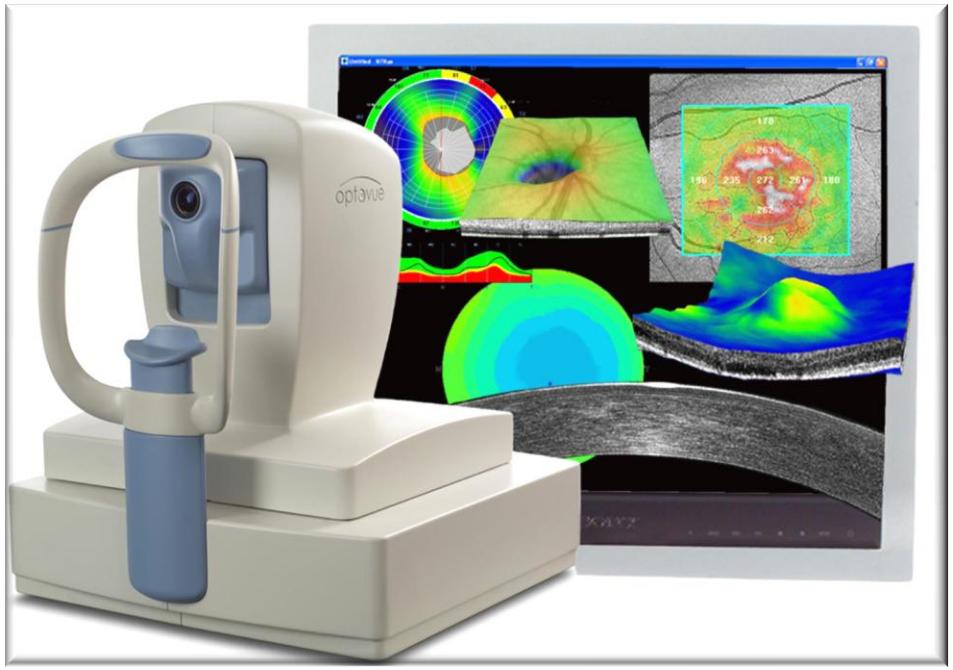
OCT’de Hata Kaynakları



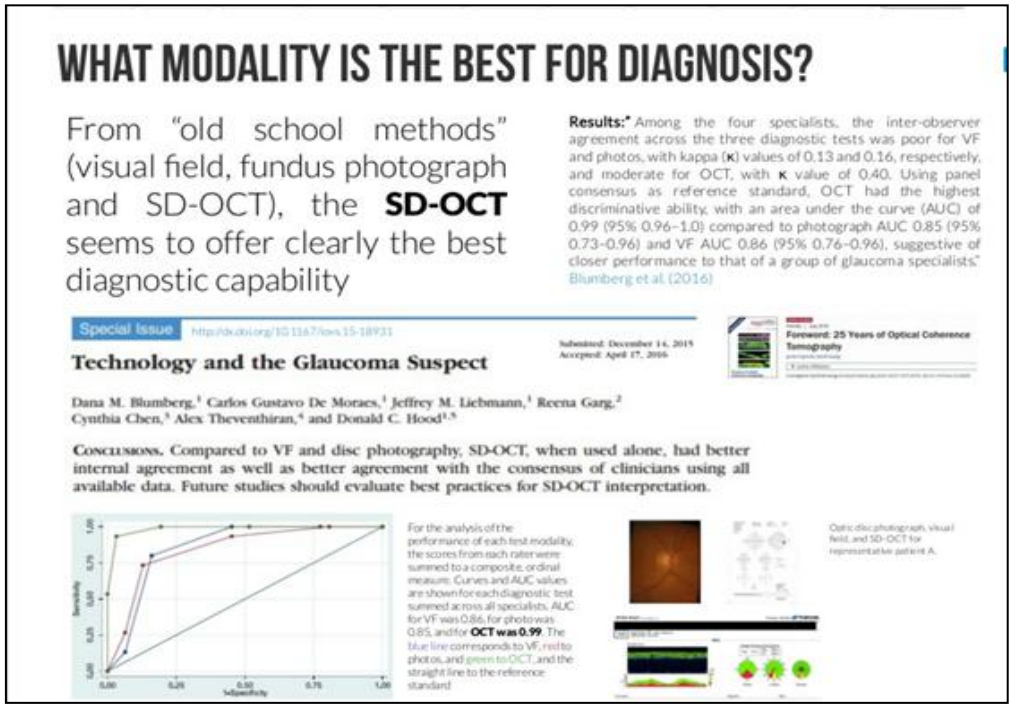
Prof.Dr.Özcan Ocakoğlu

Cerrahpaşa Tıp Fakültesi

16 Aralık 2017, Antalya

Sunumda adı geçen cihazların üreticisi ve izin sahibi firmalar ile herhangi bir finansal ilişkim yoktur.

Glokomda tanı/progresyon tespitinde OCT'nin önemi



WHAT MODALITY IS THE BEST FOR DIAGNOSIS?

From "old school methods" (visual field, fundus photograph and SD-OCT), the **SD-OCT** seems to offer clearly the best diagnostic capability

Results:* Among the four specialists, the inter-observer agreement across the three diagnostic tests was poor for VF and photos, with kappa (κ) values of 0.13 and 0.16, respectively, and moderate for OCT, with κ value of 0.40. Using panel consensus as reference standard, OCT had the highest discriminative ability, with an area under the curve (AUC) of 0.99 (95% 0.96–1.0) compared to photograph AUC 0.85 (95% 0.73–0.96) and VF AUC 0.86 (95% 0.76–0.96), suggestive of closer performance to that of a group of glaucoma specialists." Blumberg et al. (2016)

Special Issue

Technology and the Glaucoma Suspect

Foreword: 25 Years of Optical Coherence Tomography

Dana M. Blumberg,[1] Carlos Gustavo De Moraes,[1] Jeffrey M. Liebmann,[1] Reena Garg,[2] Cynthia Chen,[3] Alex Theventhiran,[4] and Donald C. Hood[1,5]

Conclusions. Compared to VF and disc photography, SD-OCT, when used alone, had better internal agreement as well as better agreement with the consensus of clinicians using all available data. Future studies should evaluate best practices for SD-OCT interpretation.

For the analysis of the performance of each test modality, the scores from each rater were summed to a composite, ordinal measure. Curves and AUC values are shown for each diagnostic test summed across all specialists. AUC for VF was 0.86, for photo was 0.85, and for **OCT was 0.99**. The blue line corresponds to VF, red to photos, and green to OCT, and the straight line to the reference standard

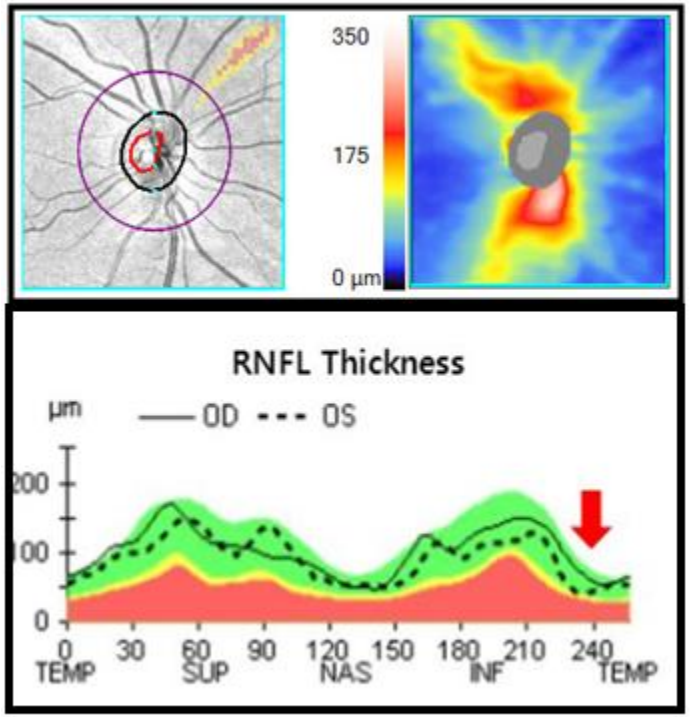
Optic disc photograph, visual field, and SD-OCT for representative patient A.

OCT sonuçlarını değerlendirmeden önce cihazın teknik özelliklerinden kaynaklanan kısıtlılıklarını ve hata kaynaklarını iyi bilmek gereklidir.

OCT glokomda erken tanı ve takipte, mevcut tanı yöntemleri arasında en iyi performansa sahiptir

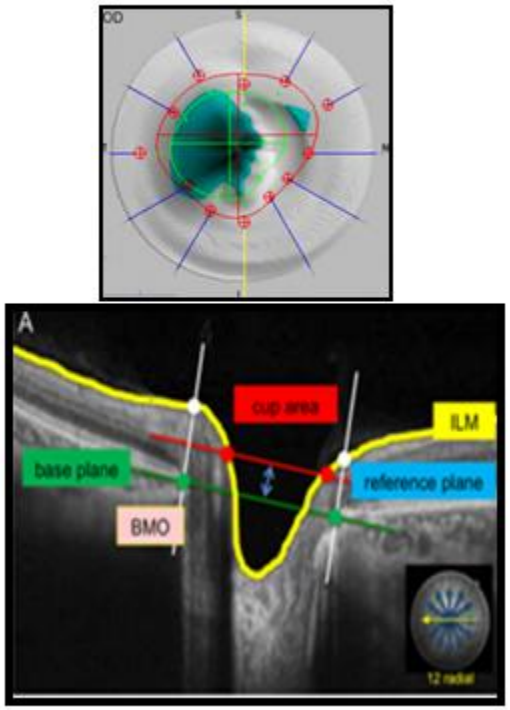
Tarama tipleri- Hata oranları

RNFL analizi



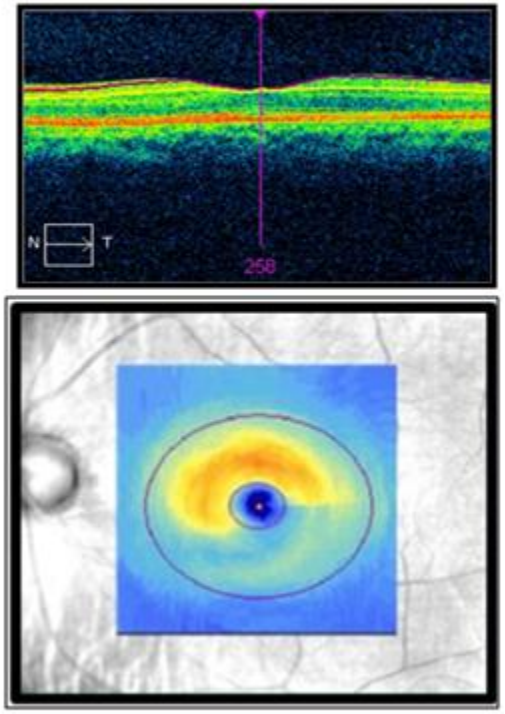
%20- % 46,3

Optik disk analizi



%12- % 56,5

Makula analizi

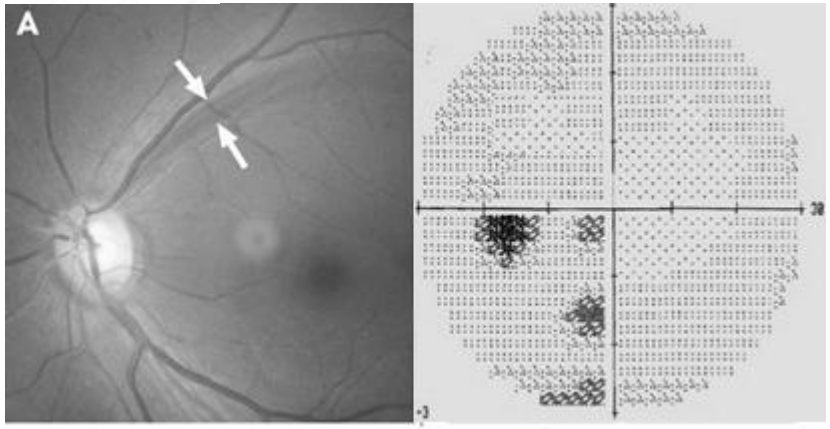


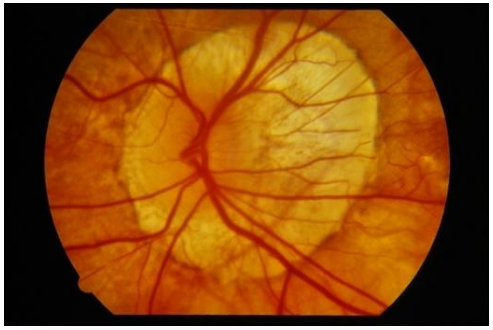
%28,2- % 90,9

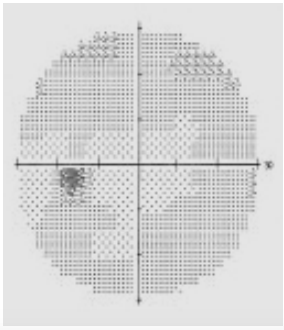
1. Asrani S, Essaid L, Adler B, Santiago-Turia C. JAMA Ophthalmol 2014;132:396-402
2. Hodzic-Hadzibegovic D, Sander BA, Luna Anderson H.Acta Ophthalmol 2015;93:74-82
3. Kim KE, Jeoung JW,Park KH,et al. Ophthalmology 2015; 233:503-520
4. Lee SY,Kwon HJ,Bae HW et al. Current Eye Research 2016;41:957-964

