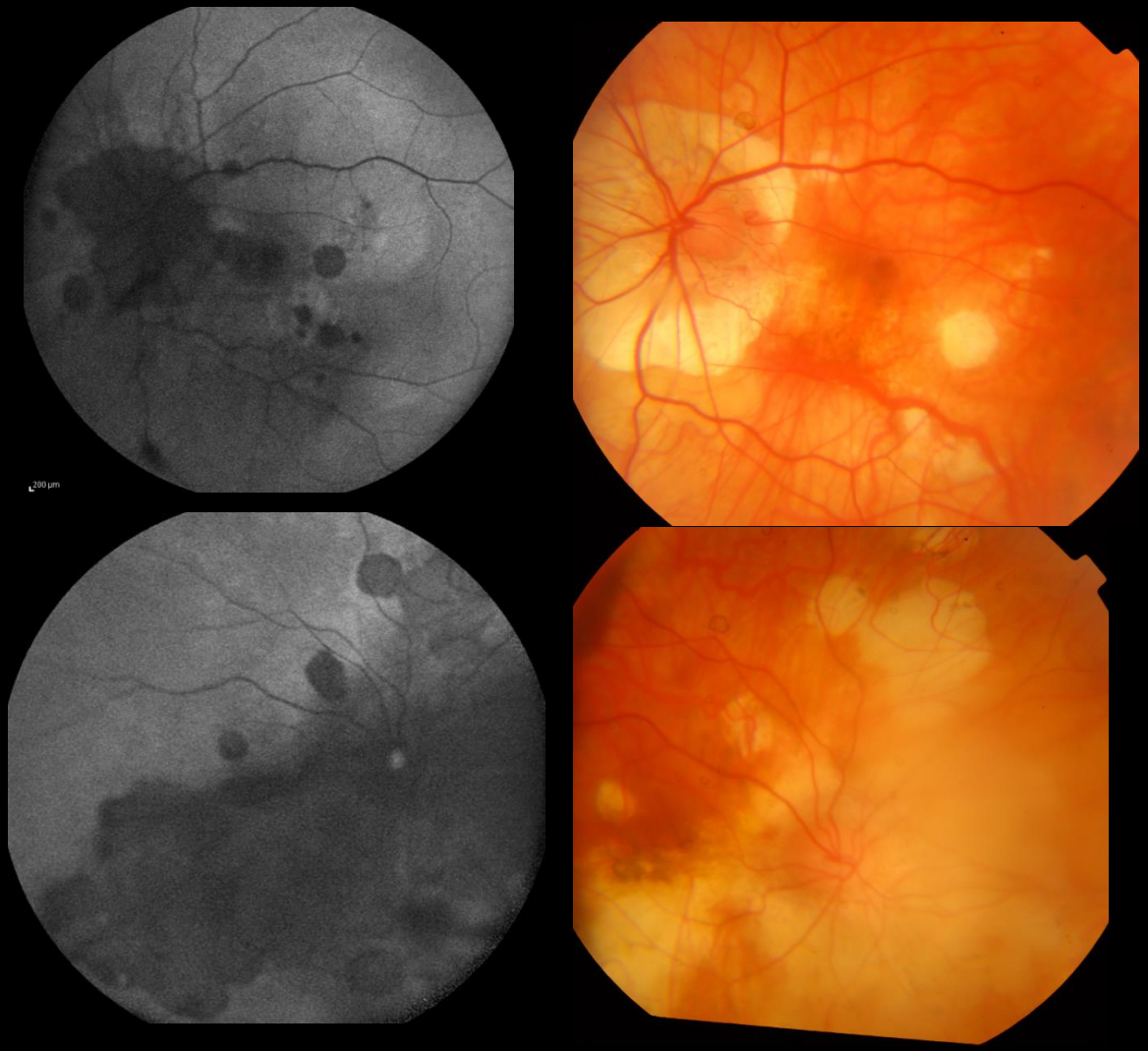
34 Y K
TAM/TAM

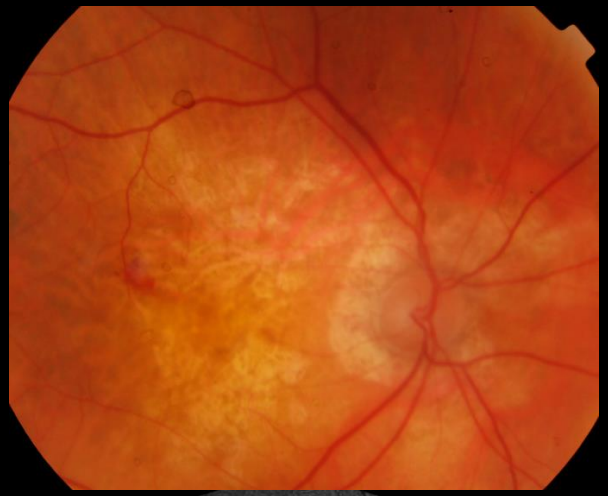


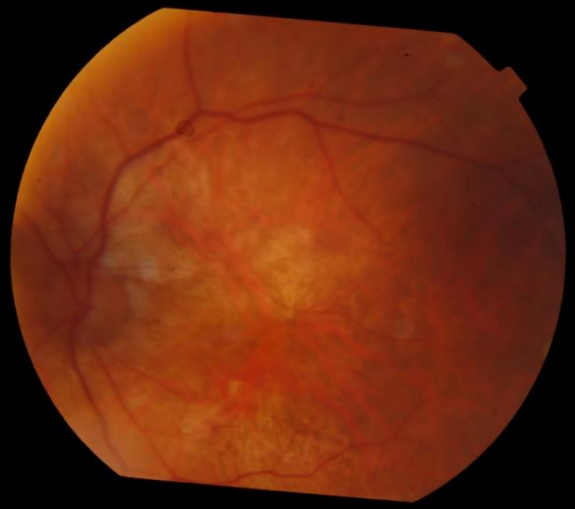


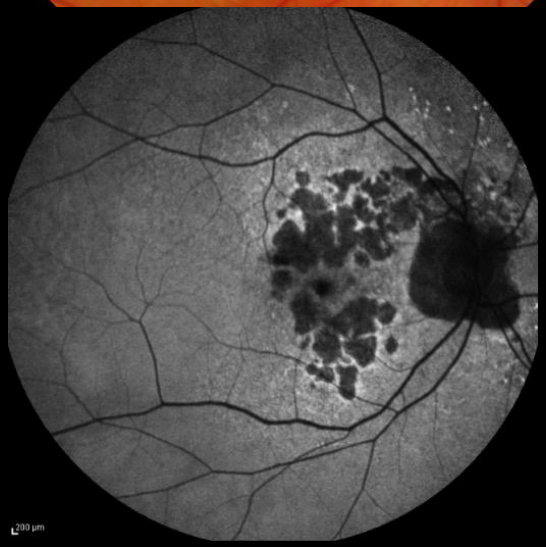


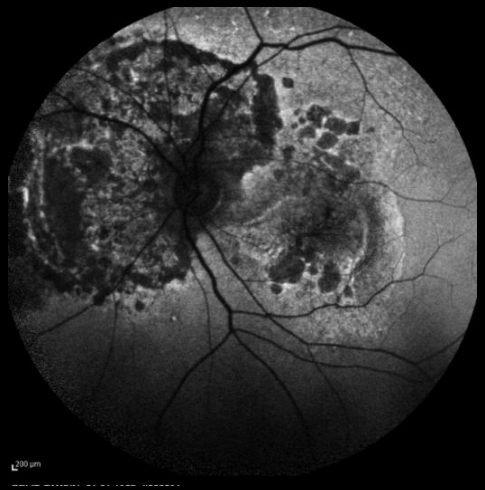
# DEJENERATİF MİYOPİ







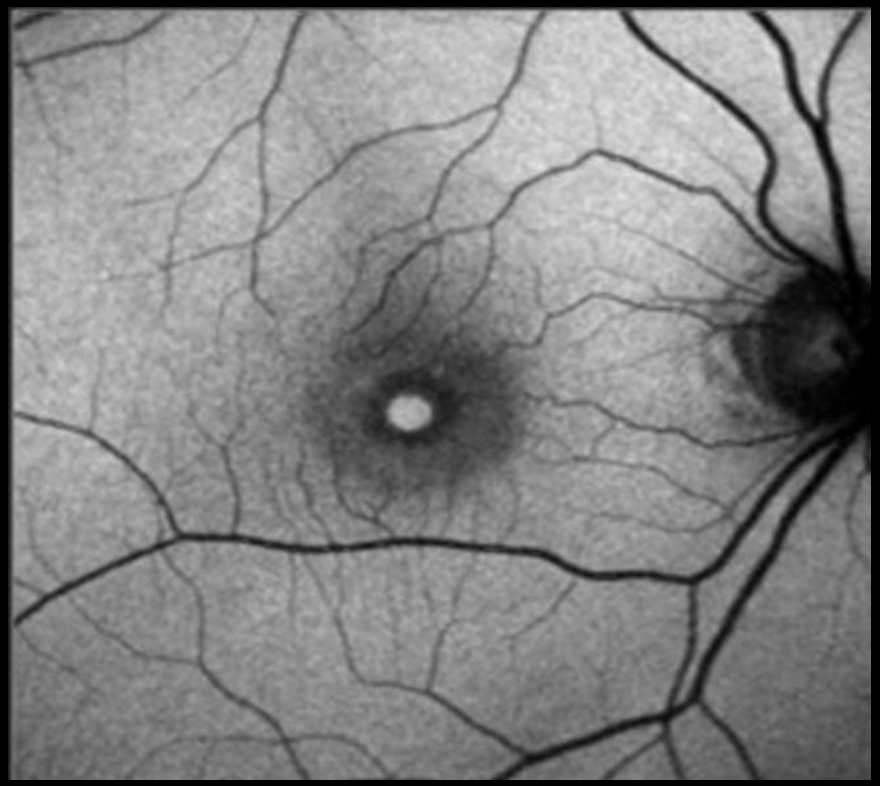




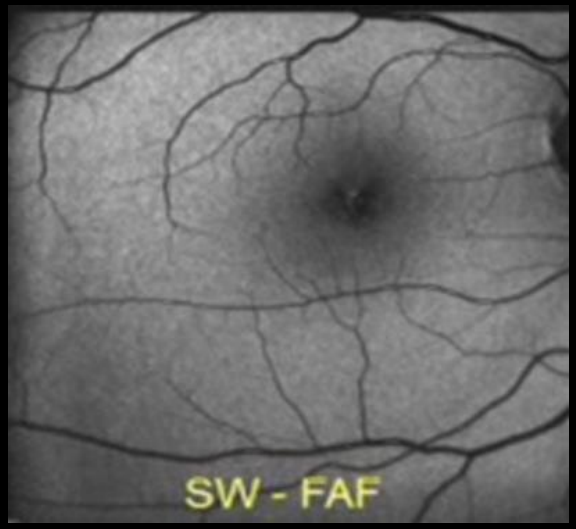
87 Y E
0.8/ 1 MPS

# MAKULER HOL/ LAMELLER HOL

- Makuler hol: dış pleksiform tabaka kaybı= makulada lutein pigment kaybı

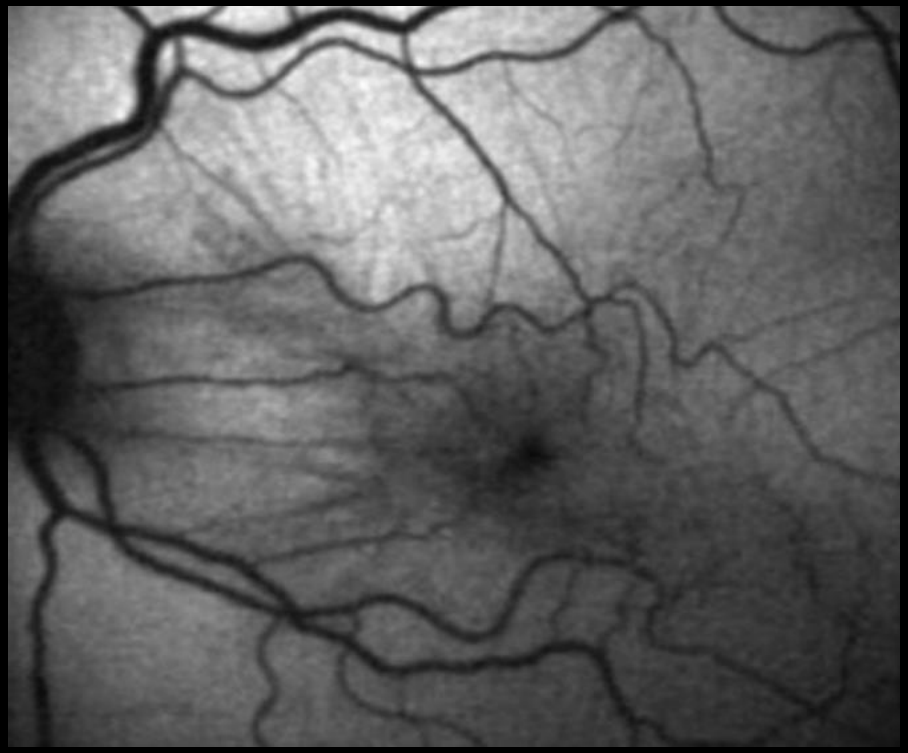


Beyaz : doku kaybı
Siyah halka: kalkık kenar
Beyaz silik noktalar: kistler
Operkuluma bağlı siyahlık
Lameller holde siyah halka yok!!



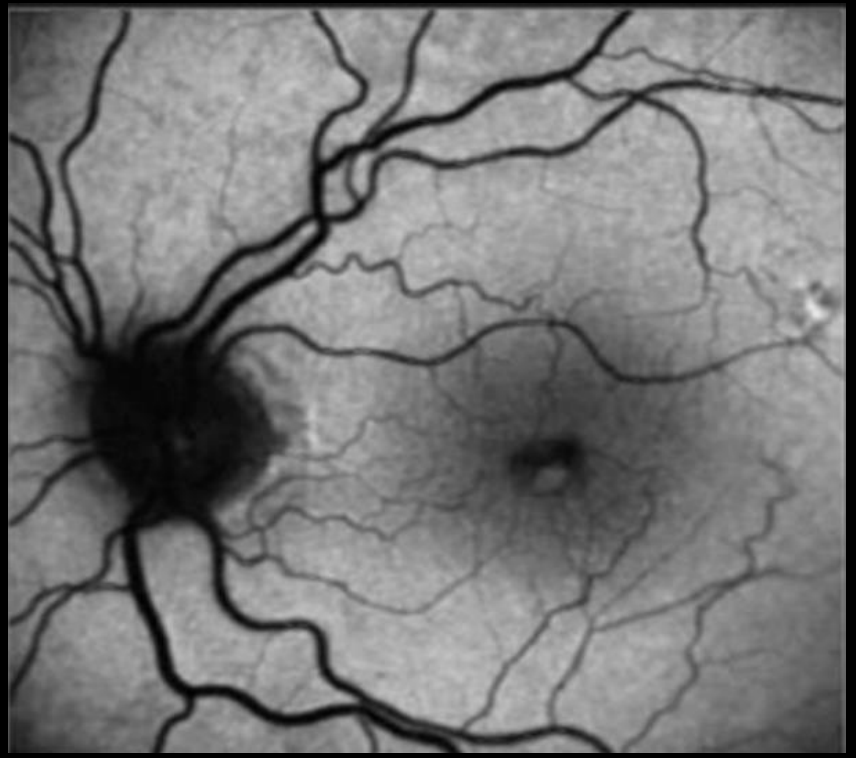
# PSÖDOHOL/LAMELLER HOL

## Psödohol



Dik kuyu şeklinde foveal kontur
Kalın,kistik makuler kenar
Kuyunun dibinde normal foveal doku
Genellikle GK iyi

## Lameller hol



Yarılmış foveal kenar
