

2- Epi-Off CXL

When to do???

- In moderate and advanced cases.
 - In young patients < 25 ys old.
-

Birthdate: 08/09/1991
 Identification code: 111467
 Exam date and time: 06/11/2014 5:07 AM
 Acquisition date: 06/11/2014 05:07:58 [1-2]

Acquisition quality

Summary Indices

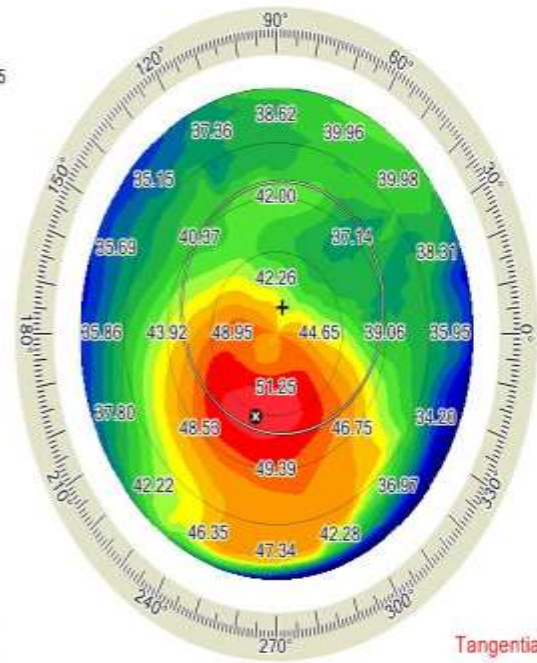
Horizontal Visible Iris Diameter
 HVID = 12.74 mm
 + Pupil (Topographic)
 x = 0.13 mm, y = 0.49 mm
 Ø = 4.63 mm
 ♦ Thinnest location
 x = -0.83 mm, y = -0.87 mm
 Thk = 429 µm
 ⊙ Apex
 x = -0.46 mm, y = -1.53 mm
 Thk = 445 µm Curv = 52.01 D
 Anterior chamber
 CCT + AD = 0.443 + 4.05 = 4.49 mm
 Volume = 279 mm³
 Iridocorneal angle = 53°
 Corneal volume (Ø = 10 mm)
 Volume = 48.7 mm³

K readings (Front)

Sim-K
 n0 = 1, n1 = 1.3375
 Sim-K
 K1 = 45.21 D @ 49°
 K2 = 47.54 D @ 139°
 Avg = 46.35 D
 Cyl = -2.33 D Ax 49°



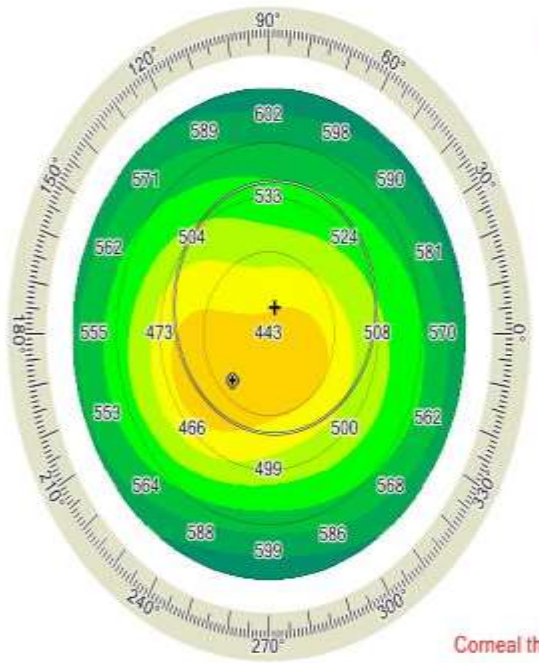
OD



Tangential anterior

OD
 n0 = 1
 n1 = 1.3375
 65.50
64.00
62.50
61.00
59.50
58.00
56.50
55.00
53.50
52.00
50.50
49.00
47.50
46.00
44.50
43.00
41.50
40.00
38.50
37.00
35.50
34.00
32.50
31.00
29.50
28.00