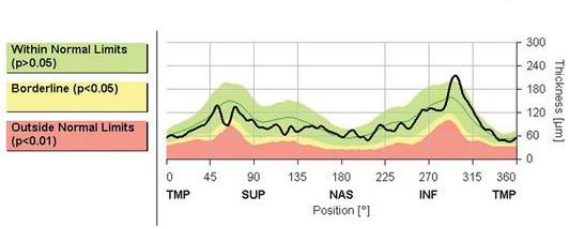
Yeşil Hastalık

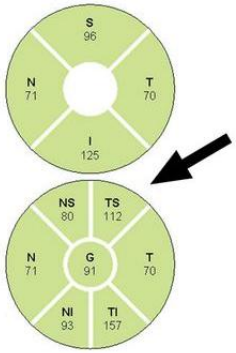
Kırmızı Hastalık

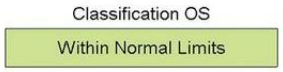


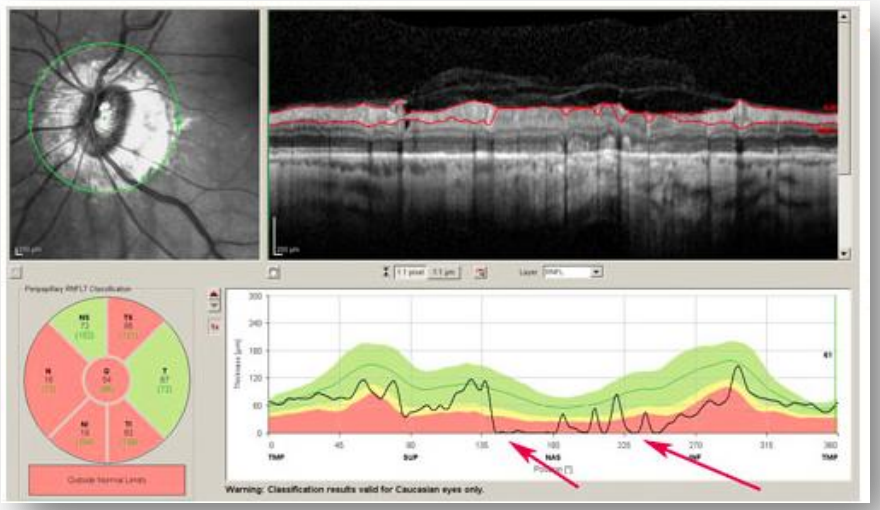












Yeşil hastalık: Hastalık var, OCT'de normal sonuç (False negatif)

Kırmızı hastalık: Hastalık yok , OCT'de anormal sonuç (false pozitif)

OCT’de hata kaynakları

- **Cihaza bağlı**
  - Normotif database yetersizliği
  - Segmentasyon hatası
  - Santralizasyon hatası
- **Operatöre bağlı**
  - Hatalı çekim (defocus, out of range,cut edge)
- **Hastaya bağlı**
  - Düşük sinyal gücü (ortam opasiteleri, kuru göz, vitreus içi opasiteler)
  - Göz kırpma, gözde aşırı hareketlilik
  - Retina ve optik disk anomalileri

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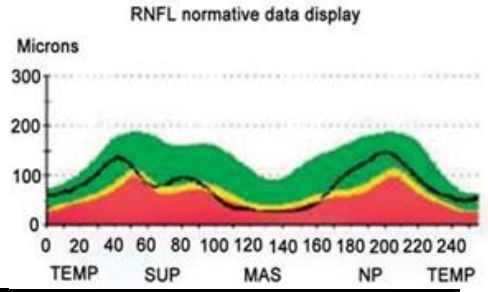
Normotif database yetersizliği



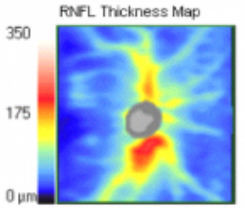
Model	Carl Zeiss Meditec[1]	Topcon Medical Systems[2]	Heidelberg Engineering[3]	Optovue[4]
Number of Subjects	284	182	201	480
Ages (years)	19 to 84	19 to 84	18 to 78	18 to 84
Gender (M/F)	133 M 149 F	Disc: 54 M / 92 F Macula: 112 F / 61 M	111 M 90 F	N/A
Ethnicity	43% Caucasian 24% Asian 18% African American 12% Hispanic 1% Indian 6% Mixed Ethnicity	64% Caucasian 21% African American 15% Hispanic	Caucasian	33% Caucasian 22% Asian 20% African American 12% Hispanics 12% Indian 1% Other
Anatomy Evaluated	pRNFL thickness Optic nerve Parameters GCL + IPL thickness Macular thickness	Optic disc Macula	RNFL thickness	RNFL thickness Ganglion cell complex Macular thickness
Study Location(s)	United States, China	United States	Germany	11 Clinical sites worldwide

Denek sayısı yetersiz
Normotif database'lerde azınlıklar yeterli temsil edilmemektedir

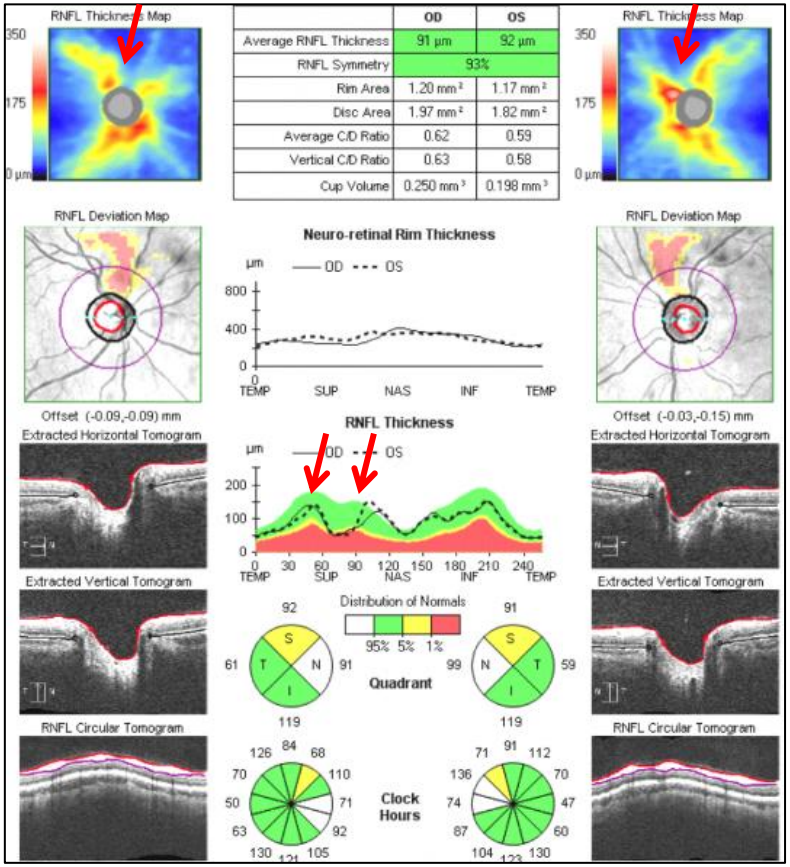
Miyopi’de RSLT değişikliği

- Miyopik hastalarda üst ve alt kutuplarda RSLT iki ayrı demet halinde diske girebilir (spilitted=yarıklanmış demet) veya yüksek miyoplarda arka kutbun geriye kayması sonucu RSLT kalınlık haritası değişebilir (shifted = kaymış demet)
- Miyoplar (özellikle yüksek miyopi) için hazırlanmış özel database yok
- Her hasta için zamanla «kendi normotif database’i» hazırlanmalı