Normal makuler kenar, kistik değişiklikler yok
Fovealar incelme
%89 ERM

# ARKA ÜVEİTLER

- İnflamasyon RPE ve fotoreseptör fonksiyonlarını etkileyerek otofloresan moleküllerin üretimini arttırabilir.
- Mikroglia ve makrofajlar oksidasyon ürünlerinin fagositozu sonucu bir takım floroforlar taşırlar
- Immunsupresif tedavinin etkinliğini noninvaziv olarak monitörize edilmesinde yardımcı

# İNFLAMASYONUN EVRESİ OTOFLORESANS

- Aktif İnflamasyon fazında: FAF artar

- RPE hipertrofisi, reaktif hiperplazi
- RPE deki floroforların boyut ve içeriğinin değişmesi
- Preoksidatif yolların indüklenerek floroforların arttırılması
- Makula ödemi

- İnflamasyon ilerledikçe: FAF azalır

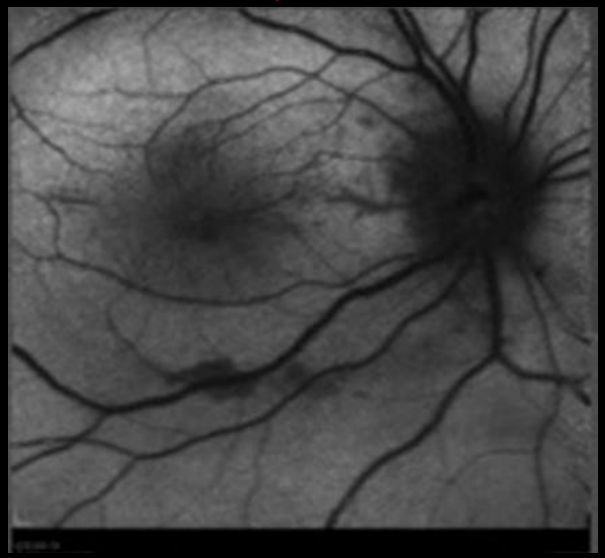
- İnflamatuar lezyon merkeze doğru büzüşür, çevresinde RPE hücre kaybı vardır. (diffüz/benekli)

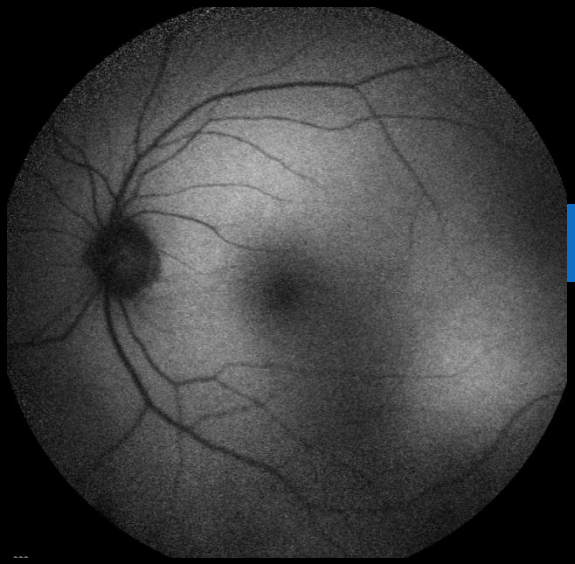
- İnflamasyon iyileşme fazında:

- Pigmentte hafif grileşme otofloresansta azalma (Subretinal fibrozis )
- RPE tekrar yoğunlaştığı için hiperotofloresan noktalar

İnflamatuar CNV : azalmış AF sinyali etrafında halka şeklinde artmış AF sinyali

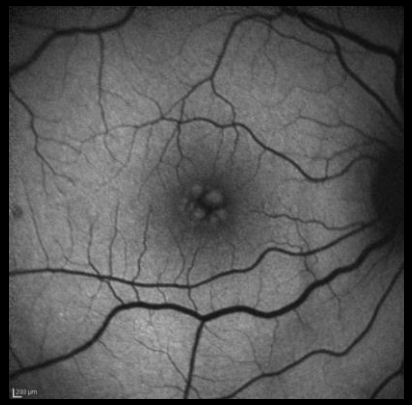
# BEHÇET HASTALIĞI



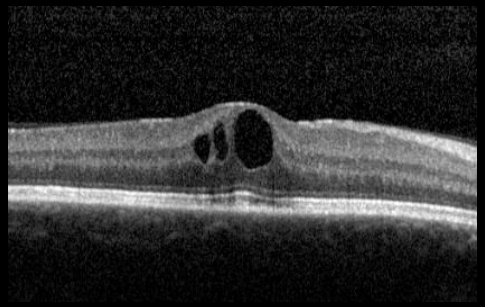


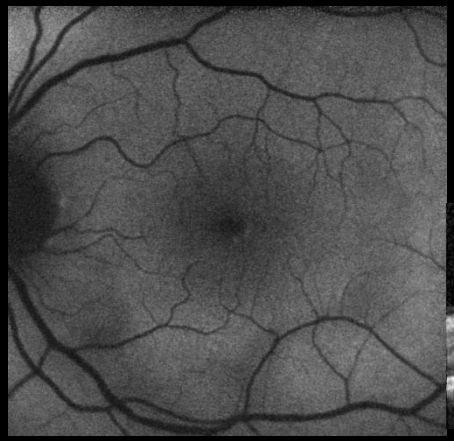
VİTRİTİS

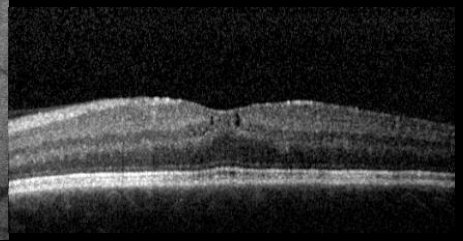
PAPİLLİT



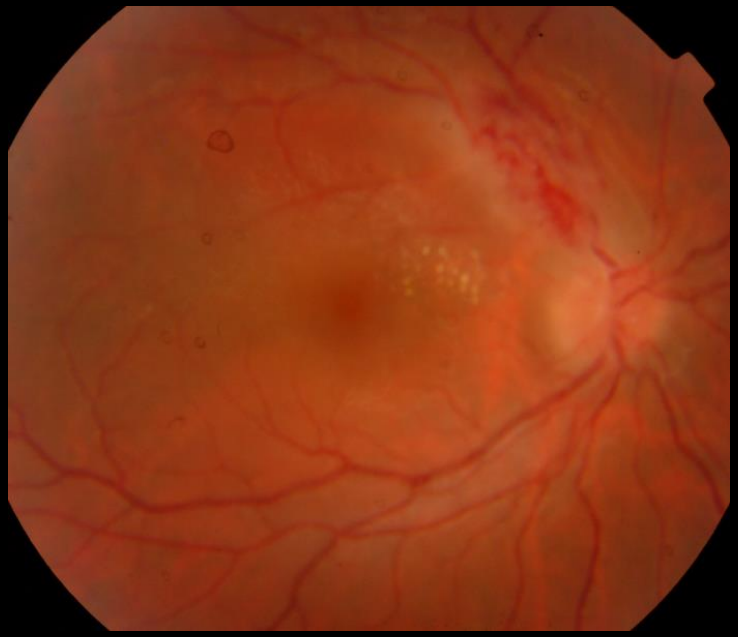
KMÖ

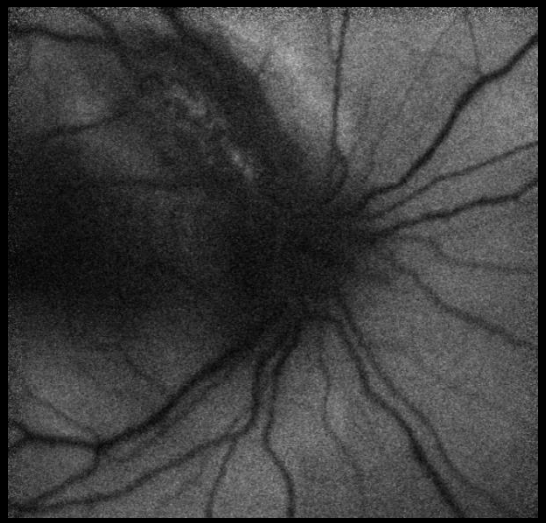


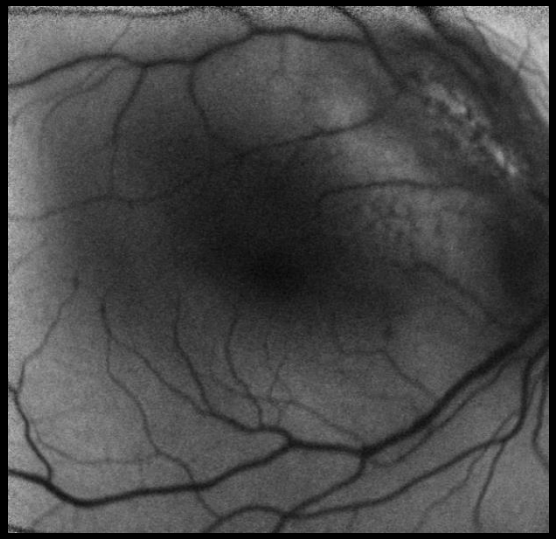


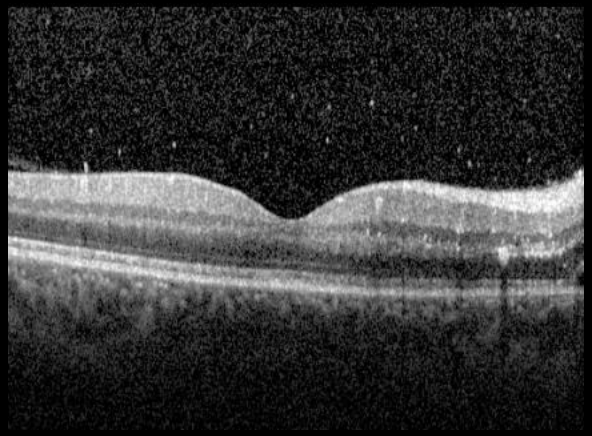


# TOXOPLASMA RETİNİTİ

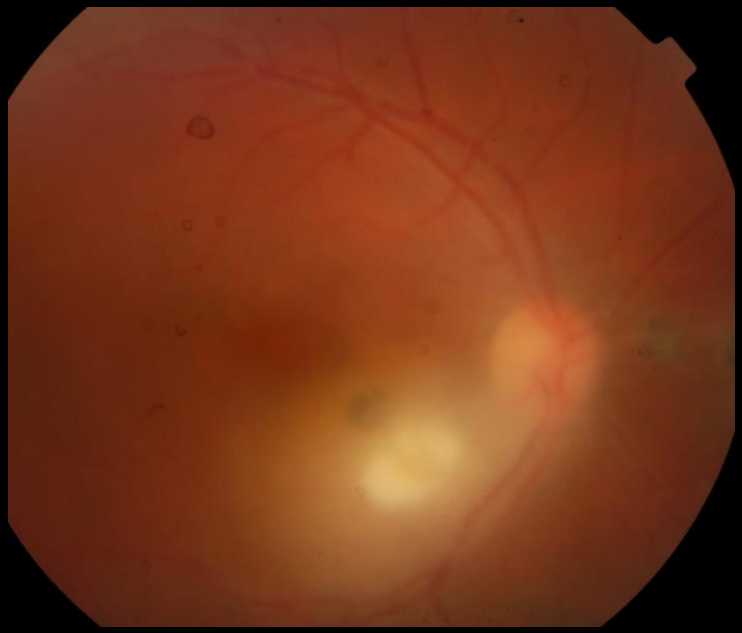