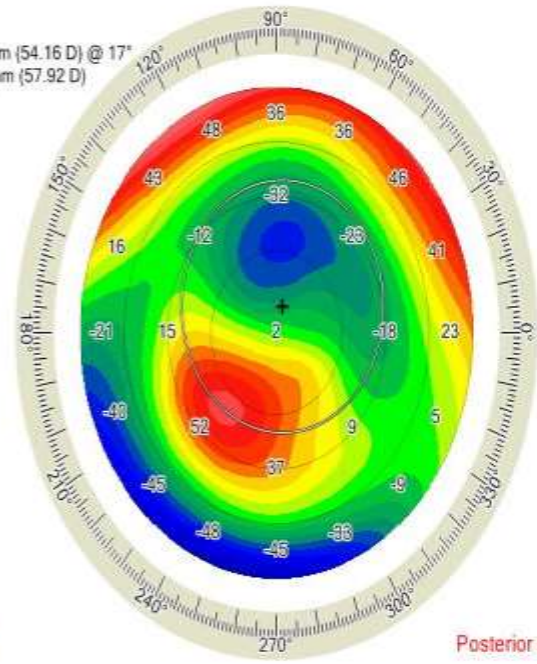
OD



Corneal thickness

CSO

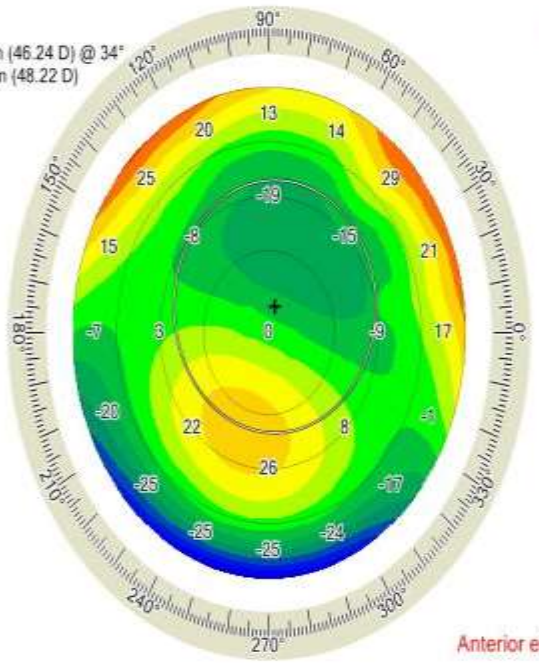
OD



Posterior elevation

OD
 120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

OD



Anterior elevation

CSO

170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

CSO

120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120

CSO

r = 7.30 mm (46.24 D) @ 34°
 rs = 7.00 mm (48.22 D)
 Q = -0.50

r = 6.23 mm (54.16 D) @ 17°
 rs = 5.83 mm (57.92 D)
 Q = -0.57

Intracorneal Rings

Goals of Rings for Keratoconus

- To improve UCVA
- To improve BCVA
- To decrease HOA
- To increase Contact Lens Tolerance

and Prevent the need for a Corneal Transplant

However with Realistic expectations :
Patients will still be dependant
on visual aids



What can be expected from Rings ?

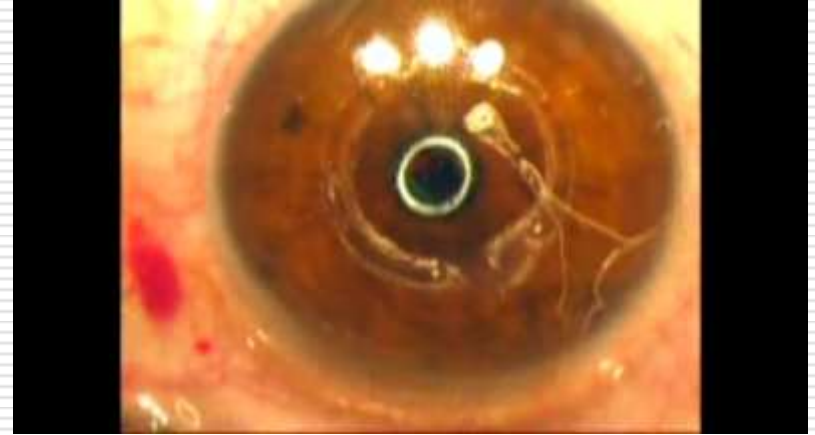
- SE Decreased by a mean of 1.45 to 3.46 D
- CYL Decreased by a mean of 0,24 to 2.88 D
- K readings Decreased by a mean of 1.57 to 5.59 D

Based on the literature data, with more than 100 publications upon Rings' topic!