Normal RSLT

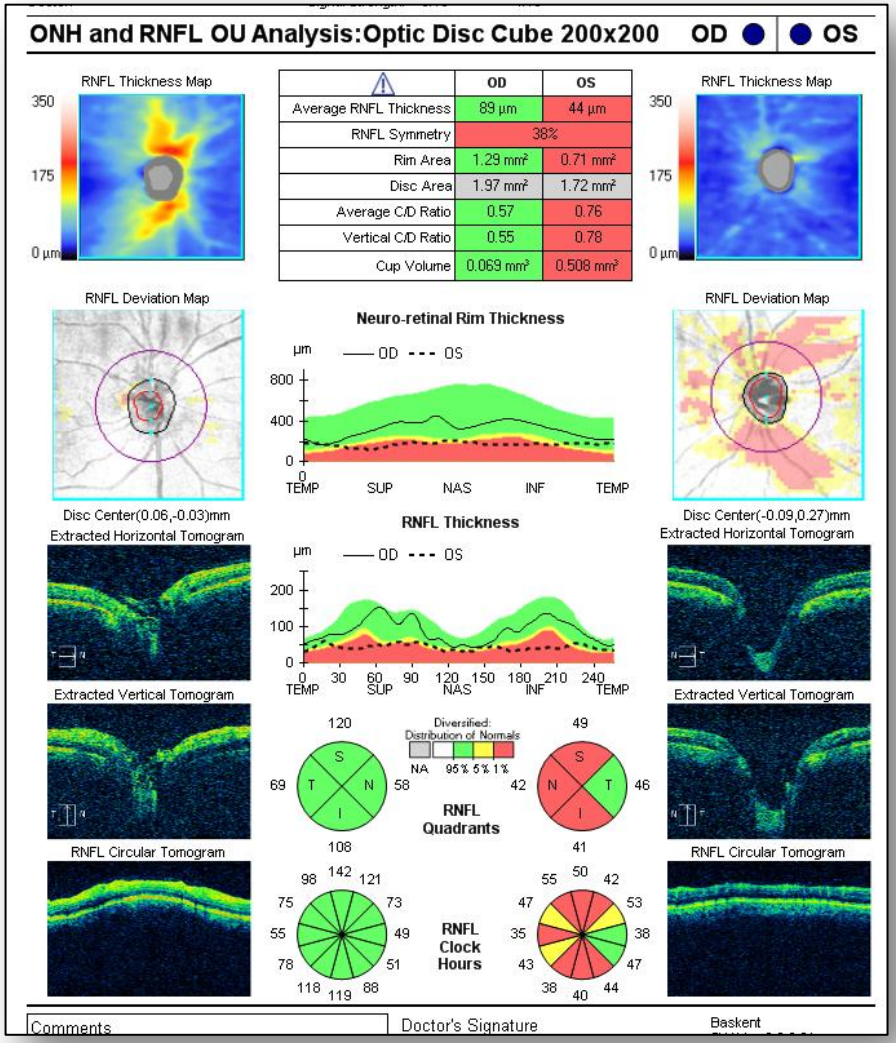


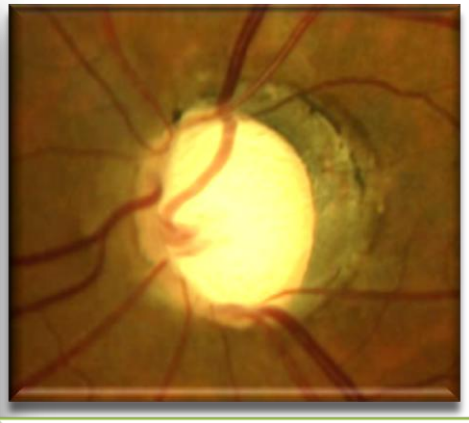
Spilitted=yarıklanmış RSLT

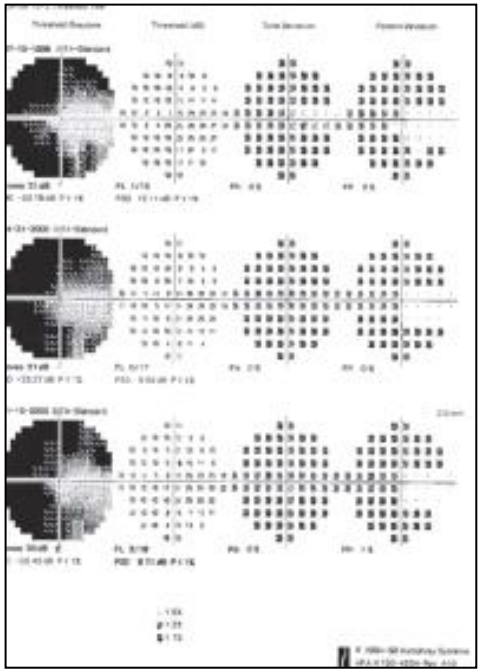


Leung CK, Yu M, Weinreb RN, et al. Retinal nerve fiber layer imaging with spectral-domain optical coherence tomography: interpreting the RSLT maps in healthy myopic eyes. Invest Ophthalmol Vis Sci 2012;53:7194-7200.

Taban etkisi



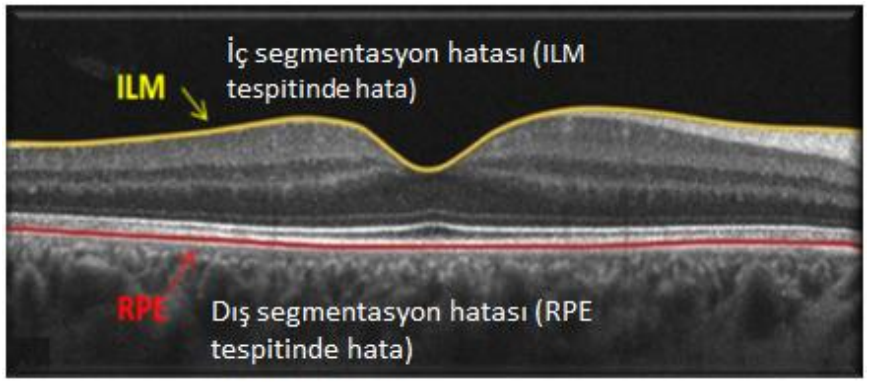




- İleri hastalıkta, RSLT kalınlık değeri kalan glial yada nöron dışı dokuların etkisinden ötürü asla <u>40 µ'nun</u> altına inmez.
- Bu seviyedeki hastalıkta görme alanı (10-2) ile takip daha yararlıdır.

Hood D et al. A framework for comparing structural and functional measurements of glaucomatous damage. Prog Retin Eye Res 2007;26:688-710

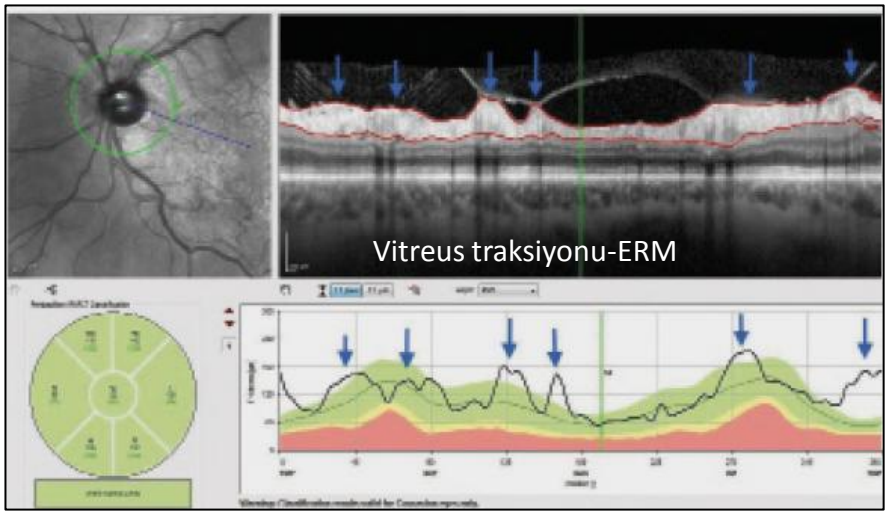
Segmentasyon hatası



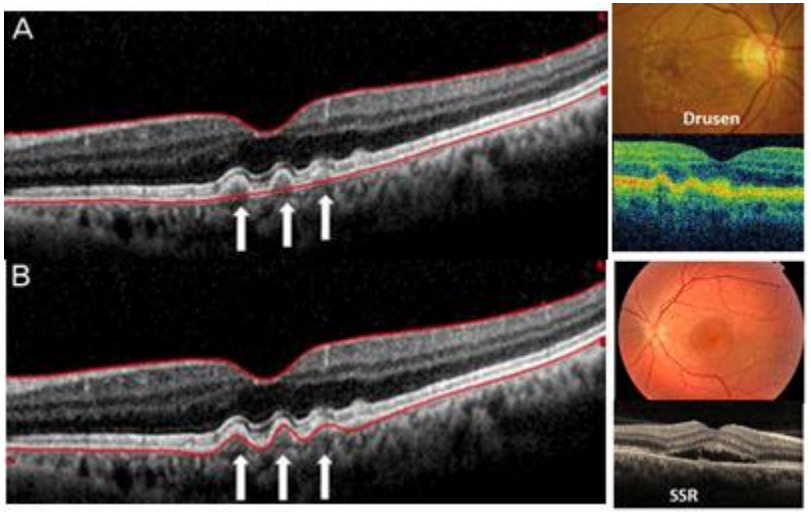
Yazılım, anatomik sınırları doğru olarak tespit edemezse doku kalınlık ölçümünde yanlış değerlendirme yapar

Nedenleri: Zayıf sinyal, tilte disk, stafiloma, geniş PPA, epiretinal zar, arka vitreus dekolmanı