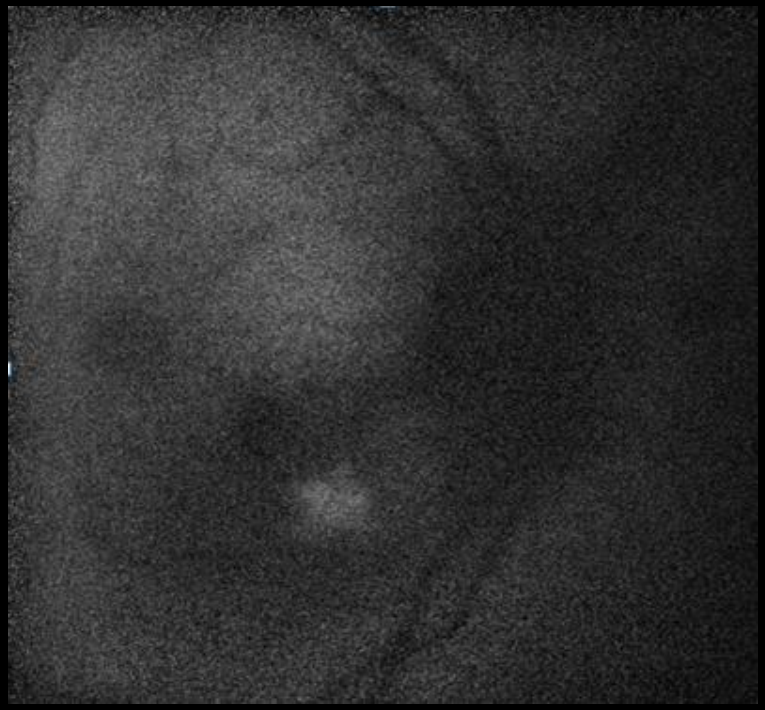


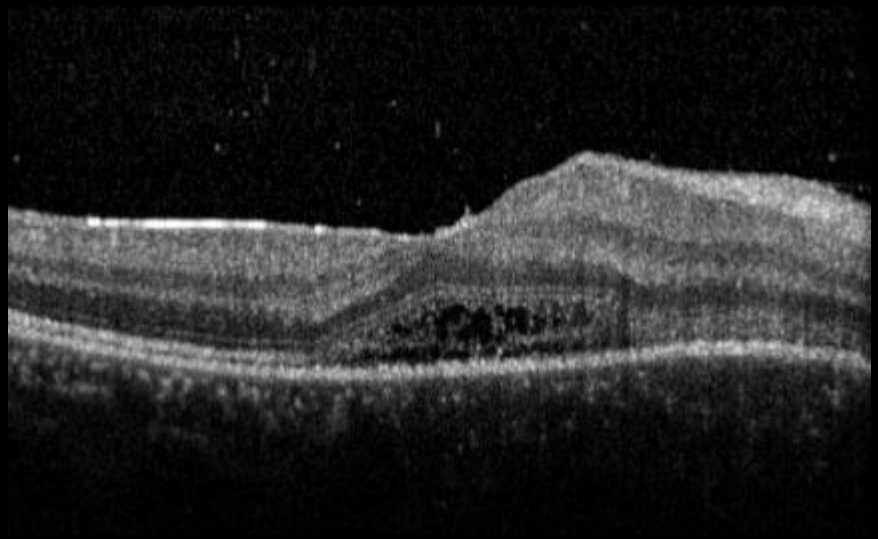




20 Y , E
TAM/TAM

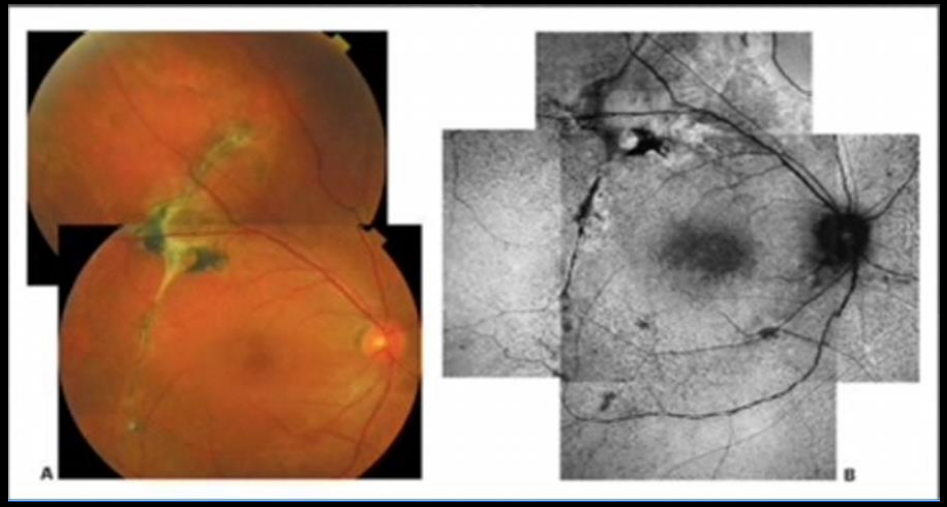


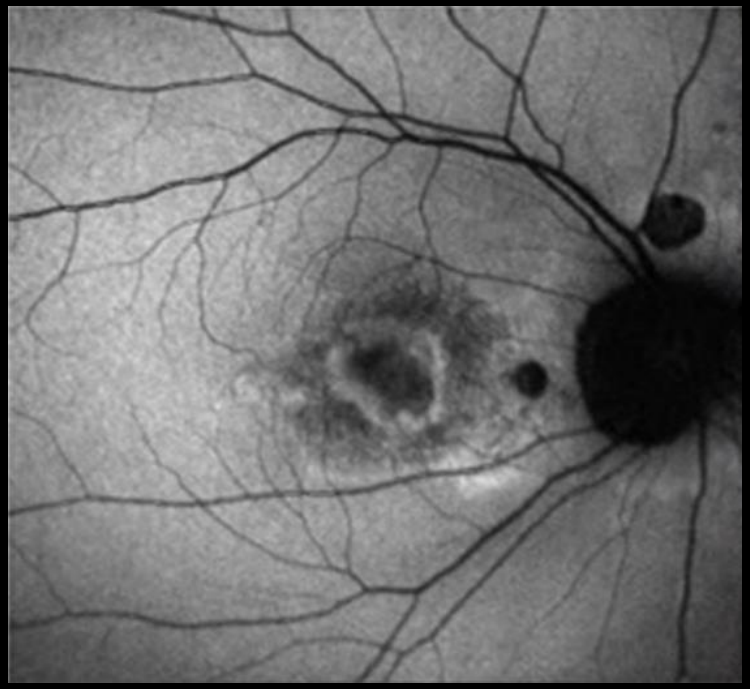


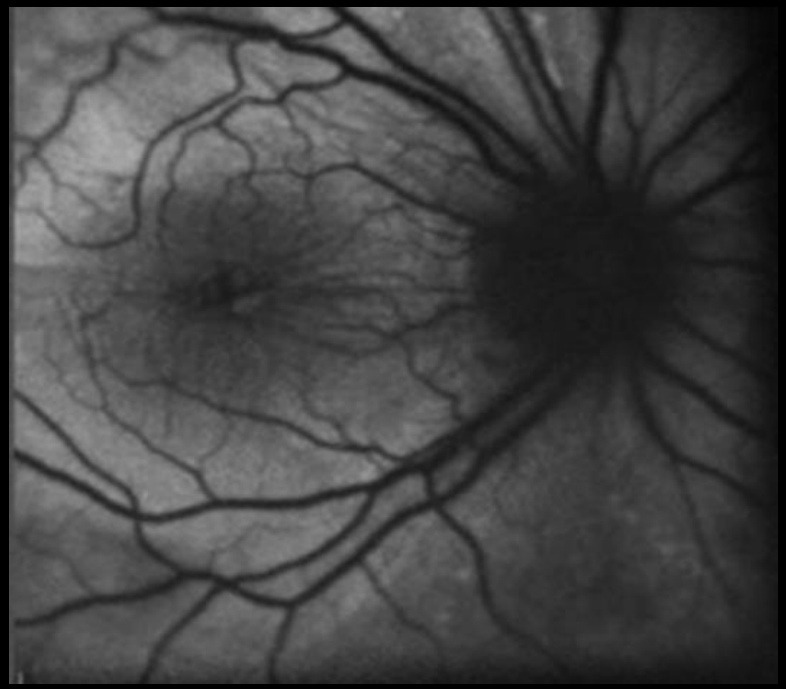


# Komplikasyonlar

- 1- makula ödemi
- 2- İnflamasyona ikincil CNVM
- 3- subretinal fibrozis

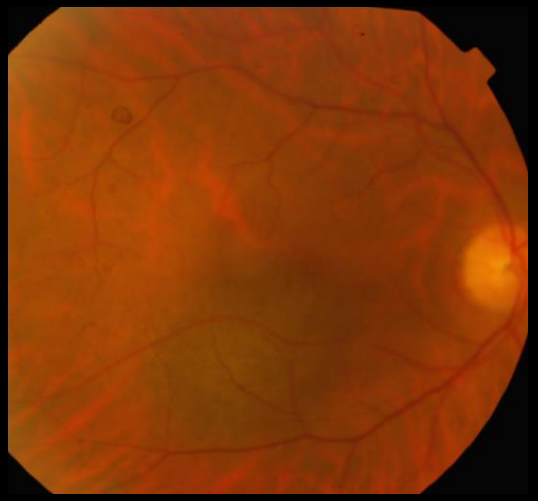


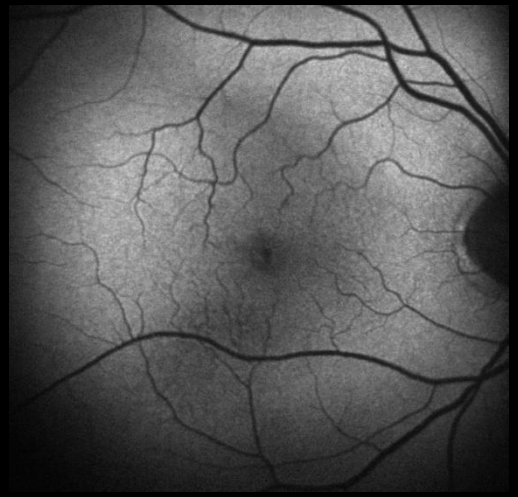


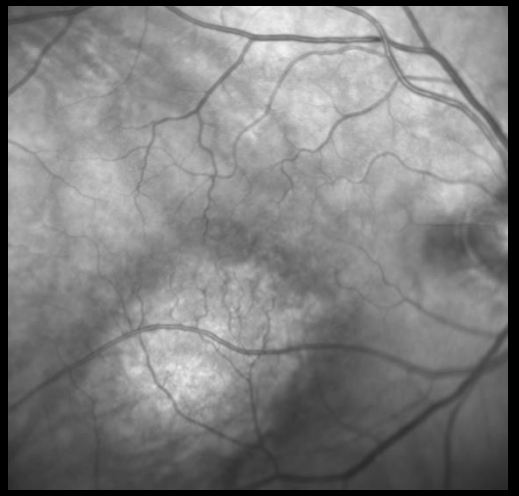


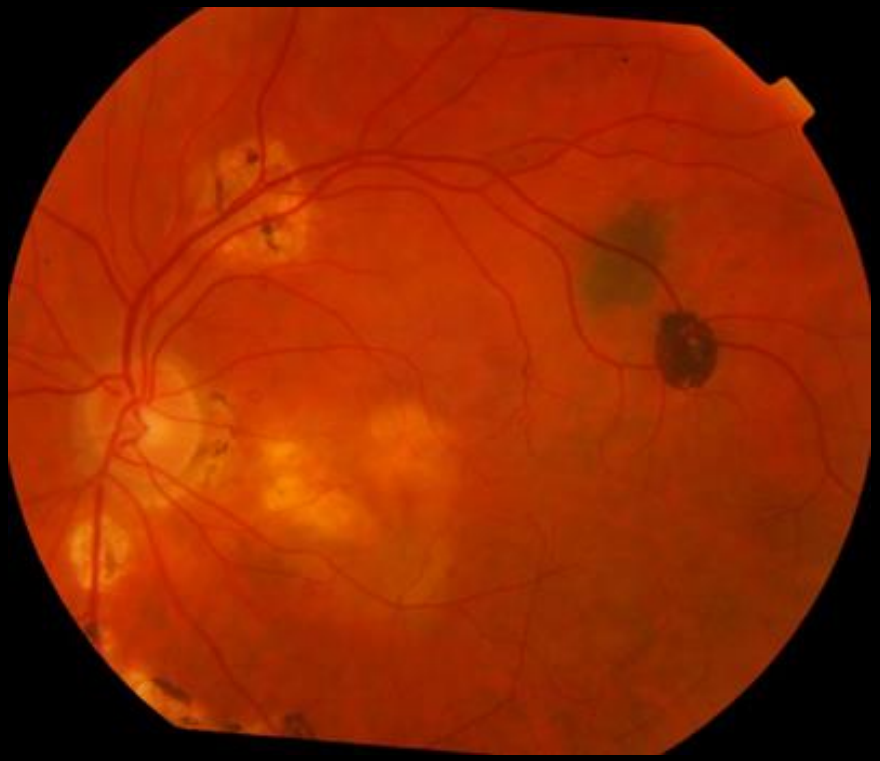
# KOROİD NEVÜSÜ/MALİGN MELANOM

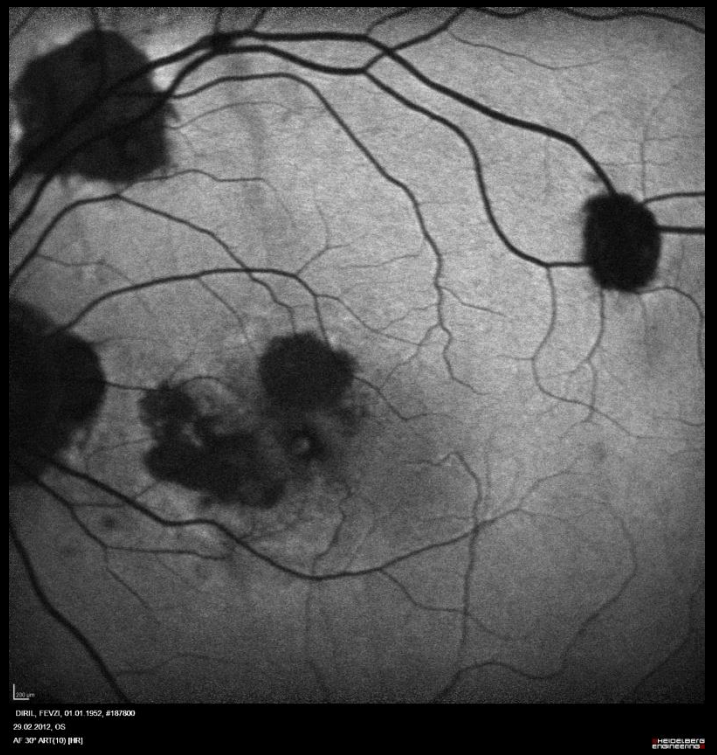
Koroidal nevüsün  genellikle bazal çapı <5 mm, yüksekliği <ımm