Author	Study type	N	SE	Target procedure	Follow-up (months)	Mean change (D)	Mean change (D)	Mean change (D)	Mean change (D)	Mean change (D)
Lee et al. (2000)	Prospective clinical trial	300	1000	Myopia	6	2.11	1.8	1.1	-	0.8
Lee et al. (2001)	Prospective clinical trial	300	1000	Myopia	12	2.11	1.8	1.1	-	0.8
Lee et al. (2002)	Prospective clinical trial	300	1000	Myopia	18	2.11	1.8	1.1	-	0.8
Lee et al. (2003)	Prospective clinical trial	300	1000	Myopia	24	2.11	1.8	1.1	-	0.8
Lee et al. (2004)	Prospective clinical trial	300	1000	Myopia	30	2.11	1.8	1.1	-	0.8
Lee et al. (2005)	Prospective clinical trial	300	1000	Myopia	36	2.11	1.8	1.1	-	0.8
Lee et al. (2006)	Prospective clinical trial	300	1000	Myopia	42	2.11	1.8	1.1	-	0.8
Lee et al. (2007)	Prospective clinical trial	300	1000	Myopia	48	2.11	1.8	1.1	-	0.8
Lee et al. (2008)	Prospective clinical trial	300	1000	Myopia	54	2.11	1.8	1.1	-	0.8
Lee et al. (2009)	Prospective clinical trial	300	1000	Myopia	60	2.11	1.8	1.1	-	0.8
Lee et al. (2010)	Prospective clinical trial	300	1000	Myopia	66	2.11	1.8	1.1	-	0.8
Lee et al. (2011)	Prospective clinical trial	300	1000	Myopia	72	2.11	1.8	1.1	-	0.8
Lee et al. (2012)	Prospective clinical trial	300	1000	Myopia	78	2.11	1.8	1.1	-	0.8
Lee et al. (2013)	Prospective clinical trial	300	1000	Myopia	84	2.11	1.8	1.1	-	0.8
Lee et al. (2014)	Prospective clinical trial	300	1000	Myopia	90	2.11	1.8	1.1	-	0.8
Lee et al. (2015)	Prospective clinical trial	300	1000	Myopia	96	2.11	1.8	1.1	-	0.8
Lee et al. (2016)	Prospective clinical trial	300	1000	Myopia	102	2.11	1.8	1.1	-	0.8
Lee et al. (2017)	Prospective clinical trial	300	1000	Myopia	108	2.11	1.8	1.1	-	0.8
Lee et al. (2018)	Prospective clinical trial	300	1000	Myopia	114	2.11	1.8	1.1	-	0.8
Lee et al. (2019)	Prospective clinical trial	300	1000	Myopia	120	2.11	1.8	1.1	-	0.8
Lee et al. (2020)	Prospective clinical trial	300	1000	Myopia	126	2.11	1.8	1.1	-	0.8
Lee et al. (2021)	Prospective clinical trial	300	1000	Myopia	132	2.11	1.8	1.1	-	0.8
Lee et al. (2022)	Prospective clinical trial	300	1000	Myopia	138	2.11	1.8	1.1	-	0.8
Lee et al. (2023)	Prospective clinical trial	300	1000	Myopia	144	2.11	1.8	1.1	-	0.8
Lee et al. (2024)	Prospective clinical trial	300	1000	Myopia	150	2.11	1.8	1.1	-	0.8
Lee et al. (2025)	Prospective clinical trial	300	1000	Myopia	156	2.11	1.8	1.1	-	0.8

See meta-analysis in literature – Afio et al

Types of Rings



Ideal patient for rings

- High errors.
 - Mean Keratometry > 48 Ds
 - K Max > 50 Ds
 - BCVA $< 6/30$
 - High patient motivation
-

