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ISTITUTO NAZIONALE DI
OTTICA APPLICATA

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Irregular Cornea's correction with Silicon Hidrogel contact lenses

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ABSTRACT

In this report we're going to see the results that we can achieve treating eyes with keratoconus or irregular cornea using Soft Silicon Hydrogel contact lenses (with central thickness $>$ than common SiHi lenses)

Usually for these cases the best solution is a RGP lens: it provides excellent optical quality but, as we know, sometimes are not well tolerated and are not suitable to practice certain sports or jobs.

In literature the use of Soft contact lenses is known to be efficacious for irregular corneas but it has got some restriction because of the traditional Hydrogel lenses low Oxygen permeability. Now we have to reevaluate this option thanks to SiHi lenses.

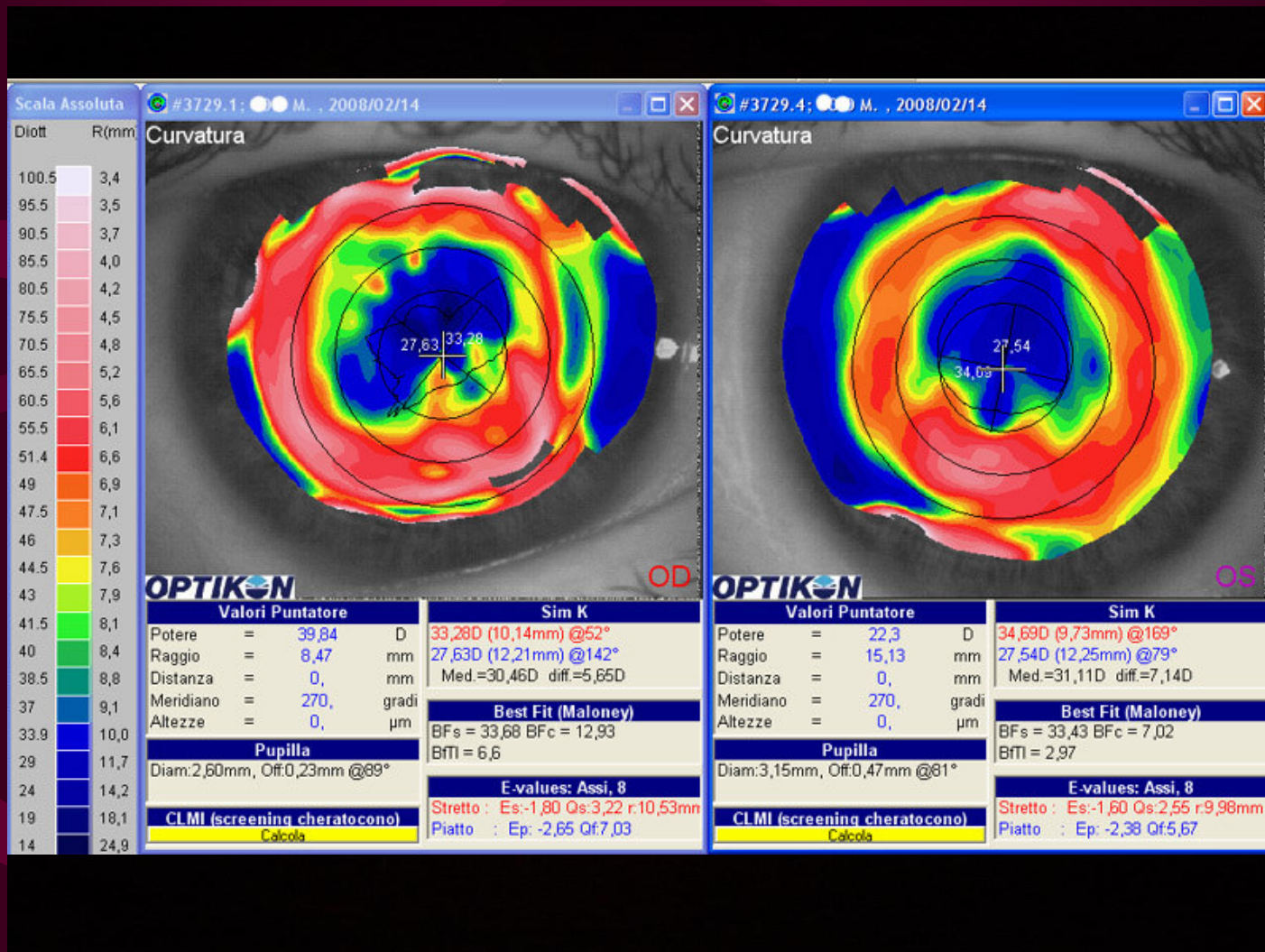
This report will show some keratoconus and irregular corneas report cases with topography and surface aberrometry before and after the correction through SiHi contact lenses.