Orange pigmentasyon YOK
Subretinal sıvı YOK
FFA da hot spot İZLENMEZ
FAF da normal arka kutup otofloresansı izlenir.
RPE tutulmadığı için FAF da artış/azalma yoktur.












49 y e hasta

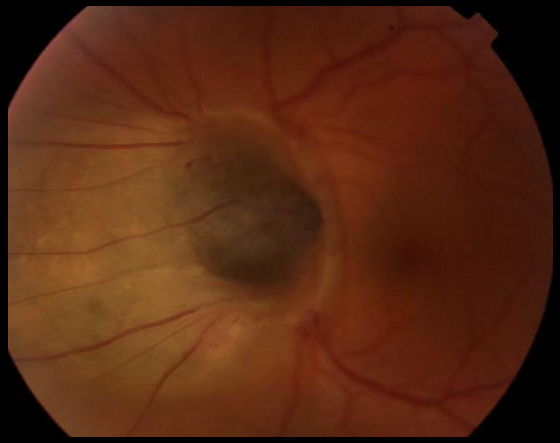
# KOROİD NEVÜSÜ/MALİGN MELANOM

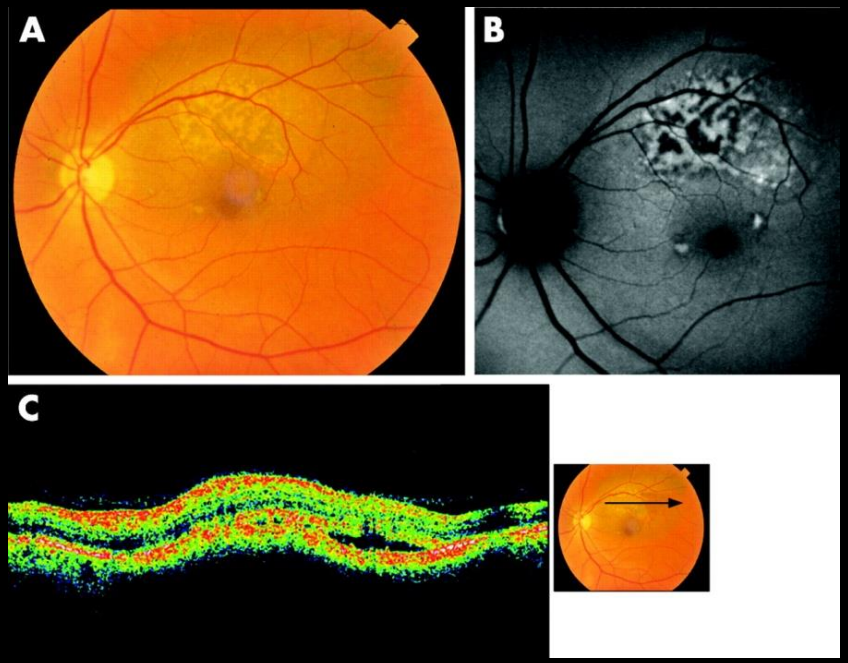
- Koroidal melanomda orange pigmentasyon VAR
- Subretinal sıvı VAR
- Superfisyal fibrozis ve RPE metaplazisi VAR
- Komşu retina dekolmanı VAR

Çoğu olguda orange pigmentlere uyan alanda artmış FAF izlenir. ( %61.5 korelasyon oranı *)

Artmış FAF orange pigmentler ortaya çıkmadan da izlenebilir.