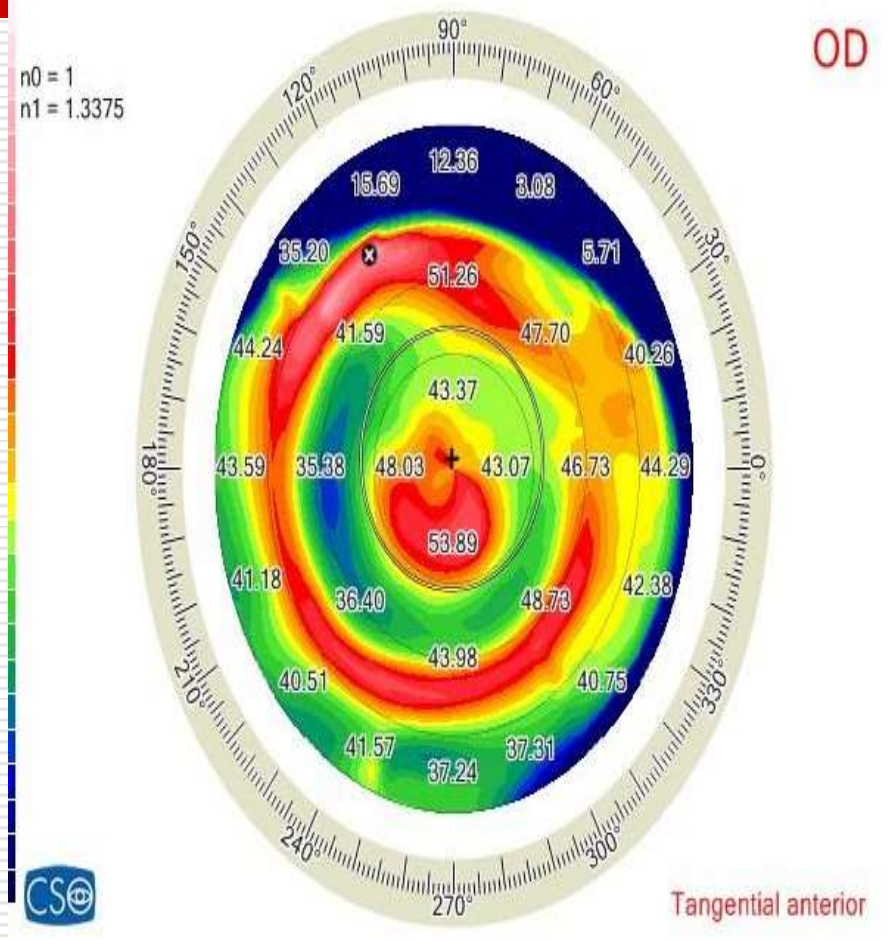
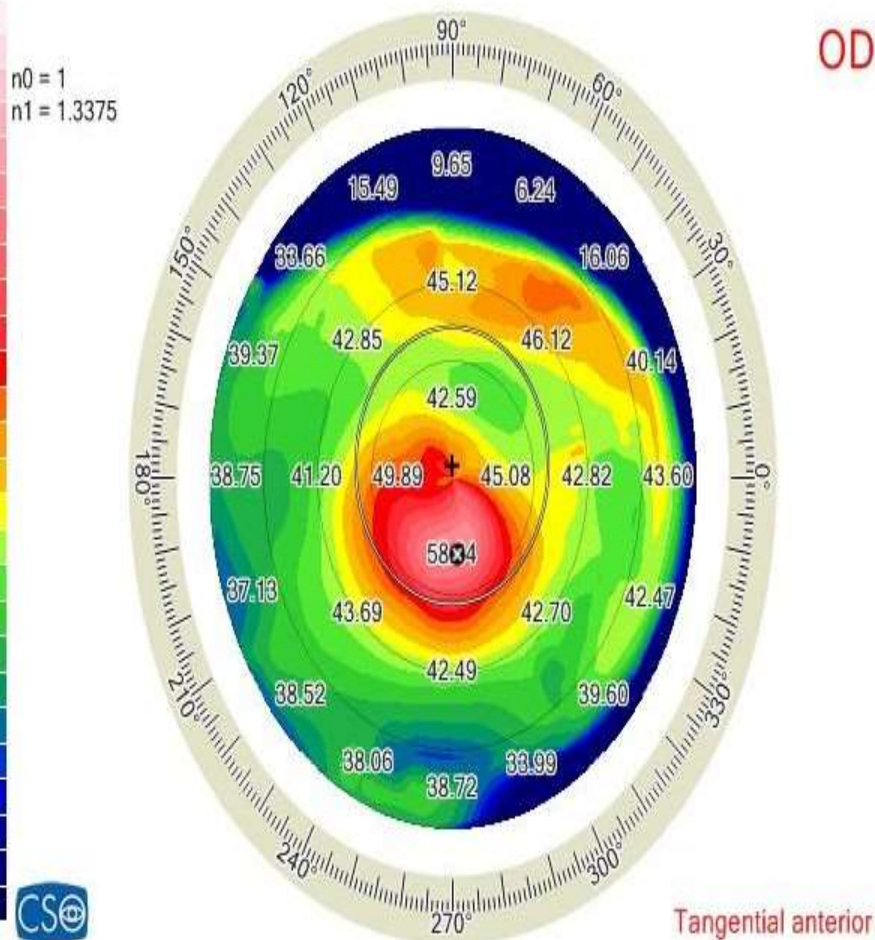
Which type ??????