INTRODUCTION

- Post Graft
- Irregular cornea
- Keratoconus

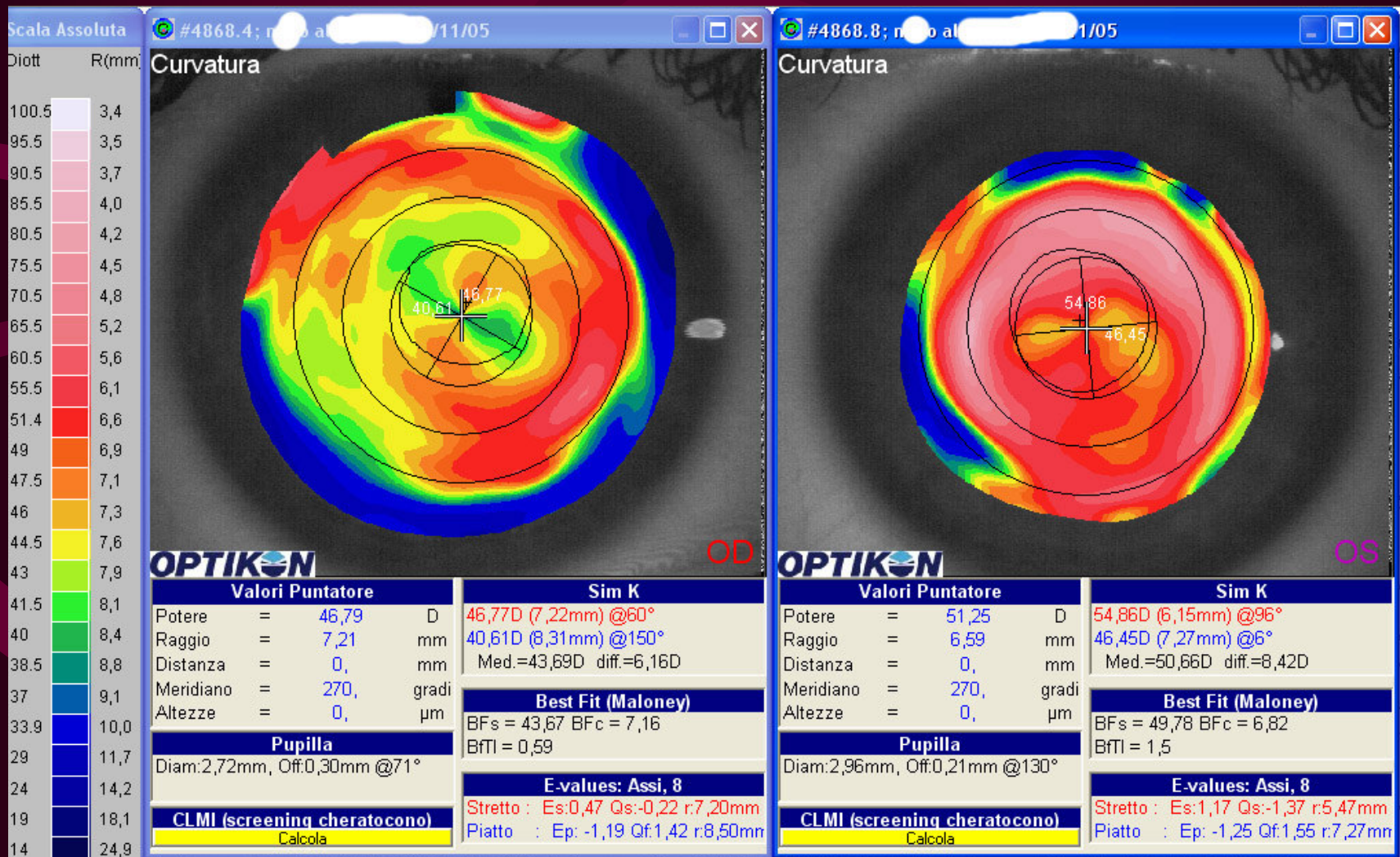
INTRODUCTION

•Post Graft (KR)