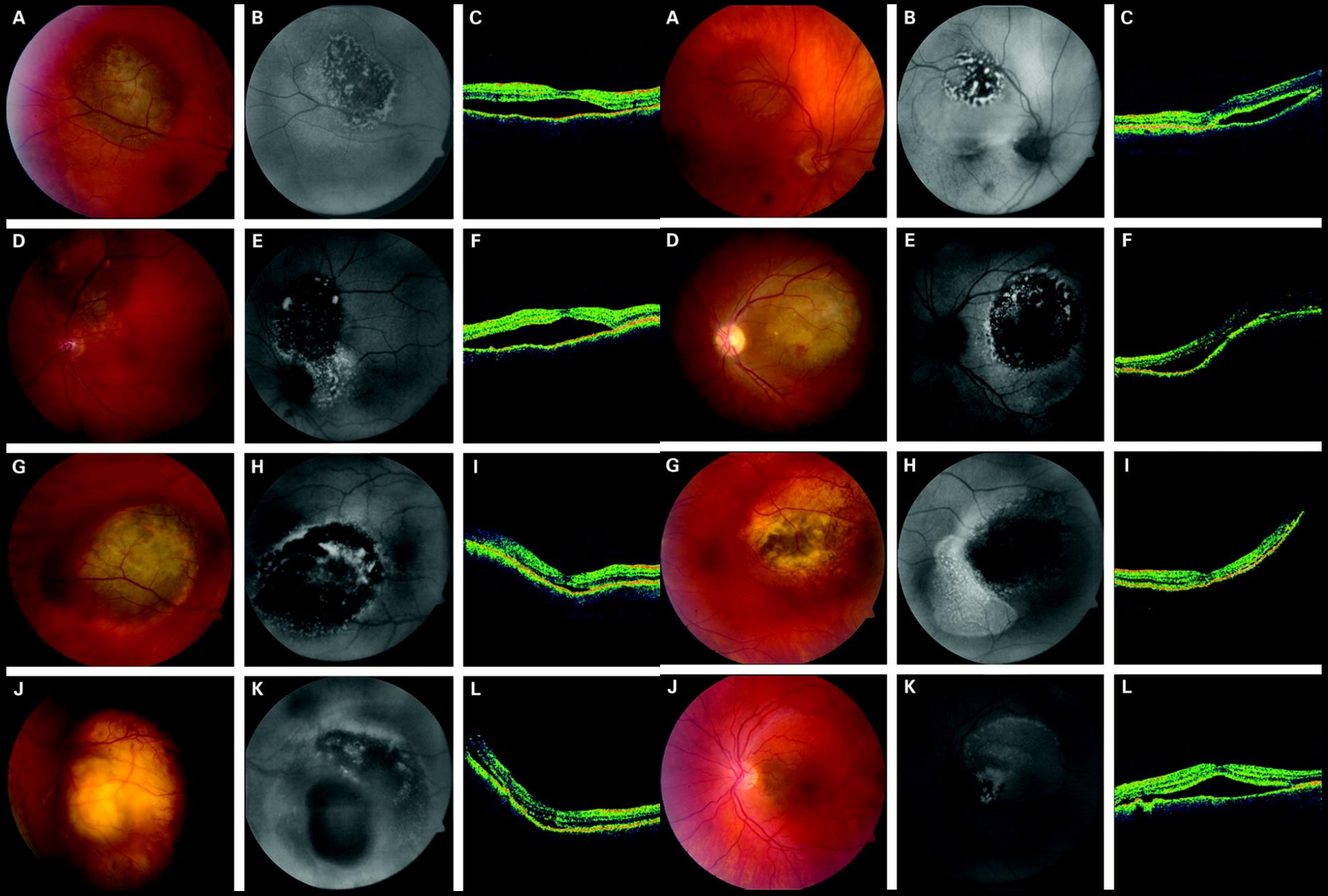
Homojen artış/ confluent plak tarzı artış



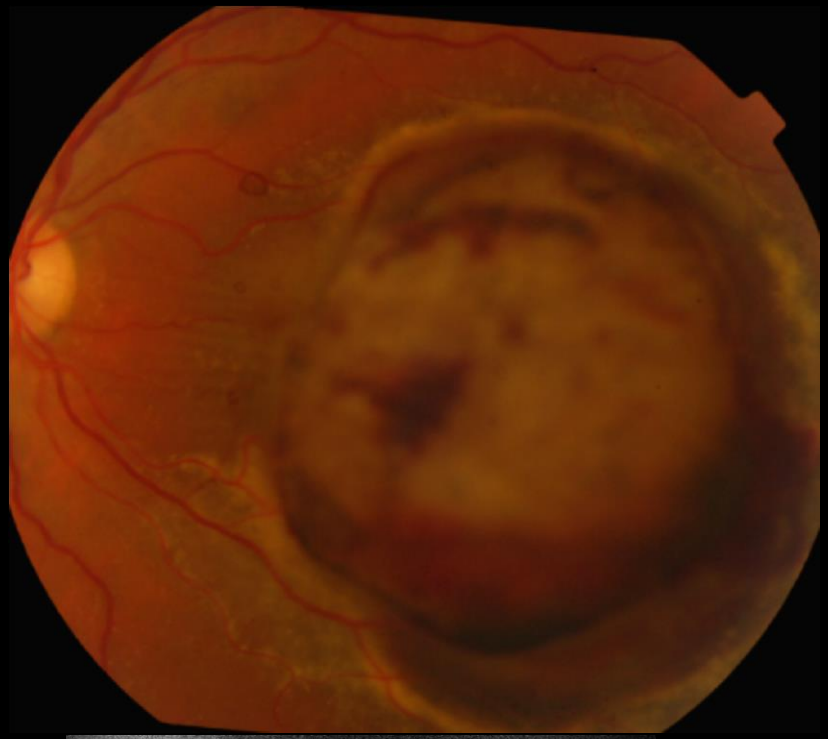


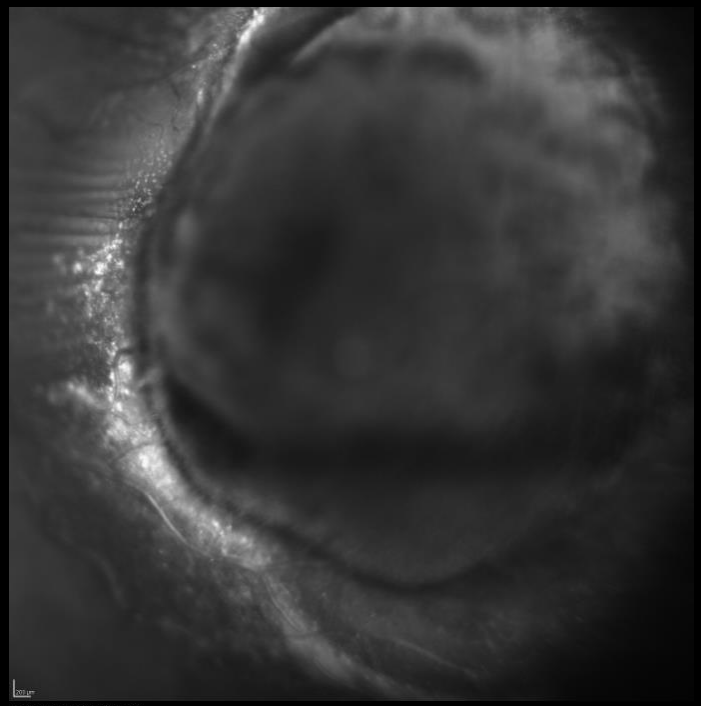

*: Gunduz K, Pulido JS, Bakrı JS et al, Fundus autofluorescence in choroidal melanocytic lesions , Retina 2007: 27: 681-687

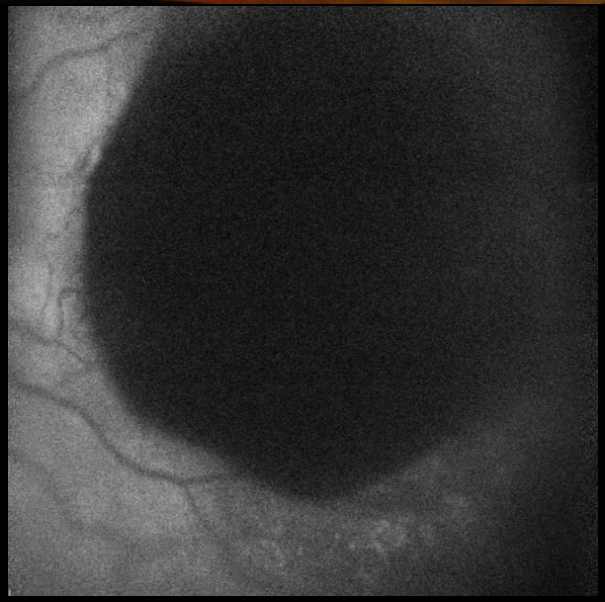
Fig A-B-C :**Fundus autofluorescence of choroidal nevus and melanoma,** Daniel Lavinsky, Rubens N Belfort, Eduardo Navajas, Virginia Torres, Maria Cristina Martins, Rubens Belfort, Jr



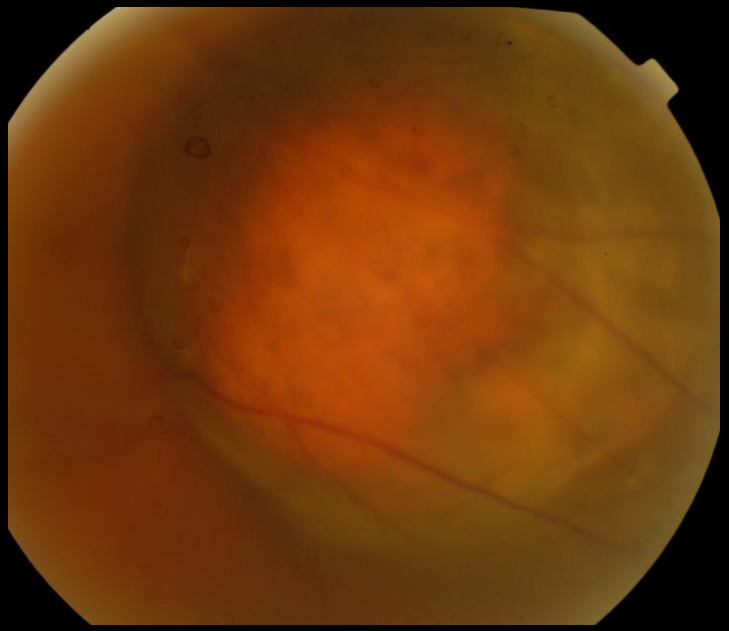

**Autofluorescence of choroidal melanoma in 51 cases,** C L Shields, C Bianciotto, C Pirondini, M A Materin, S A Harmon, J A Shields, *Br J Ophthalmol2008;92:617-622*