Kerarings

- Non central cones.
 - High cylinder.
 - High difference between K1, K2.
 - Thickness at insertion site >400 um
-

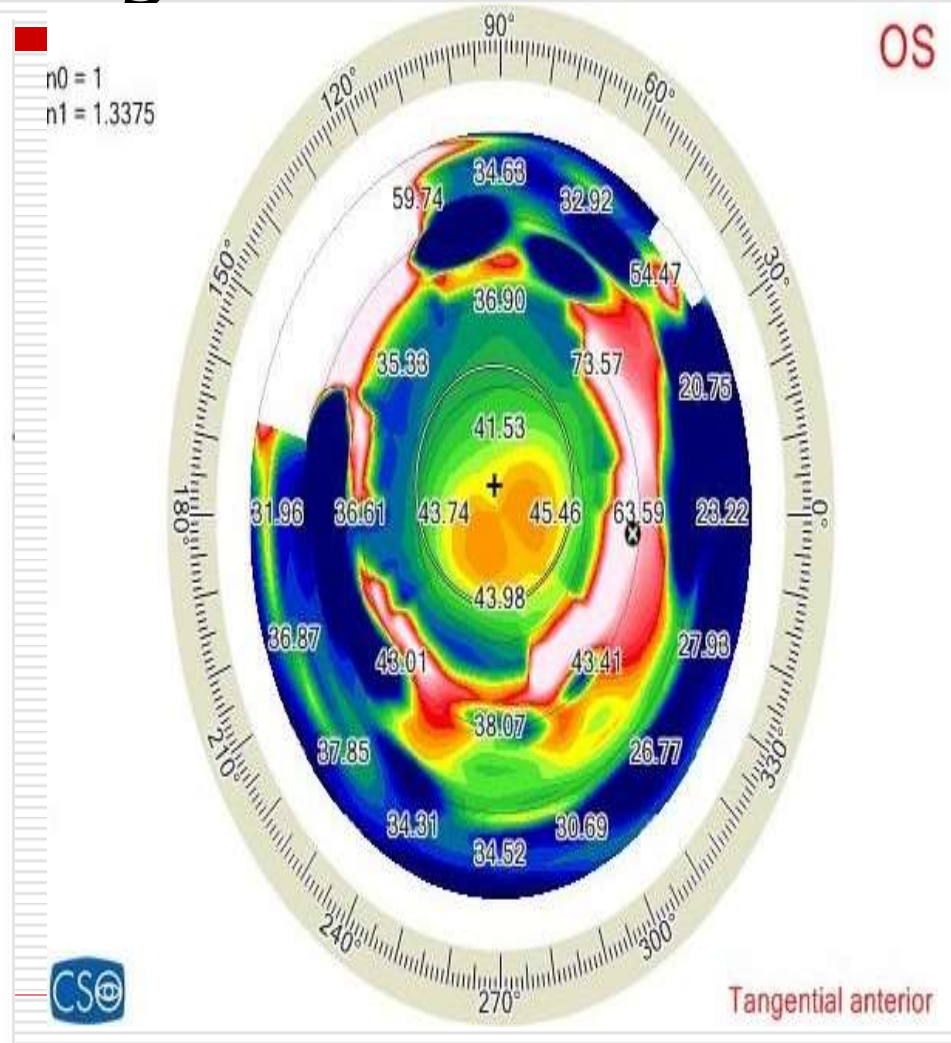
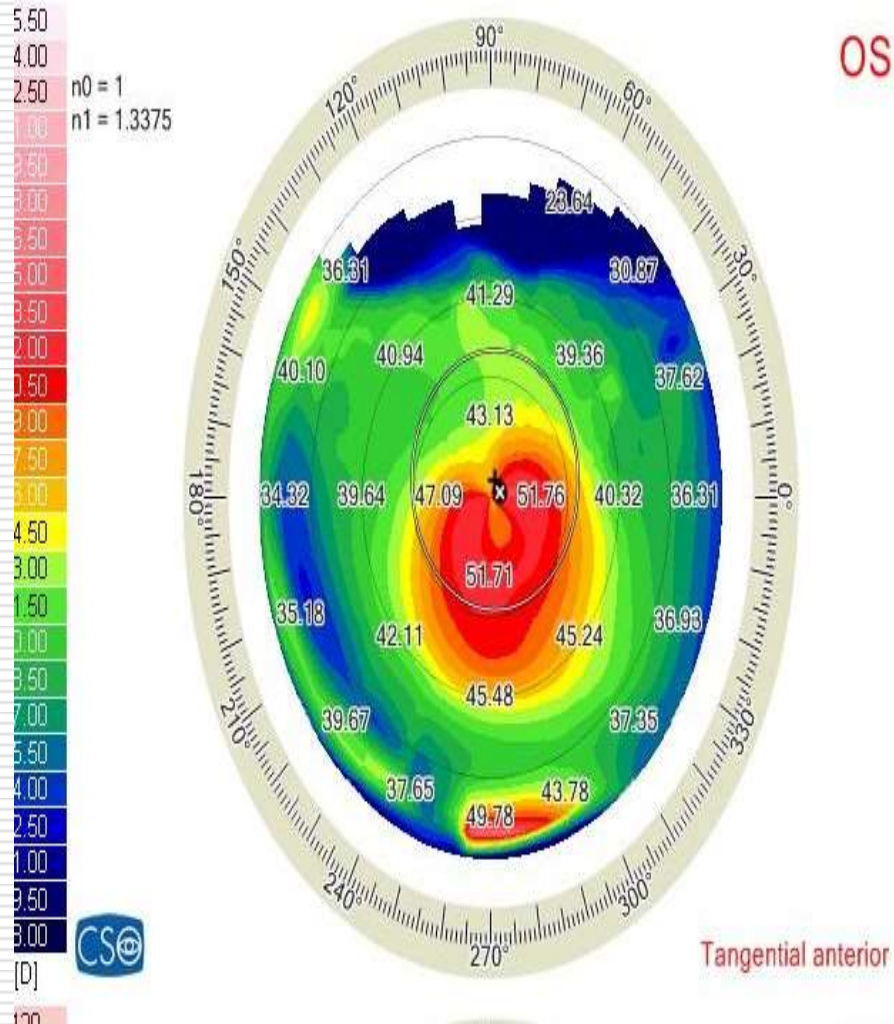
Pre and post Kerarings Pentacam