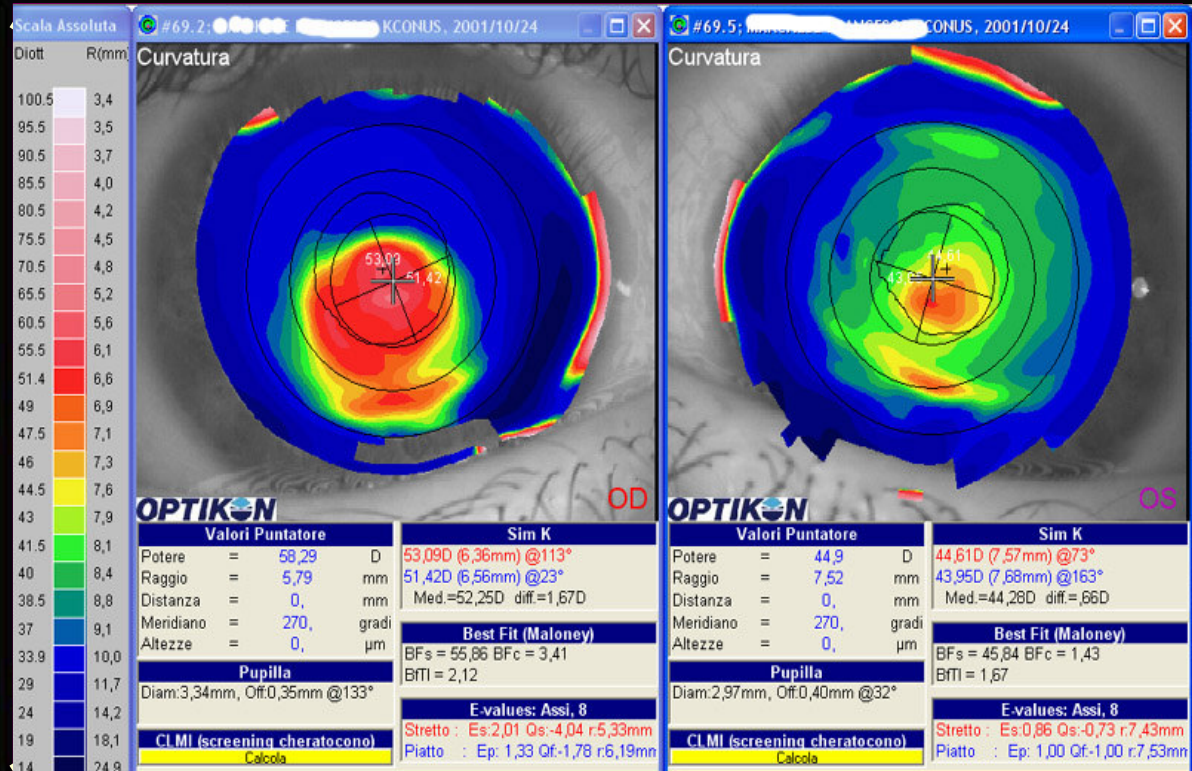
INTRODUCTION

- Irregular cornea, cheratoplastica (DLKP)



INTRODUCTION

Ectatic Conditions



Optical Solutions

**1st and 2nd Konus grade (Amsler) and low
irregularities**

- Spectacle Lenses
- Soft Contact Lenses
- RGP Lenses

Optical Solutions

≥2nd grade Konus and moderate to severe irregularities

- Aberrometric spectacle lenses
- Rgp, Hybrid, MiniScleral Contac Lenses
- SiHi Contac Lenses

Optical Solutions

Soft Silicon Hidrogel contact lenses??