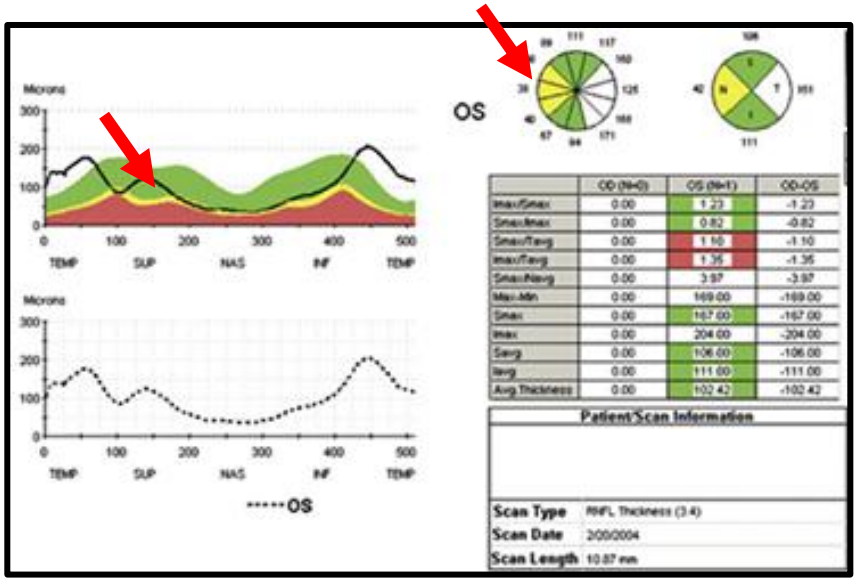
İç segmentasyon hatası



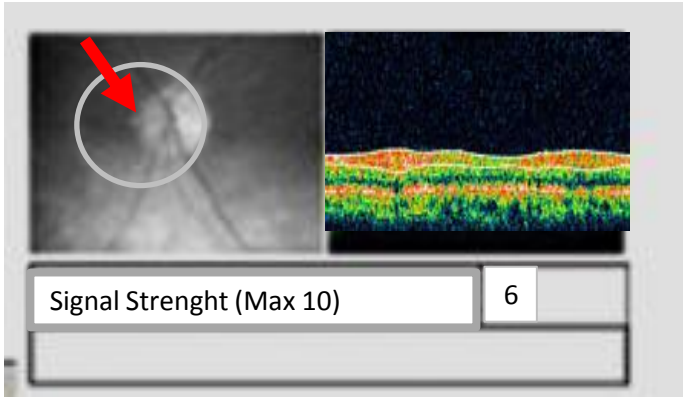
Dış segmentasyon hatası

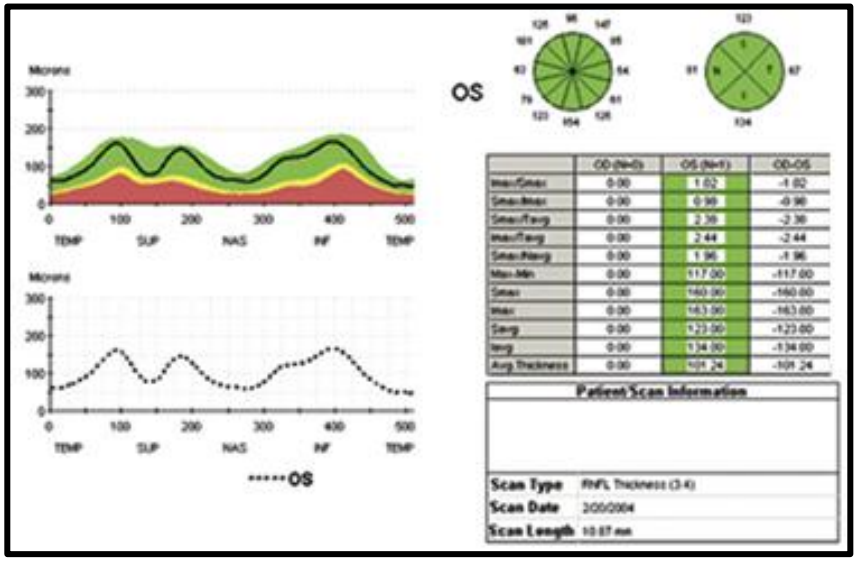


Santralizasyon

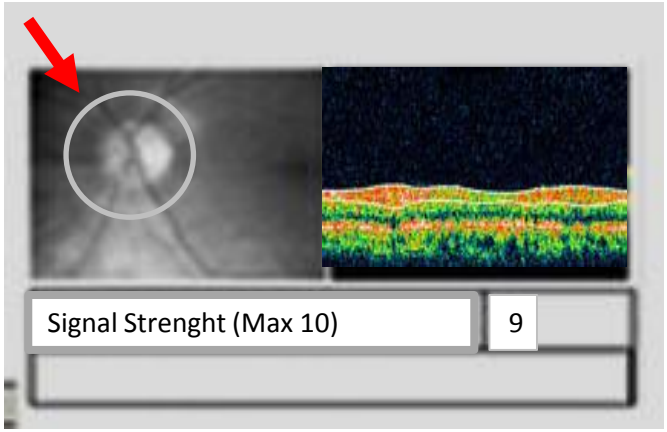


Halka yerleşimi yanlış





Halka yerleşimi doğru



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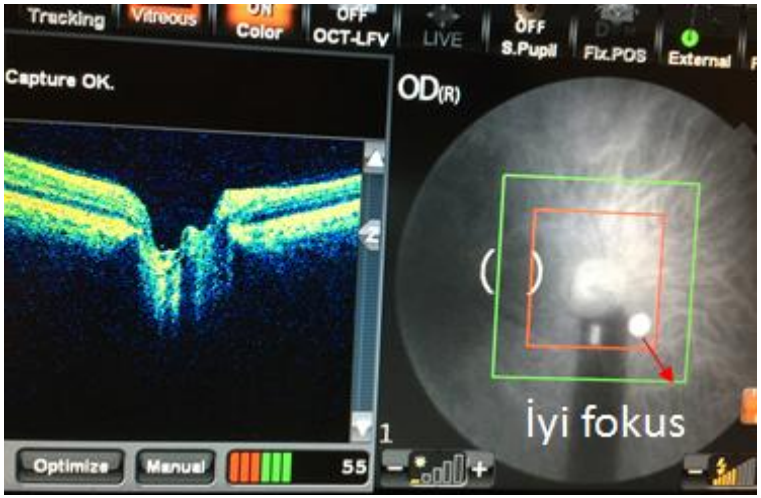
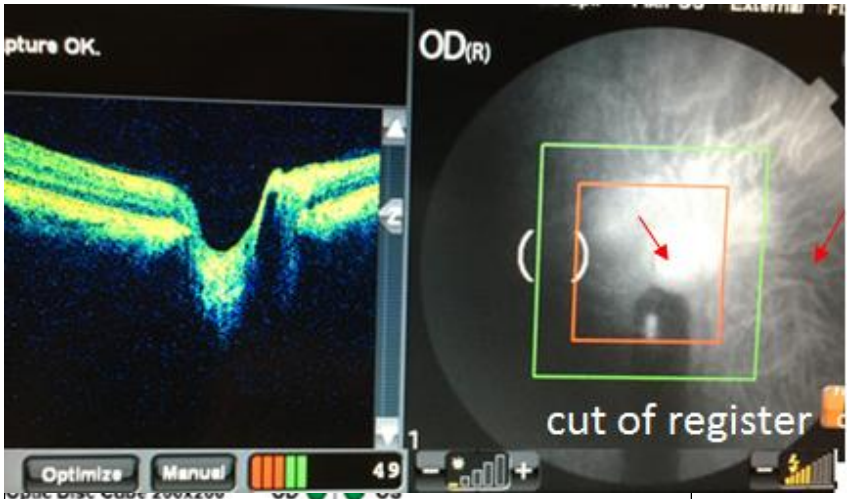
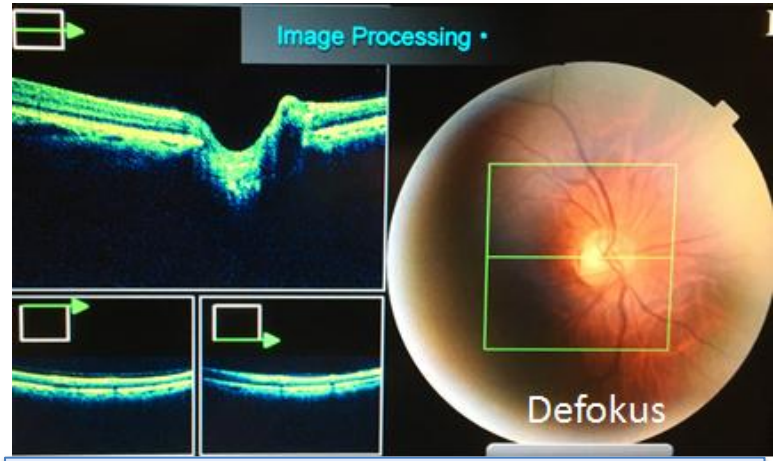
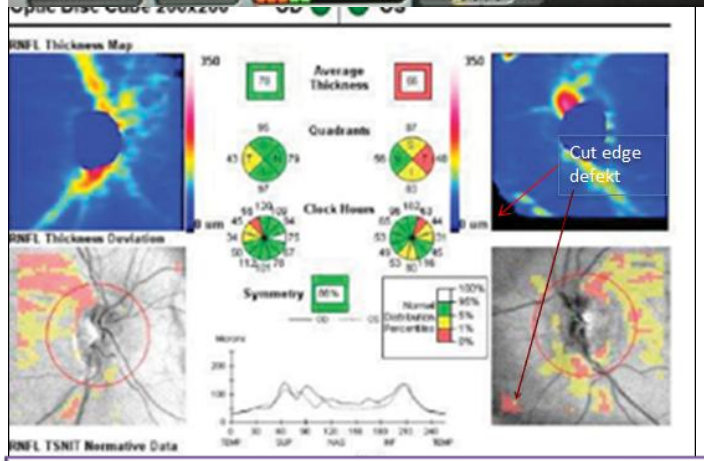
Operatör hataları:

Defokus, Cut of register, Cut edge defektleri









Cut edge defekt

±2 D'lik defokus RSLT'da yaklaşık 10 µ'luk bir incelme oluşturabilir.

- Görüntüde kenarlar tam dahil edilmemiştir
- Bu durum daha az problem yaratır, çünkü merkezi retina kalınlığını etkilemez

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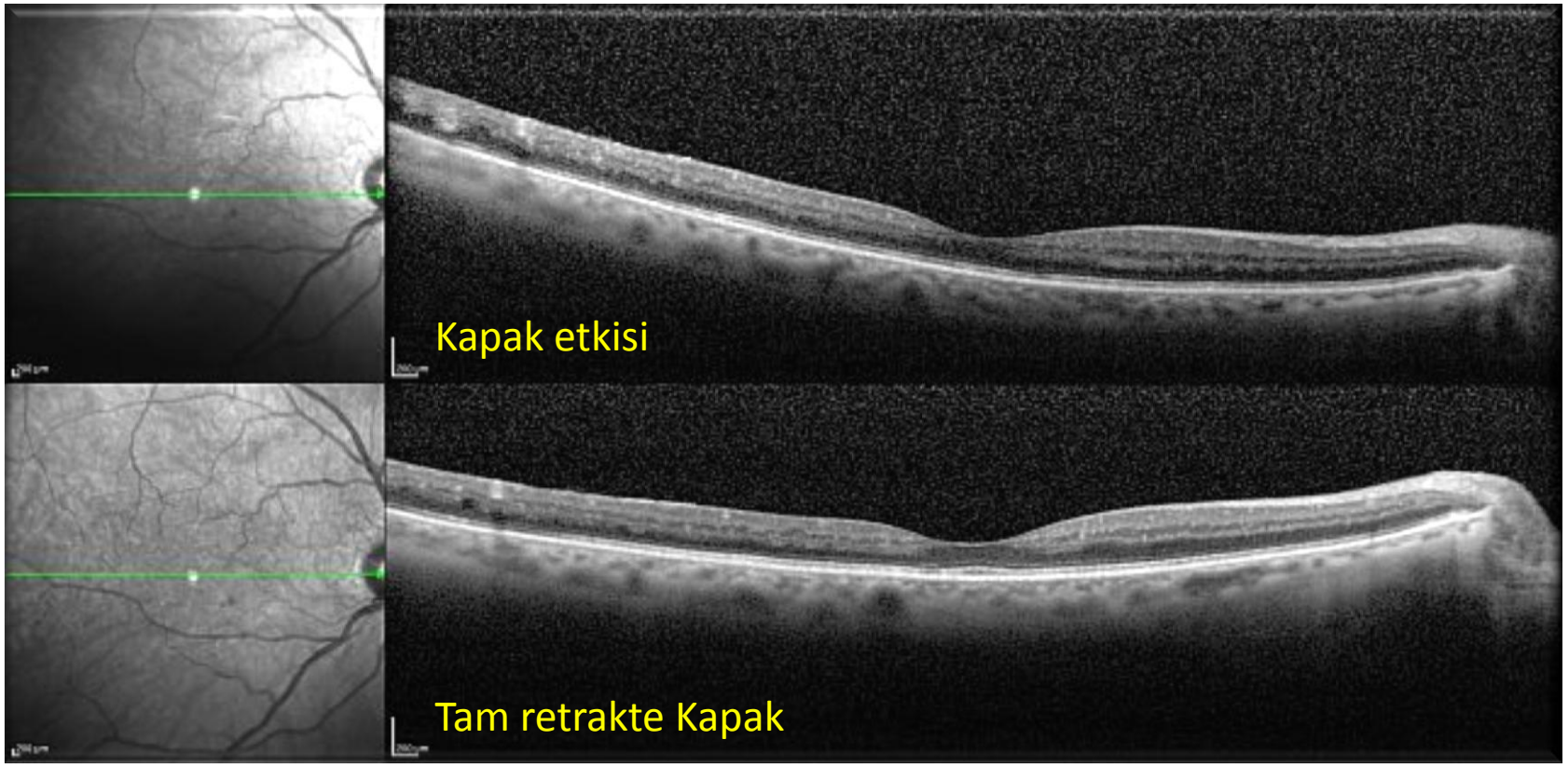
Sinyal gücü azalması

- Düşük sinyal gücü görüntü kalitesini etkileyebilir ve RSLT kalınlığında artifisyel incelme nedeni olabilir.

SD OCT tipi	Tarama kalite indeksi
Cirrus HD OCT	Sinyal gücü >6 (Max 10)
RTVue	Sinyal güç indeksi (SSI)≥ 30 (Max 100)
3D-OCT	Görüntü kalitesi >45 (Max 160)
Spectralis SD-OCT	Kalite (Q)>15 (Max 40)

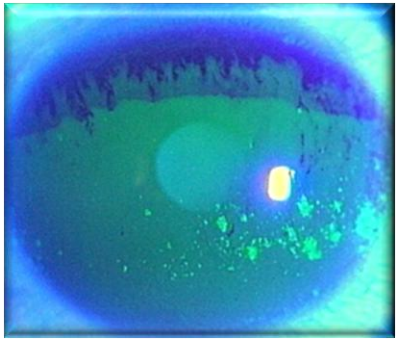
Mwanza JC, Bhorade AM, Sekhon N, et al. Effect of cataract and its removal on signal strength and peripapillary retinal nerve fiber layer optical coherence tomography measurements. J Glaucoma 2011;20:37-43.