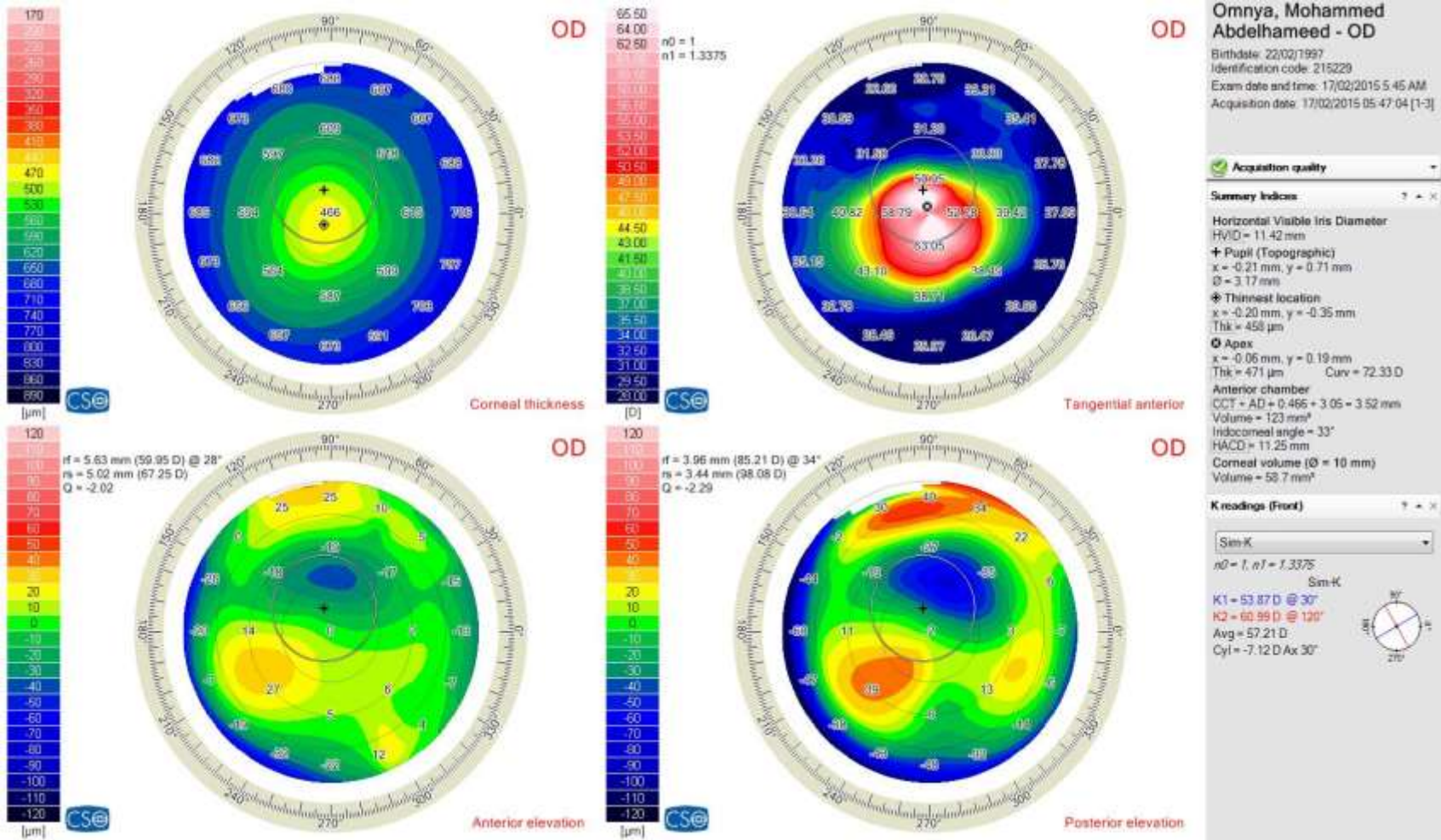


Myoring

- Central cones (Nipple ,Oval , Globus)
 - High K readings K1, K2 with low difference.
 - High errors with high sphere.
 - Thinnest location > 400 um.
 - Epi-off like CXL.
 - Eye without refraction.
-