DESCRIZIONE LENTI

KeraSoft™3 & KeraSoft™IC

- *Parameters:*
- Material: Filcon II 3 (Definitive by Contamac)
- Water% : 74%
- Light transmission: 99.3%
- Elastic Modulus: 0.39 Mpa
- Base Curve mm: 8.00 8.20 8.40 8.60
- Diameter mm: 14.00 14.50 15.00
- Central Thickness: 0.36 mm @ -3.00 D
- Permeability Dk: 57.0×10^{-11} @ 35°
- Trasmisibilità Dk/L 15.8×10^{-9} @ -3.00 D
- Edge Thickness: 0.11 mm



DESCRIZIONE LENTI

SH Soft K™

Parametri lente:

Materiale: Filcon II 3 (Definitive by Contamac)

Water% :74%

Light trasmission : 99.3%

Elastic Modulus : 0.39 Mpa

Base Curve mm : 7.00, 7.30, 7.60, 7.90, 8.20 mm

Diameter mm : 14.20 mm

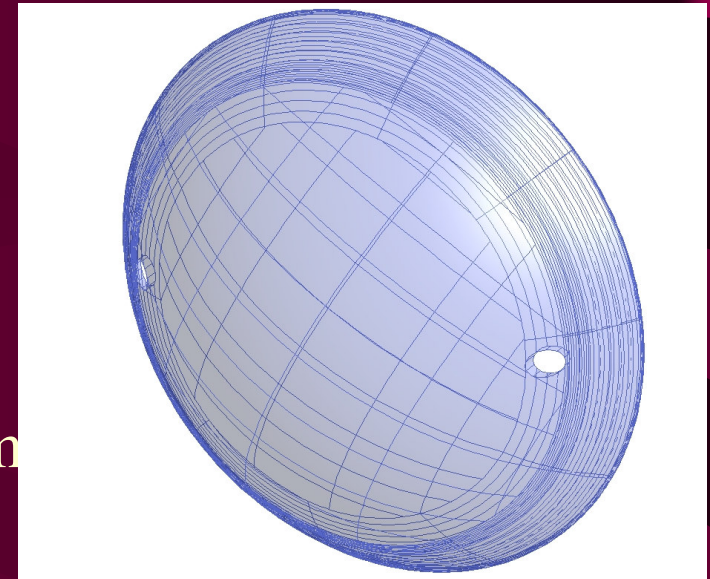
Central Thickness : 0.36 mm @ -3.00 DS

Permeability Dk : 60.0×10^{-11} @ 35°

Trasmissibilità Dk/L : 16.6×10^{-9} @ -3.00 D

Sphere Power: da +10.00 D a -20.00 D

Cyl Power: Up to -10.00. All axis

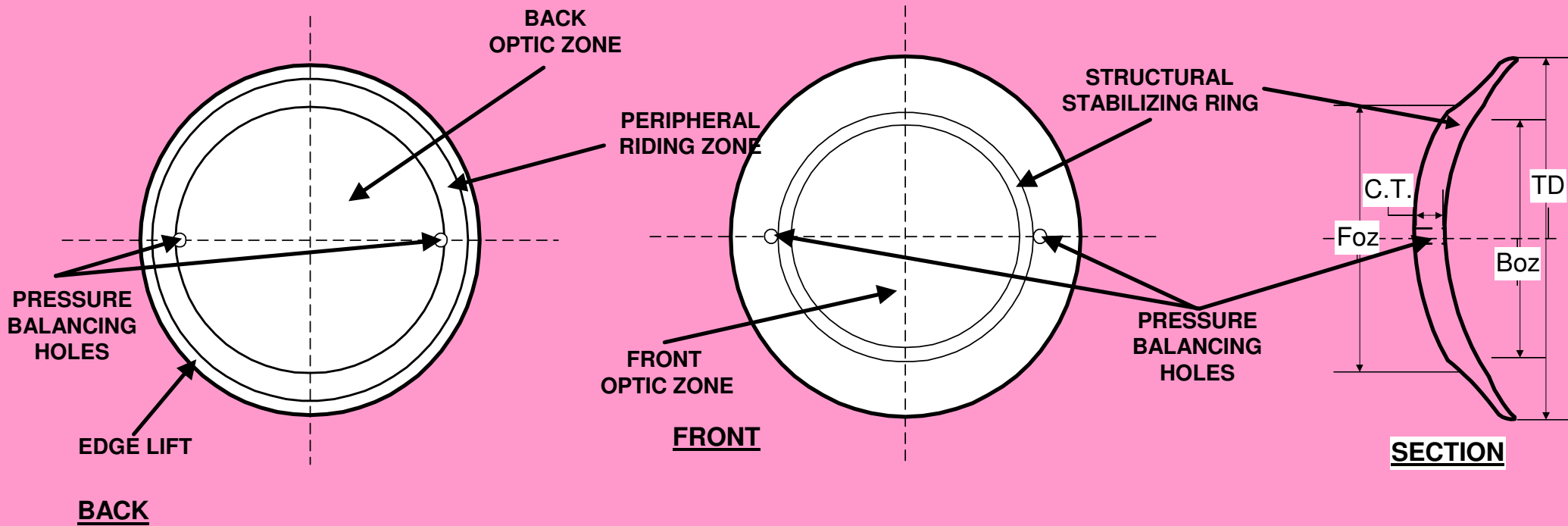


FDA approved & CE 0473