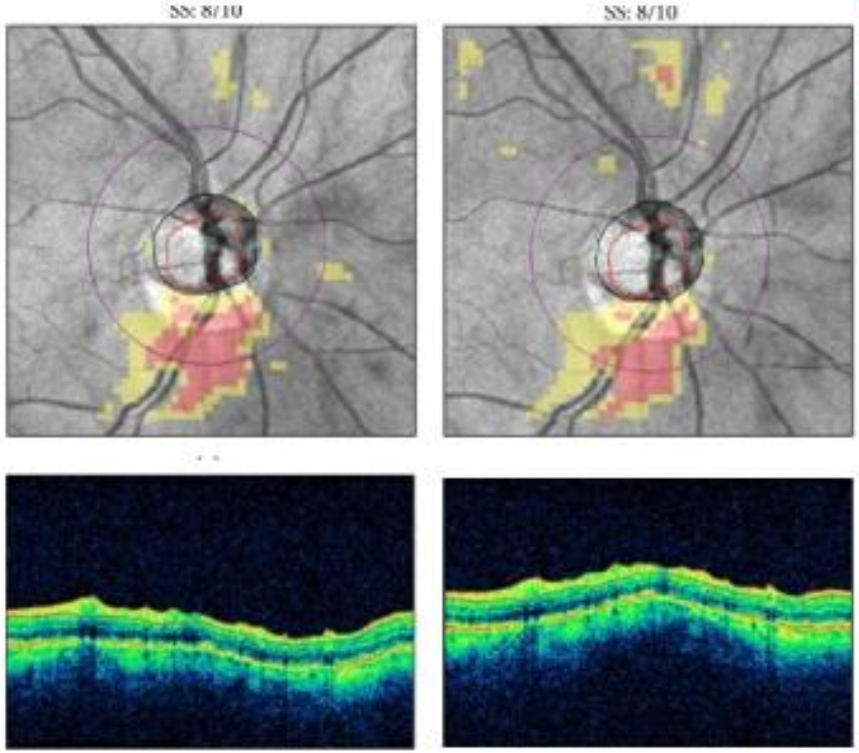
Düşük sinyal gücü
-Kapak etkisi-

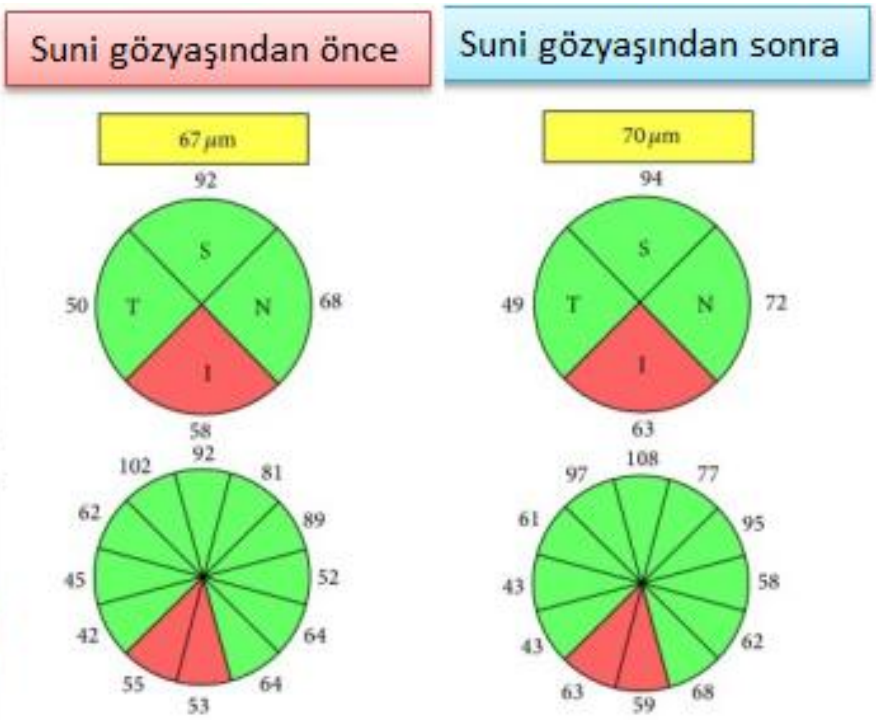


Düşük sinyal gücü

-Kuru göz-

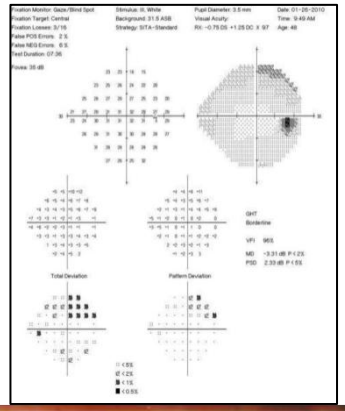


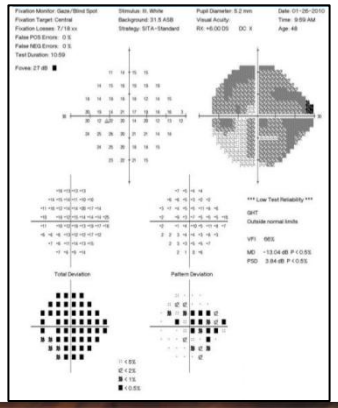


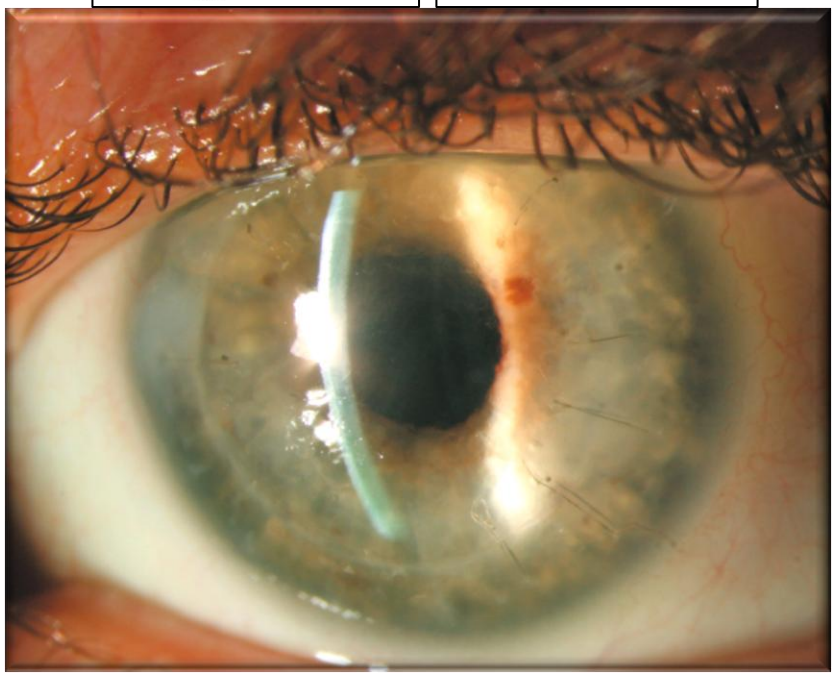


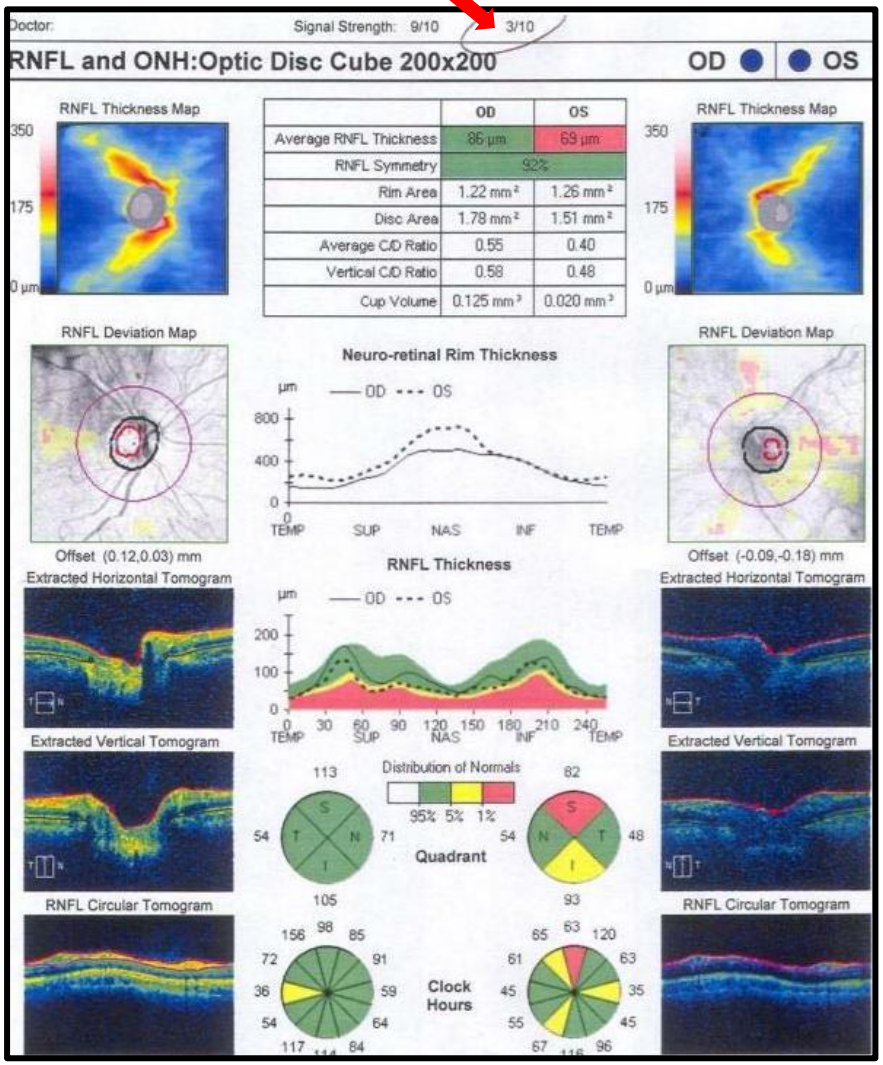
Düşük sinyal gücü

-Kornea ödemi-



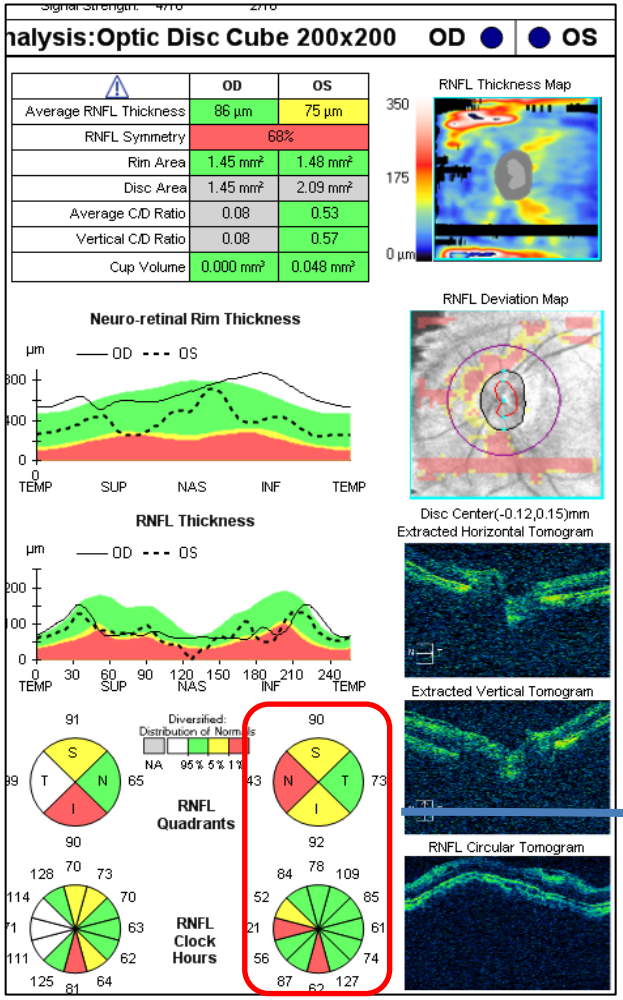


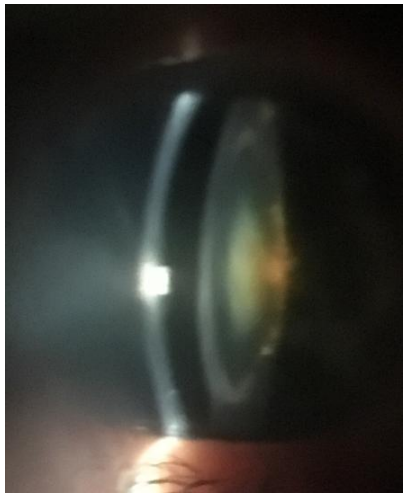




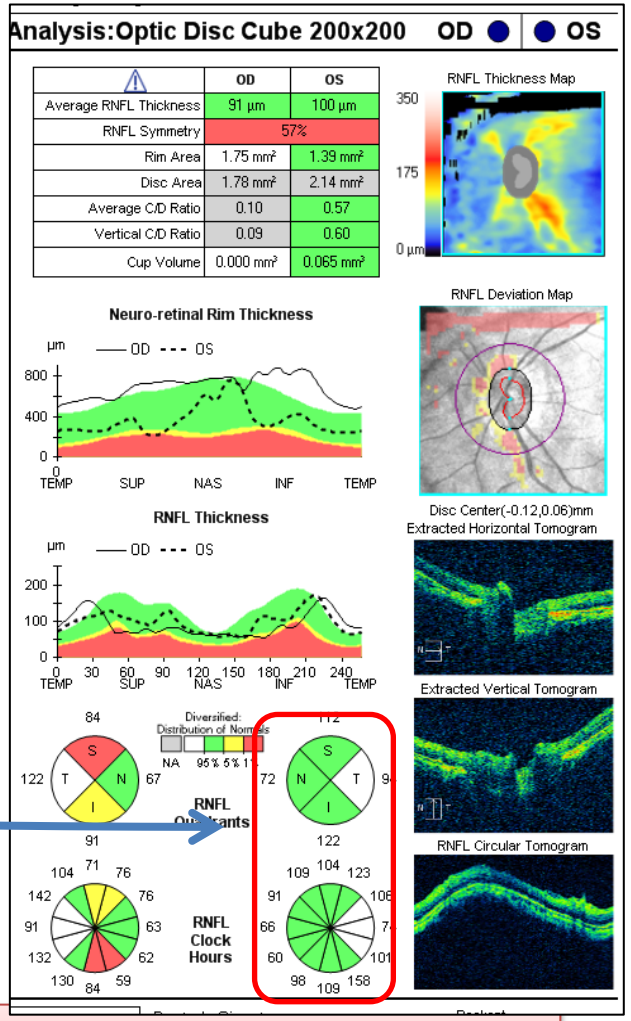