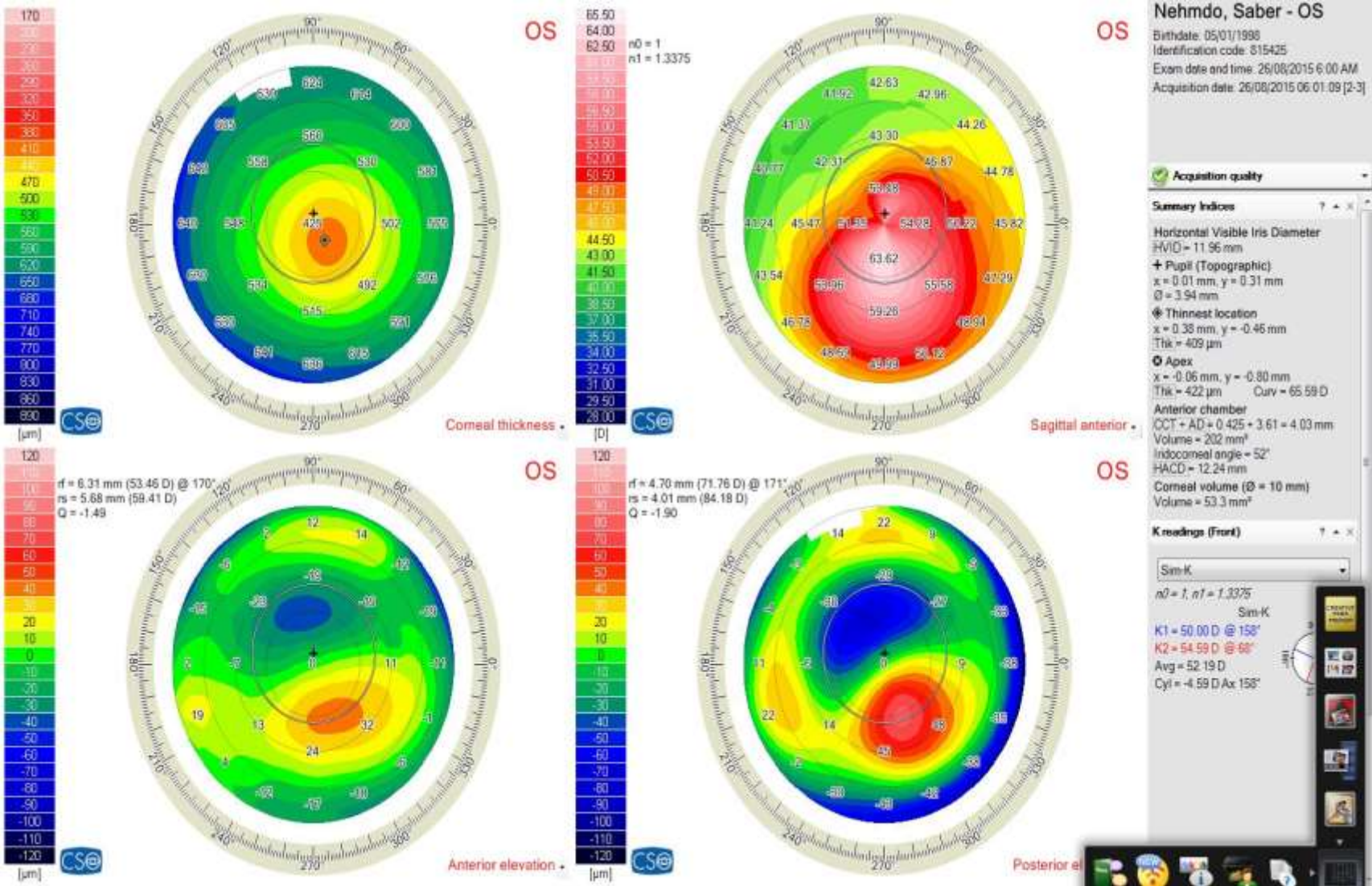
Pre and post Myoring Pentacam





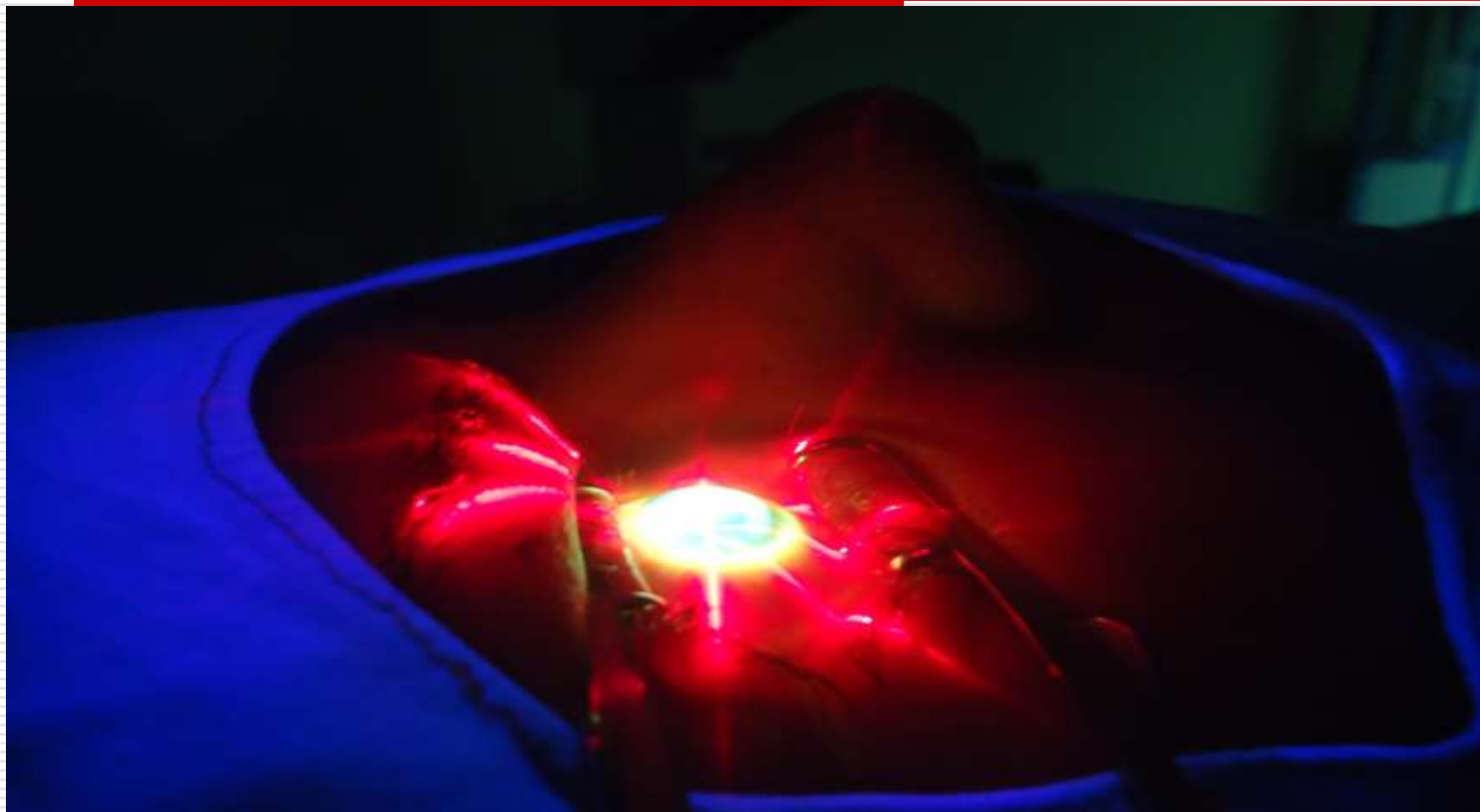
Central cone - Refraction : -8 Ds -7 Dc

- Very high K readings For **Myring implantation**



Shifted cone , Refraction : -9Ds -4.5 Dc -
 K2 @ 68 **For Kerarings implantation** -

Combined CXL with rings



When to do ???

With Myoring:

- It should be done in the same session (intrapocket CXL).
- Epi-off like effect as it crosses the epithelium

With Kerarings:

- It should be done in the same session or after ring implantation not before.
-

Age as a guideline for decision