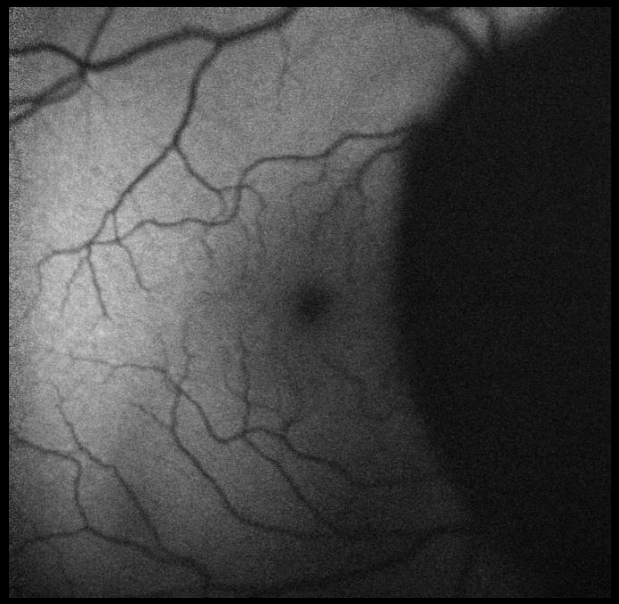


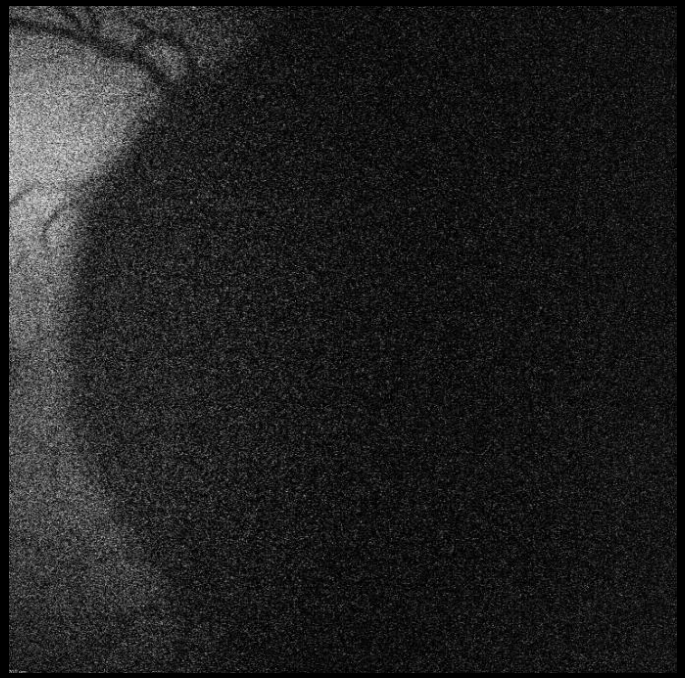




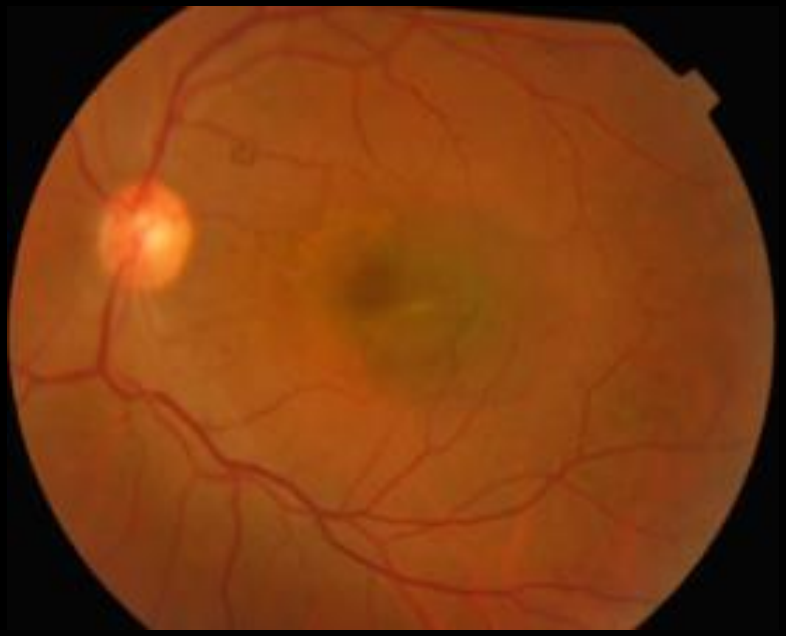
42 y e hasta

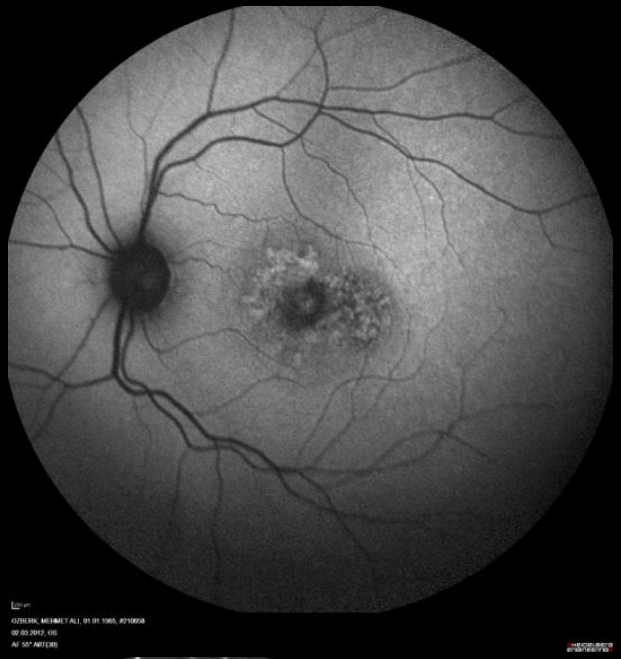




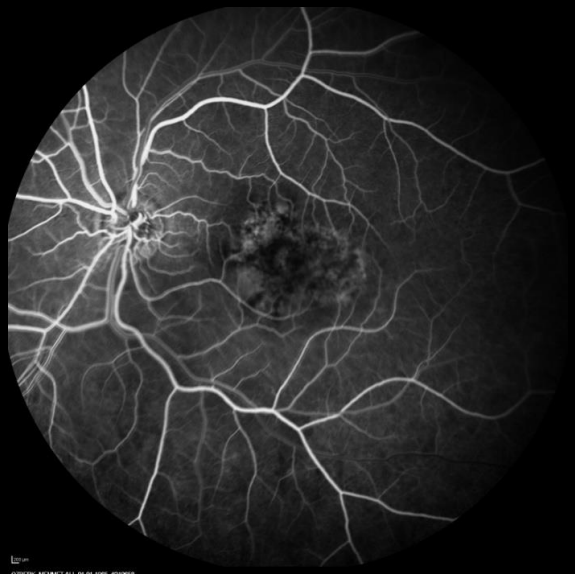


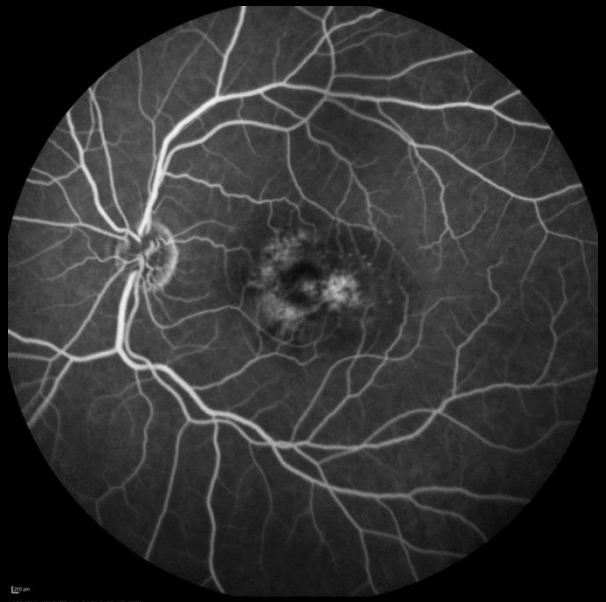
72 y E hasta
Gk: 0.4

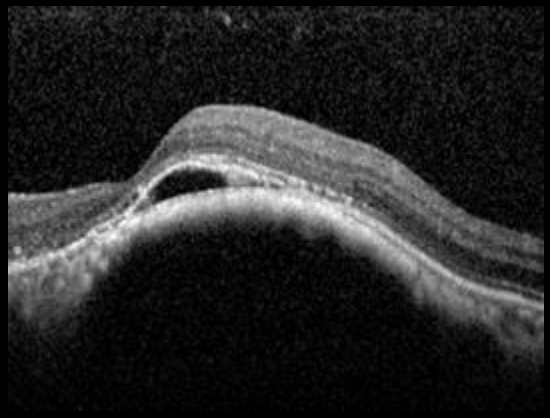


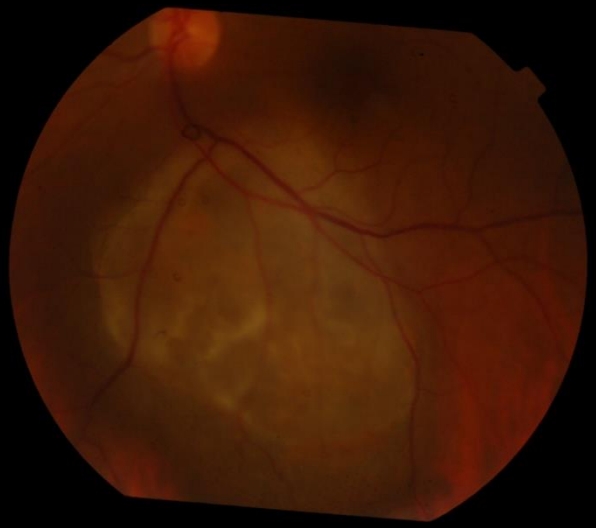


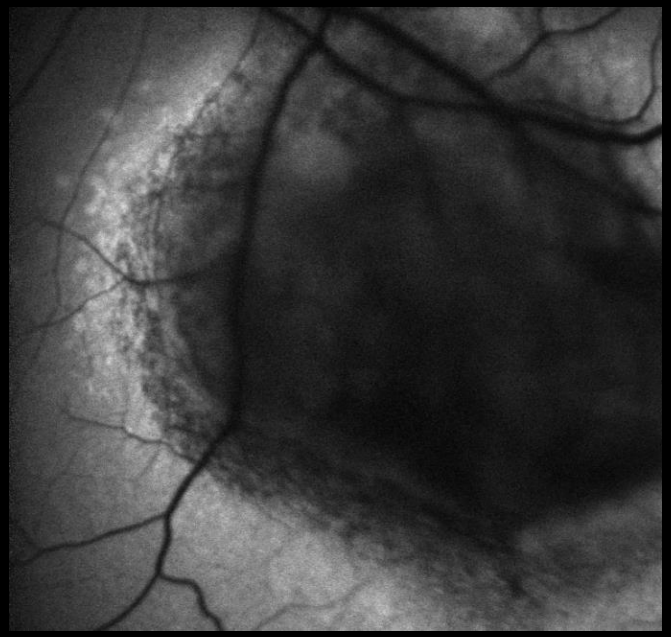
46 y e hasta
GK: 0.2

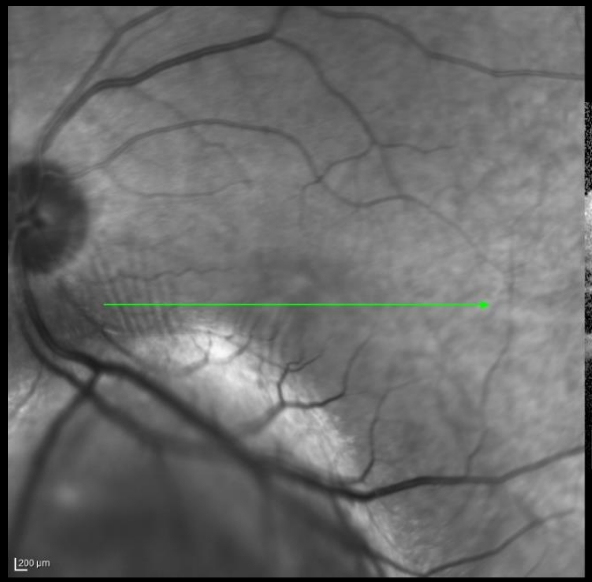


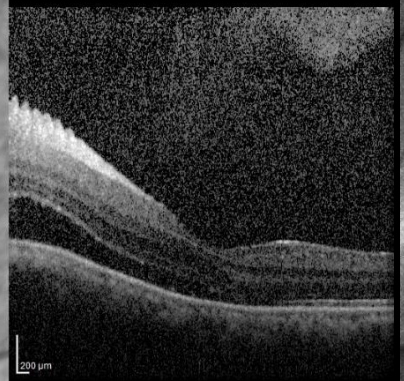


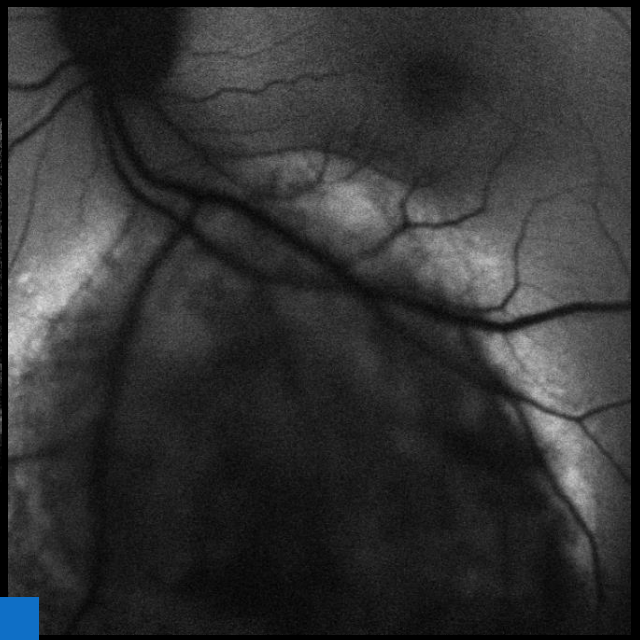




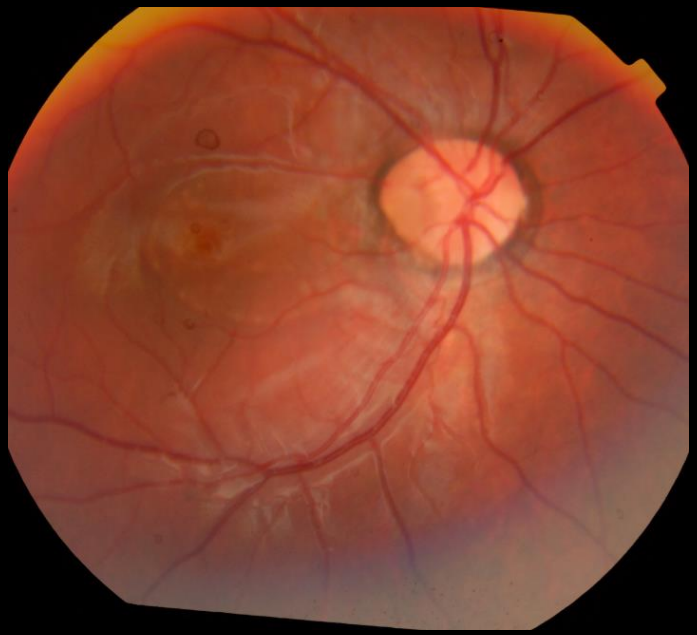