Düşük sinyal gücü

-Katarakt etkisi-





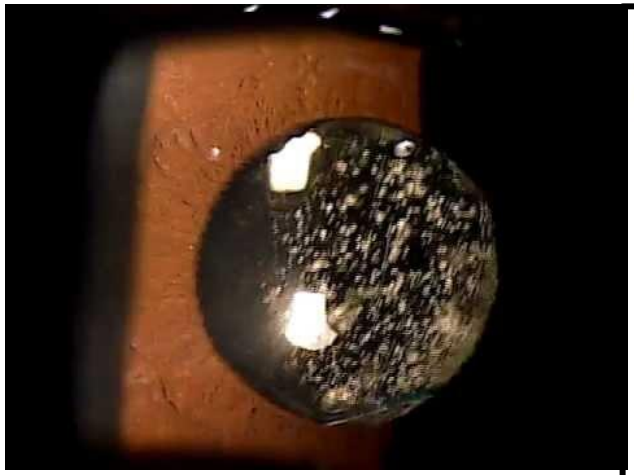
Katarakt cerrahisi

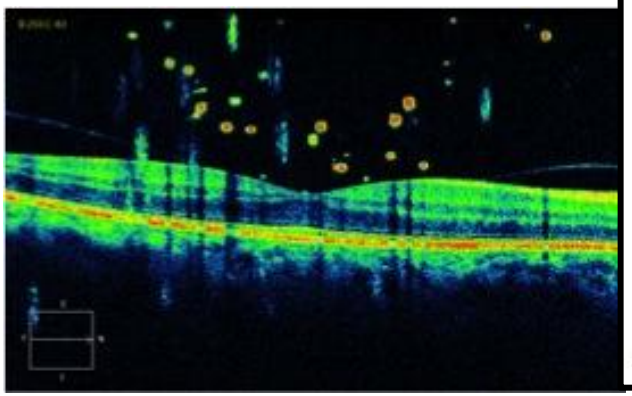


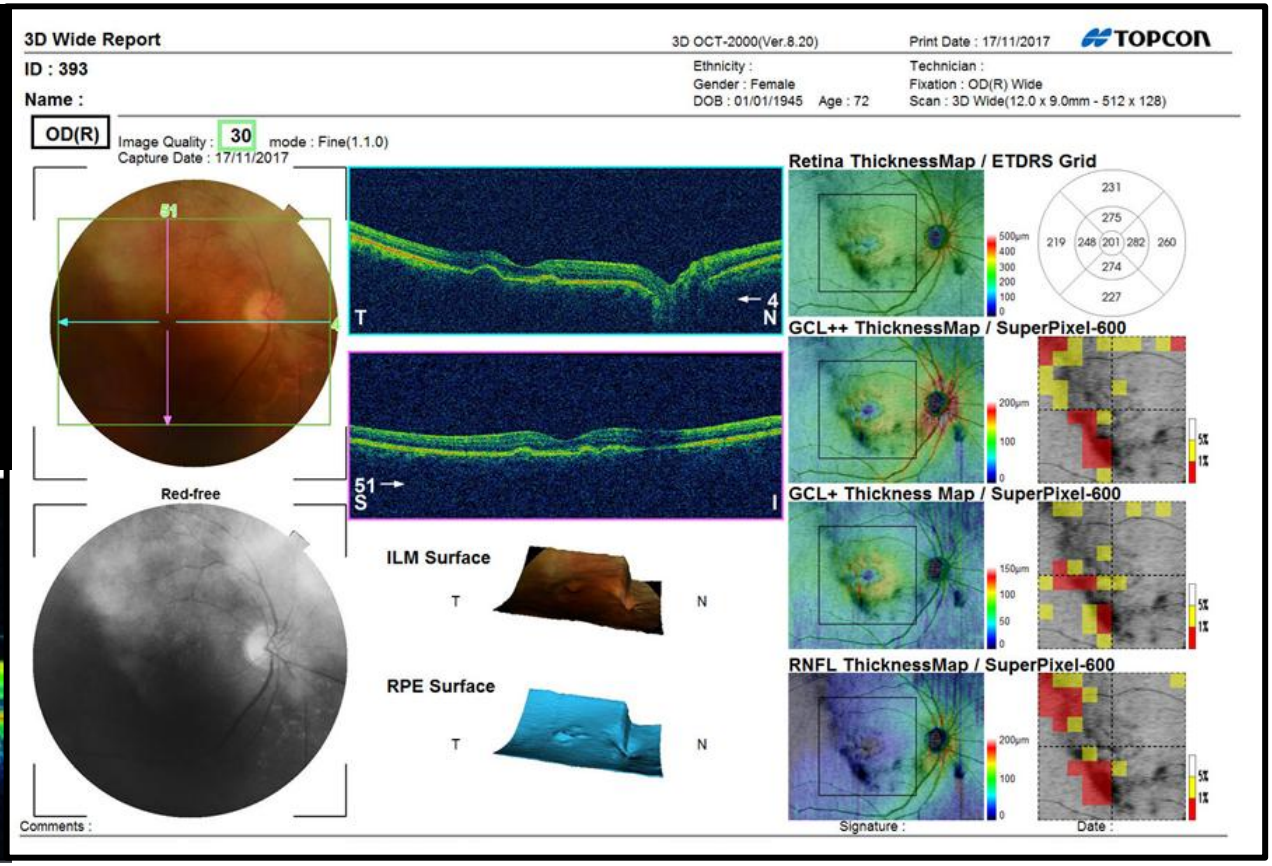
Katarakt cerrahisinden sonra ort RSLT kalınlık artışı %9,3

Mwanza JC, Bhorade AM, Sekhon N, et al. Effect of cataract and its removal on signal strength and peripapillary retina nerve fiber layer optical coherence tomography measurements. J Glaucoma 2011;20:37-43

Düşük sinyal gücü
-Sinkizis, asteroid hyaloides-

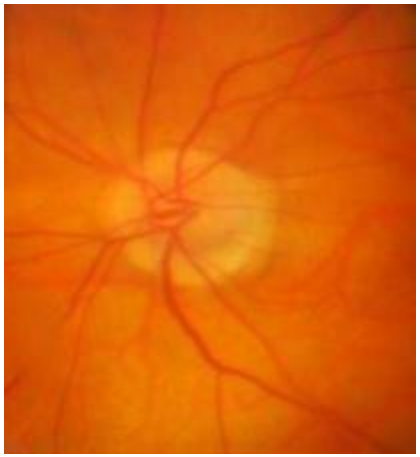


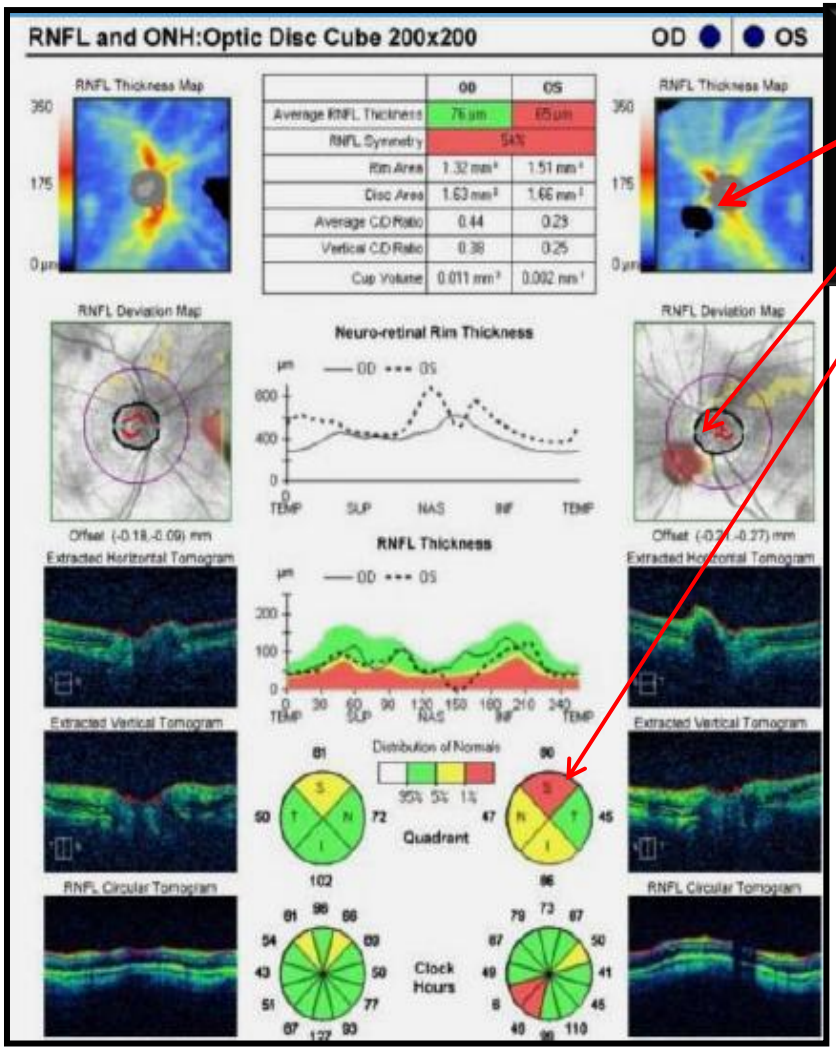


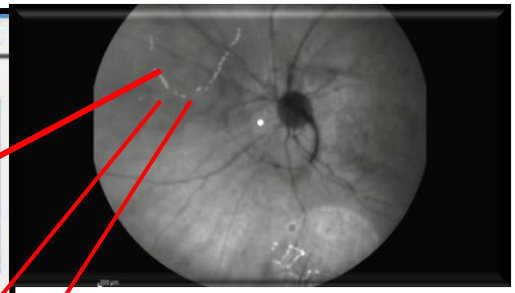


Düşük sinyal gücü

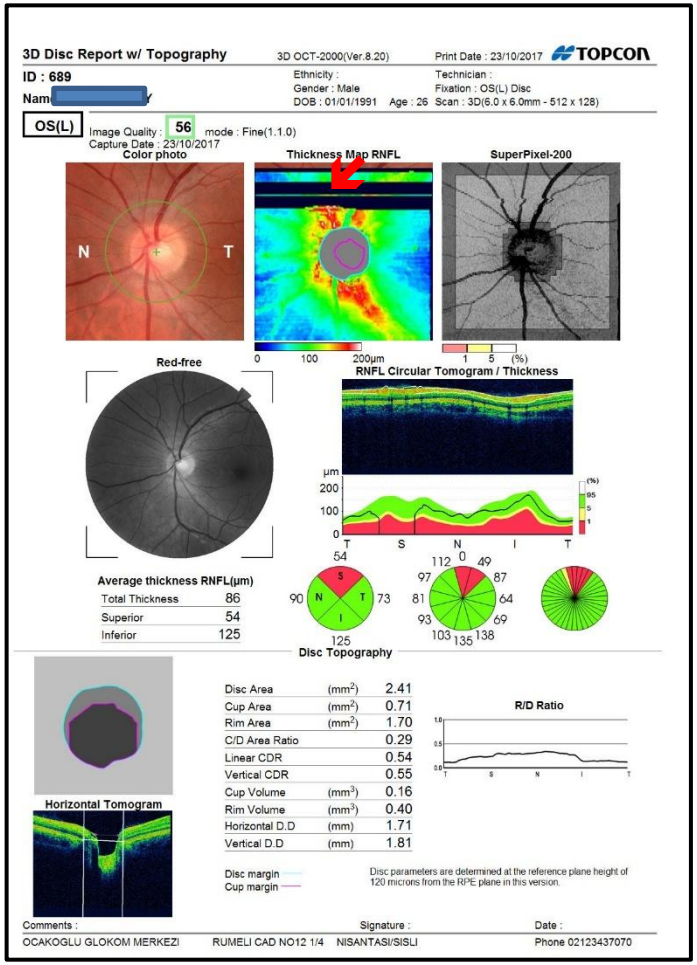
-PVD-

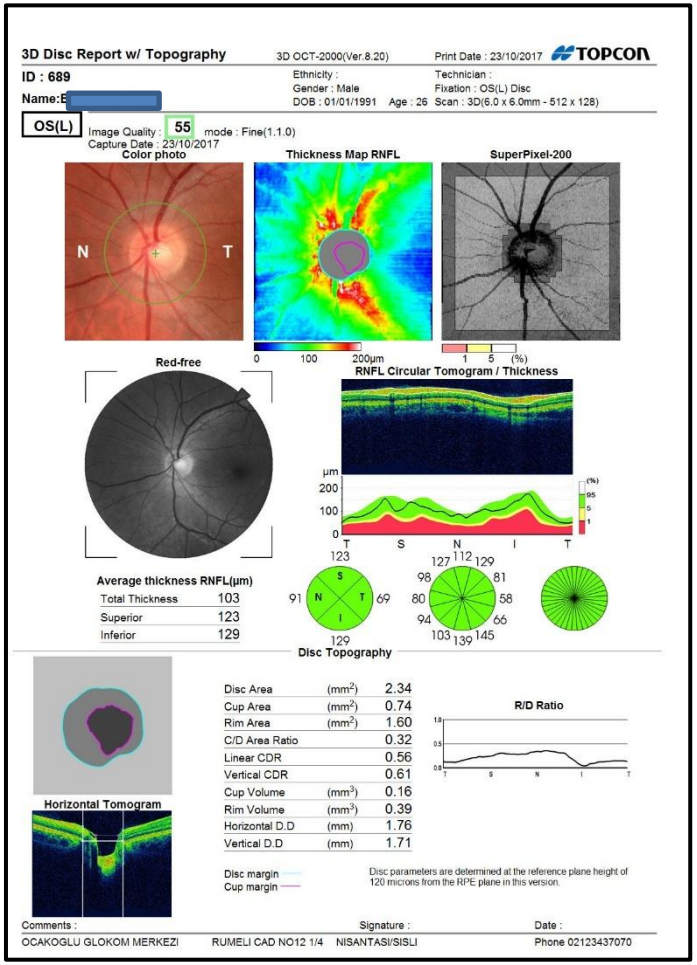






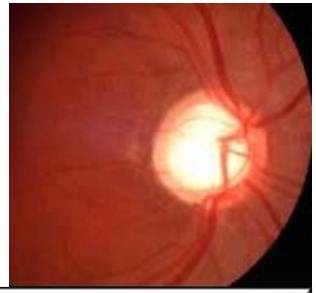
Göz kırpma



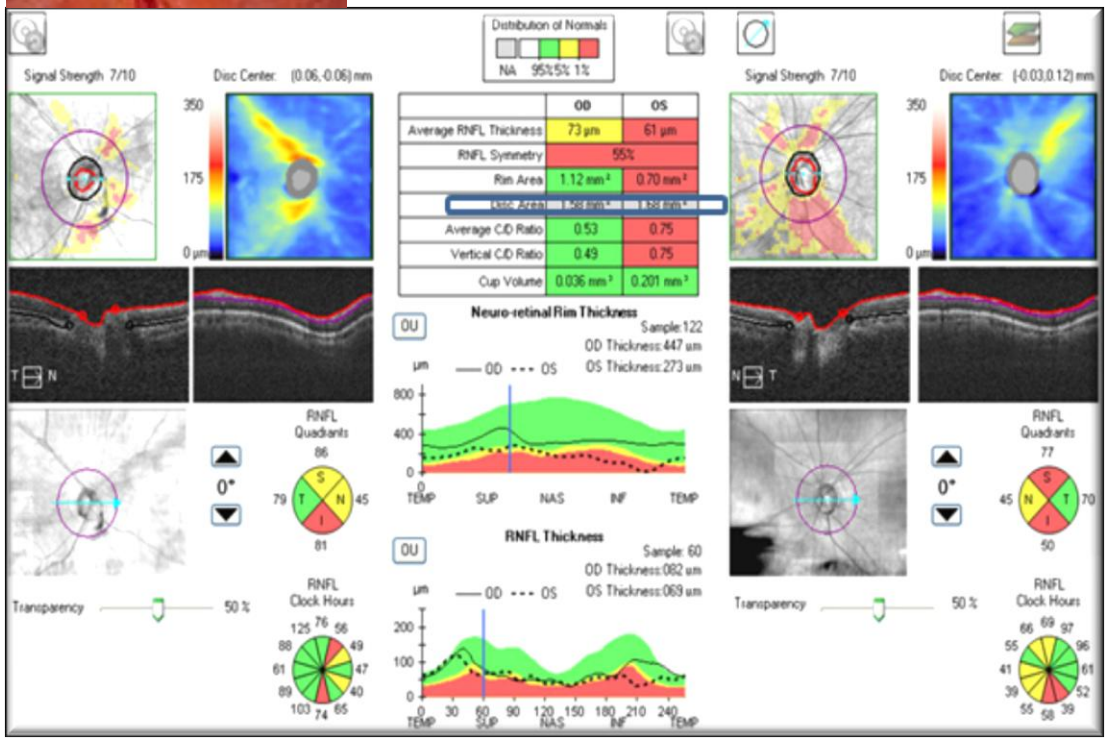


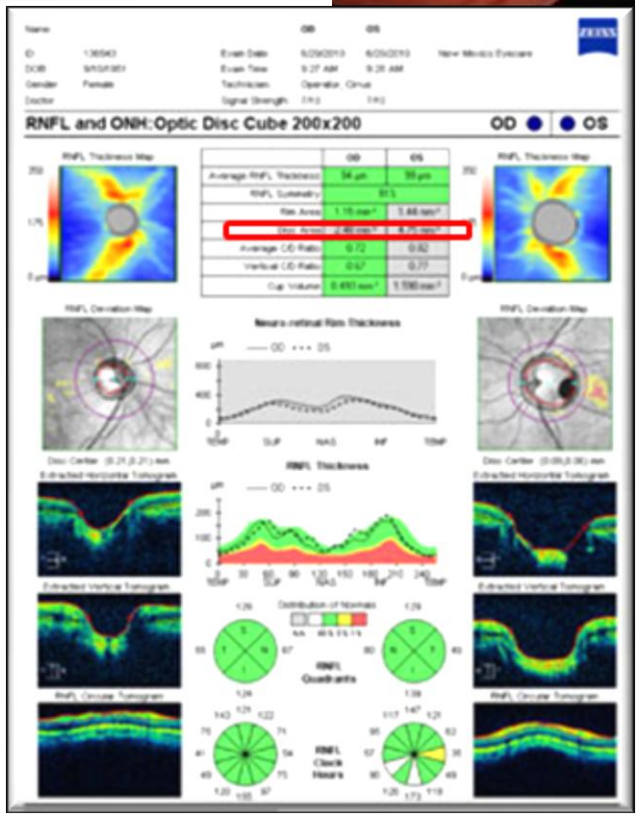
Hasta tarama esnasında gözünü kırparsa en- face görüntüde karanlık alanlar oluşur ve B taramalar bu bölgelerde retinadan data kaydedemezler

Disk alanı



Ort disk alanı: 2.74±0.49mm^2



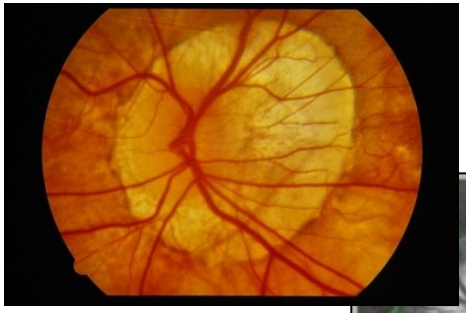


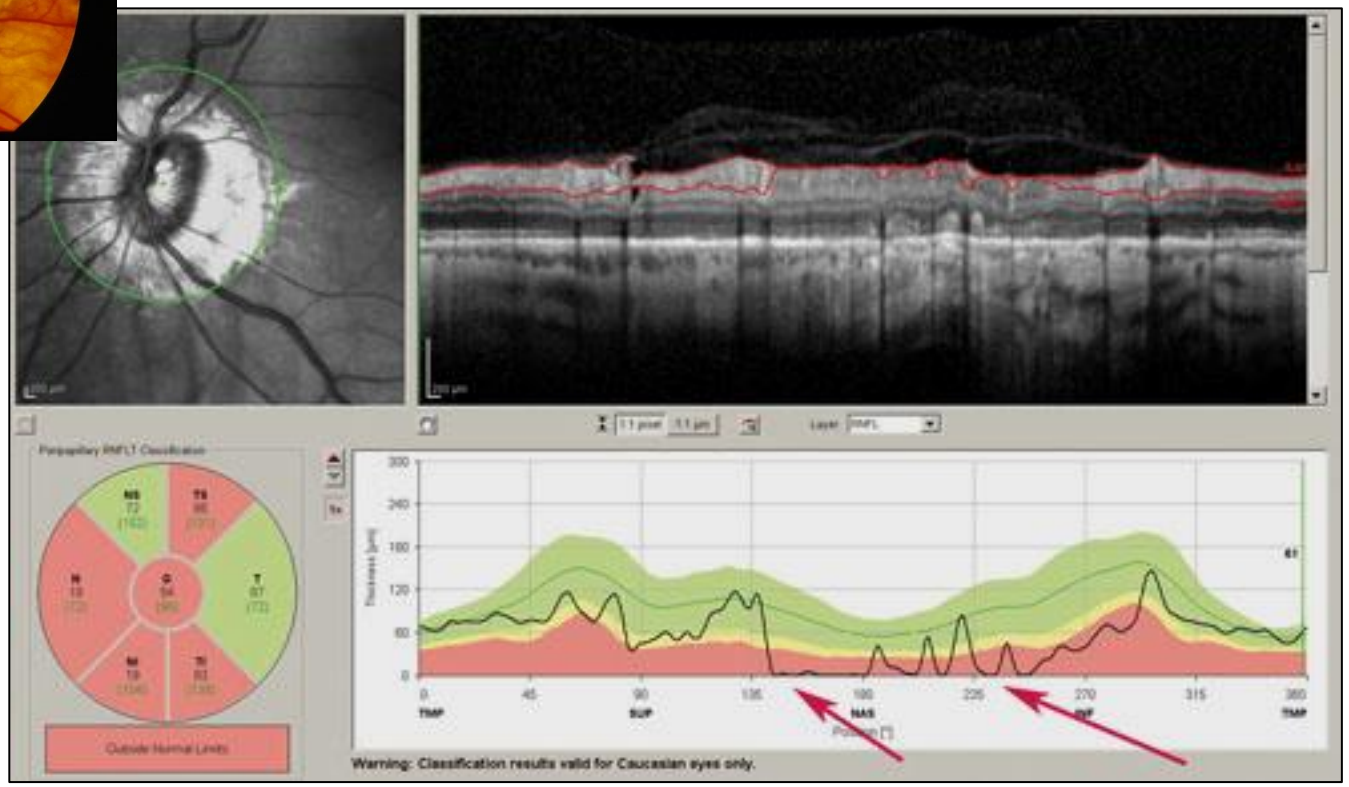
Küçük disk (<2mm^2, daha ince RSLT) ➔ OCT'de false pozitif sonuç (red disease)[1]