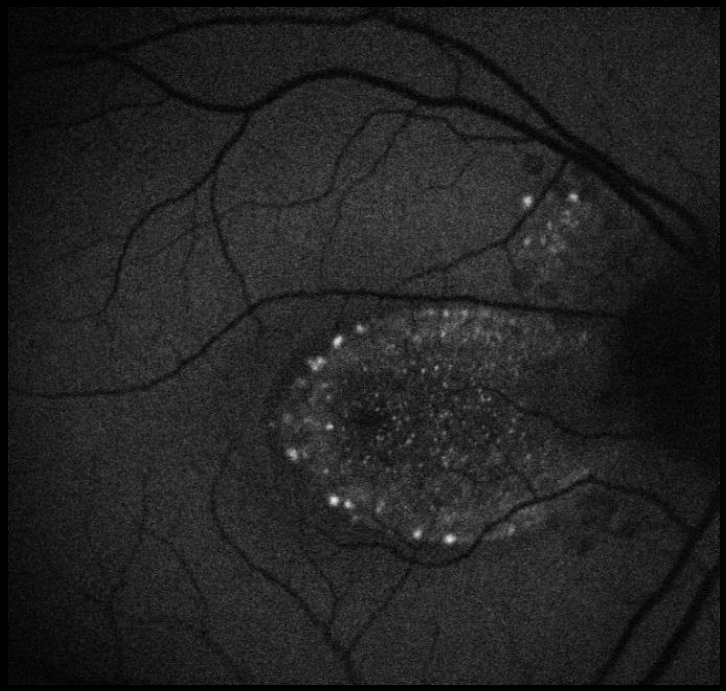


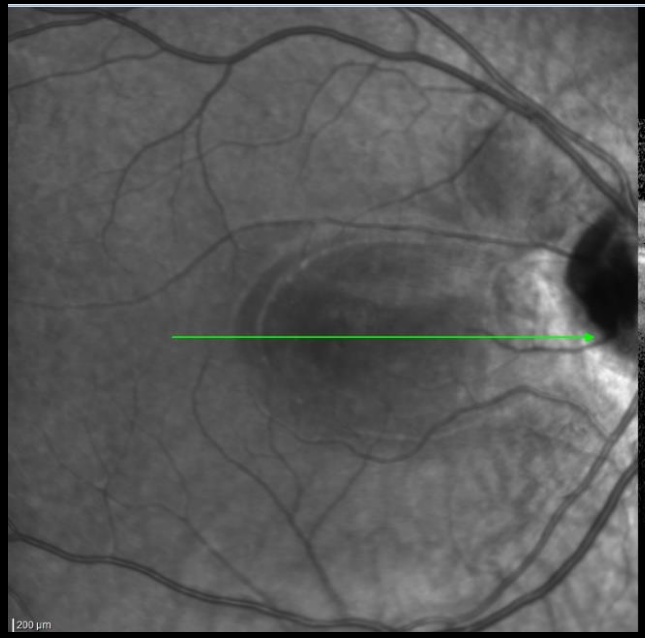



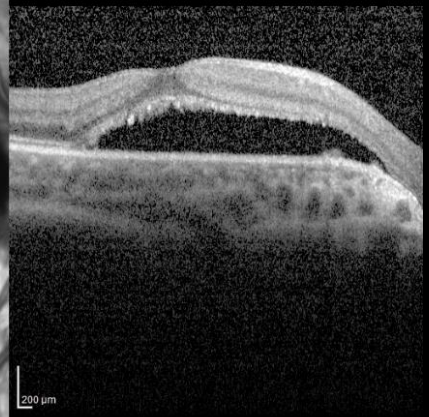



56 y K hasta








6Y K HASTA

# SONUÇ

- Fundus otofloresans çeşitli makula ve retinal hastalıkların patofizyolojisini anlamamızda yardımcı noninvaziv bir görüntüleme methodudur.
- Tanı ve takipte en faydalı olduğu hastalıklar Best, patern distrofi, SSKR, Koroidal malign melanom /nevüs, geografik atrofidir.
- Yaşa bağlı makula dejenerasyonunda hastalığın progresyonu, prognozu konusunda fikir verebilmektedir.
- Mikroperimetri ile yapılan çalışmalar FAF bulgularının fonksiyonel korelasyonu gösterilmiştir.