Büyük disk (>3mm^2, daha kalın RSLT) ➔ OCT'de false negatif sonuç (green disease)[2]

(1)Kim, Ophthalmology. 2011;118:1774 ; (2)Savini, BJO. 2005;89:489

Peripapiller atrofi

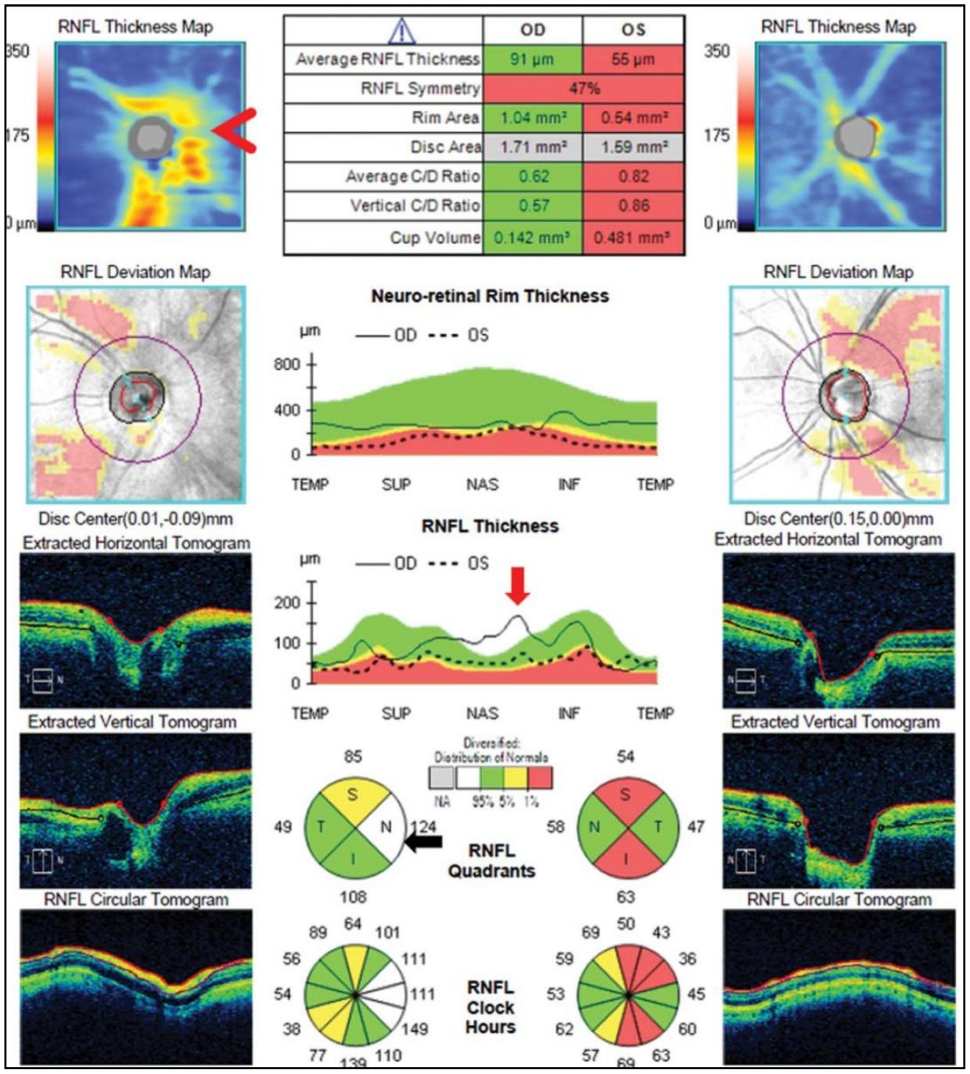




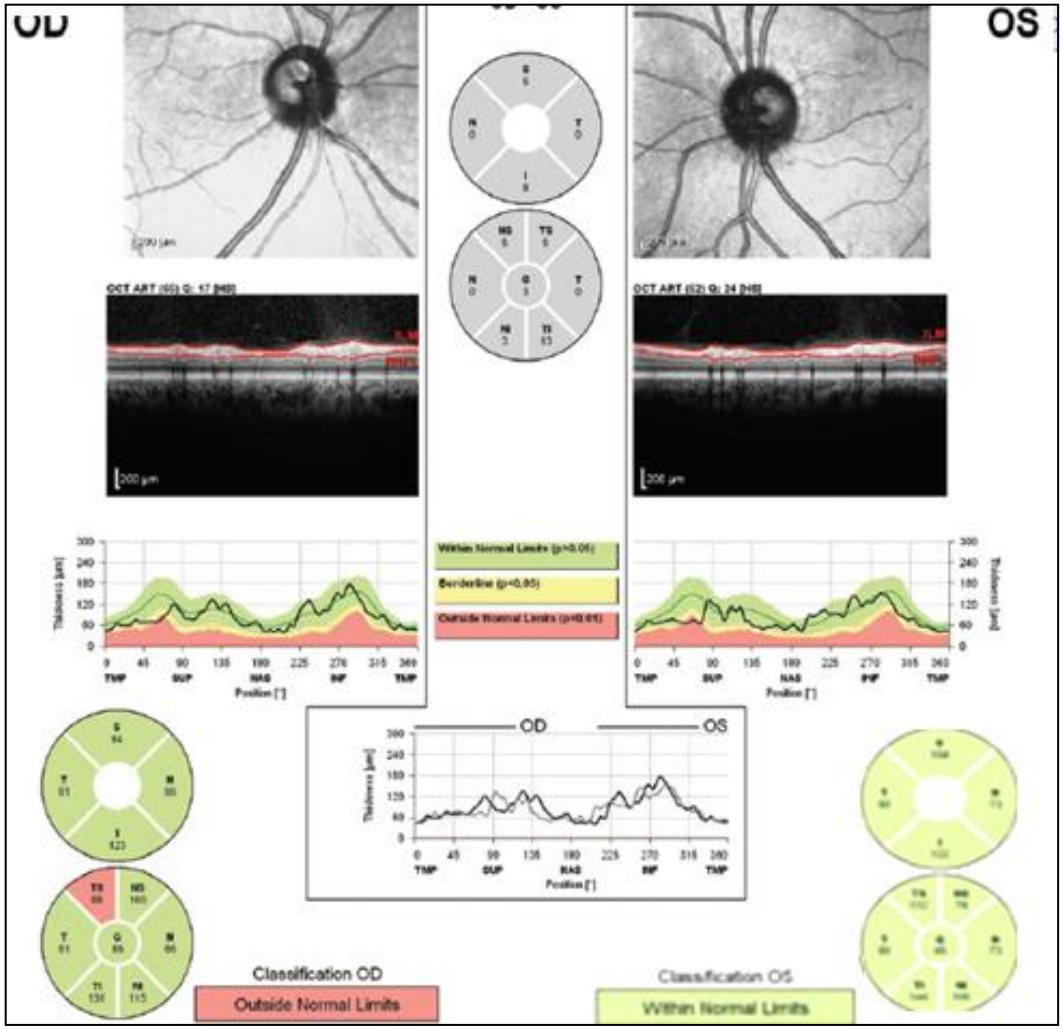
- Segmentasyon yanlış (RSLT değerleri hatalı)
- Santralizasyon sorunlu

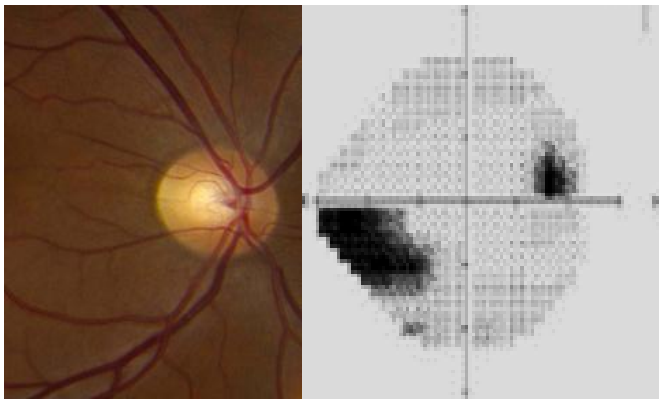
Miyelinli Lifler

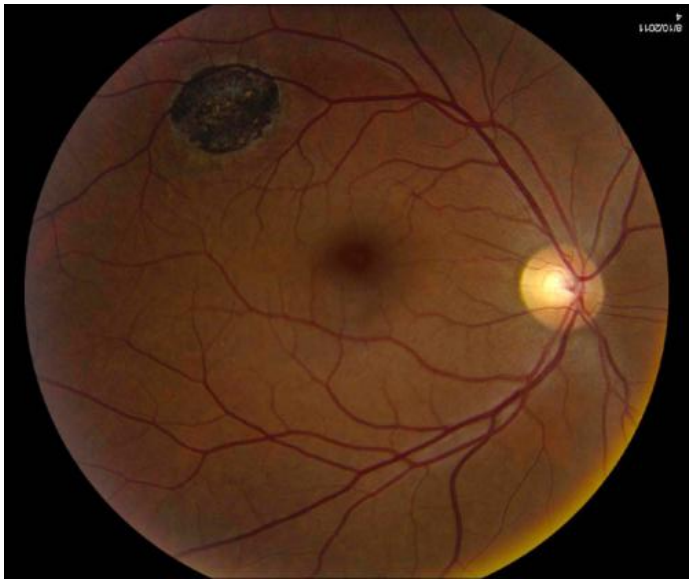
- Bilateral PAAG hastası
- Sağ gözde miyelinli lif + PAAG
- (Nazalde artifisyel RSLT kalınlaşması)



Korioretinal skar

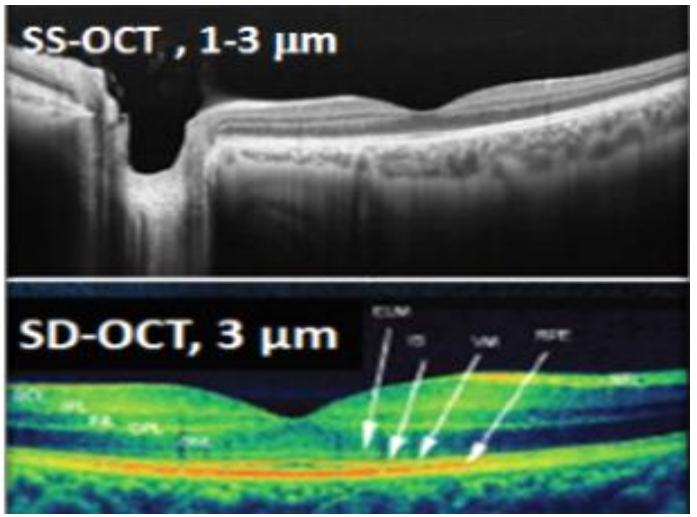






Artefaktları nasıl azaltabiliriz?

- Operatör faktörleri
  - Hastanın çenesinin iyice oturduğuna ve baş pozisyonunun doğru yerleştiğine dikkat
  - En iyi görüntüyü elde etmek için fokus ayarını iyi yap
  - Işıkları hafifçe azalt (pupillayı dilate et)
  - Kuru göze dikkat (suni gözyaşı)
  - Çekim esnasında göz kırpmaya dikkat
  - Daha iyileştirilmiş segmentasyon algoritmaları kullanımı




teşekkürler.....