B&L Soflens toric
Dk/L 16.00×10^{-9}

Lent Features

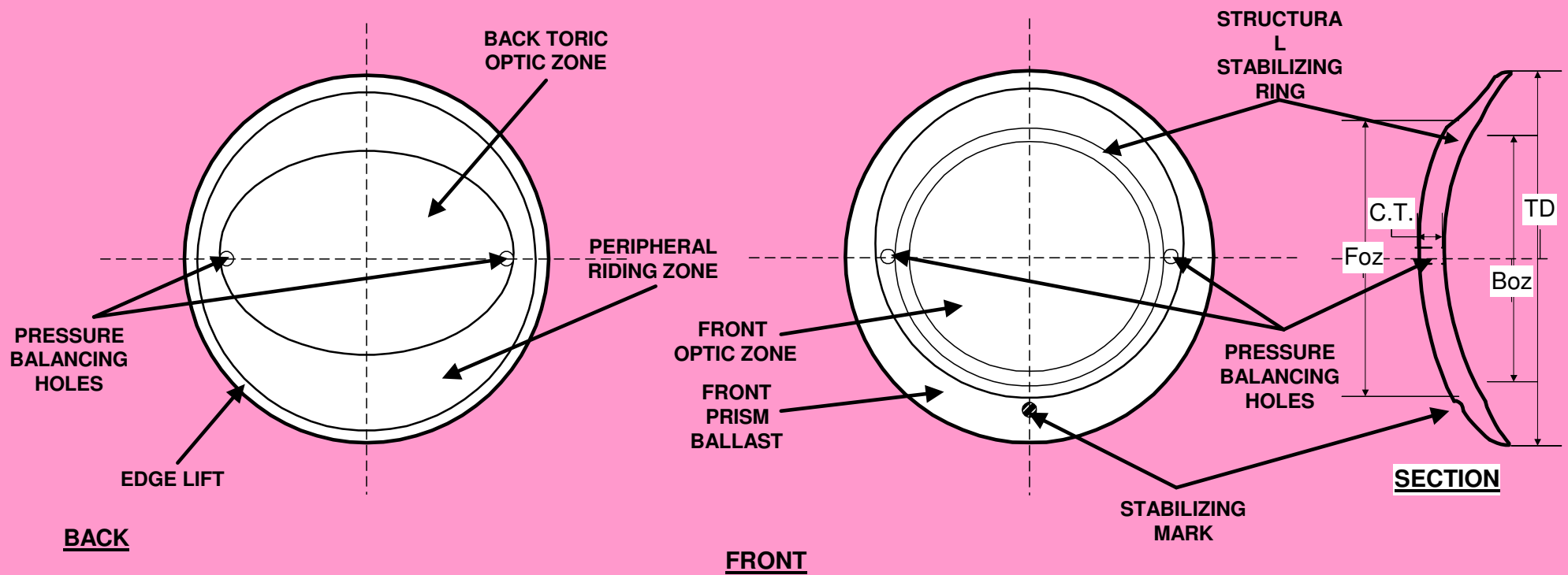
SH Soft K™



FDA approved & CE 0473

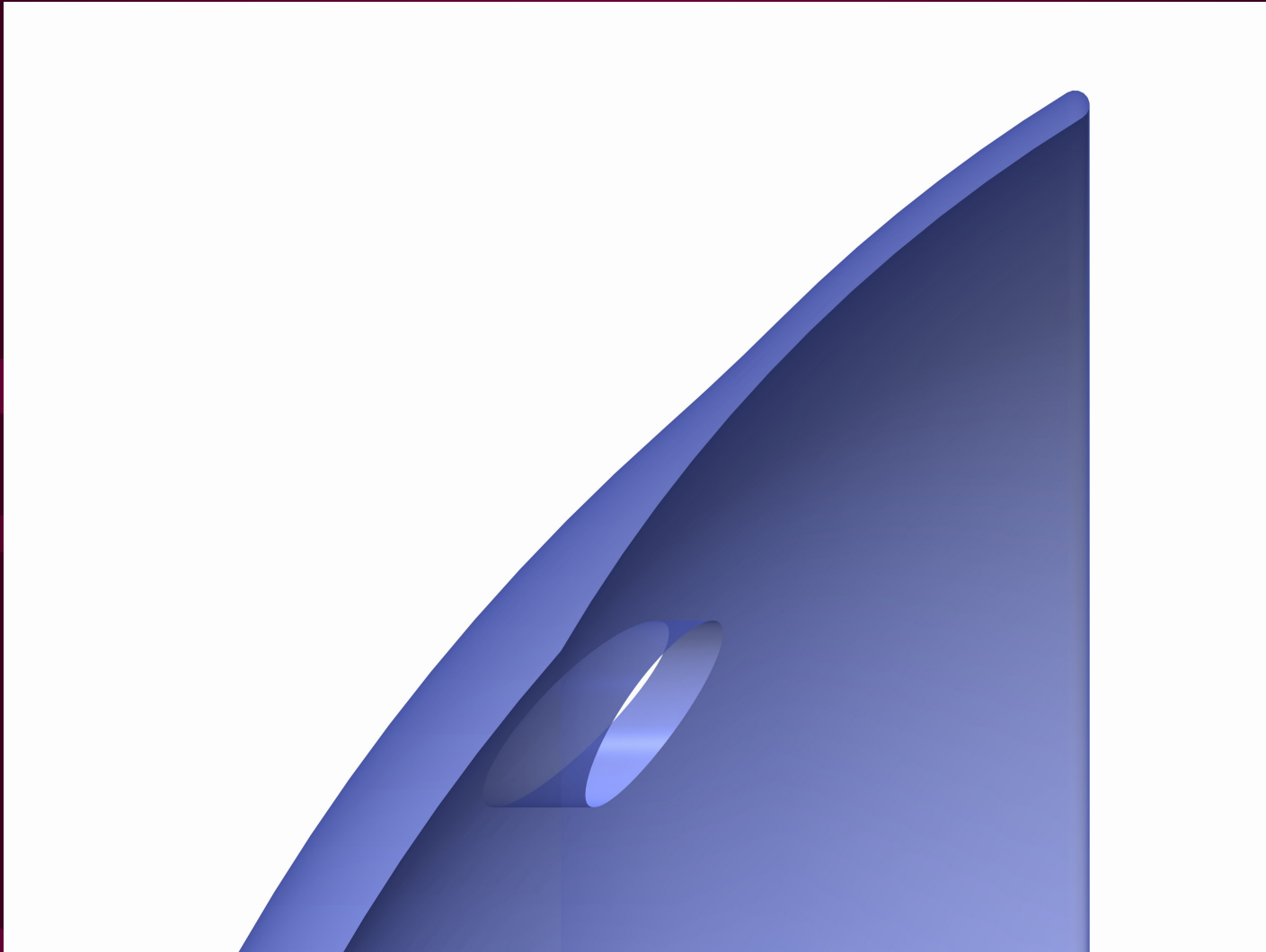
Lent Features

SH Soft KToric™

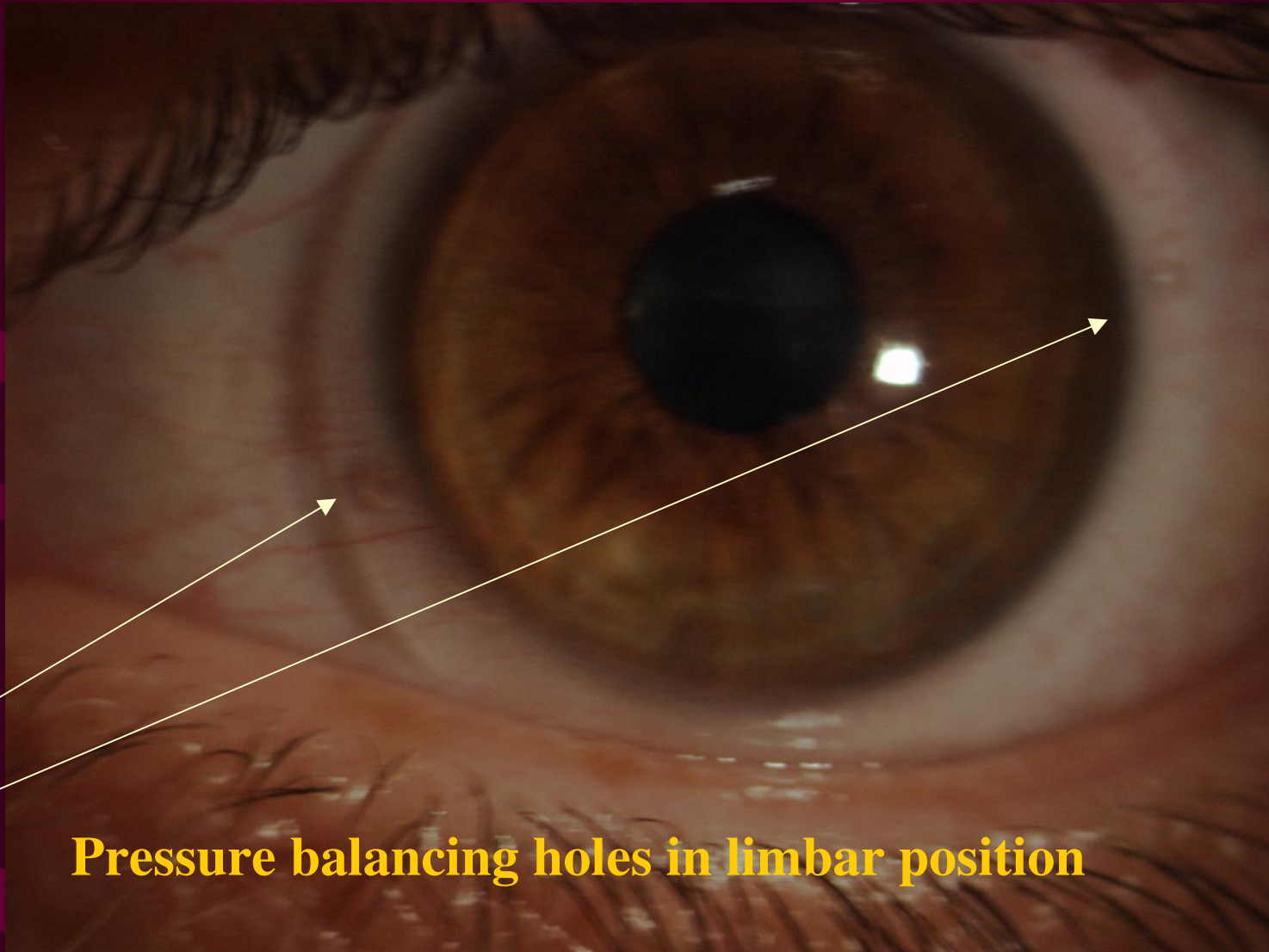


FDA approved & CE 0473

The Sh Soft K. – Pressure Balance



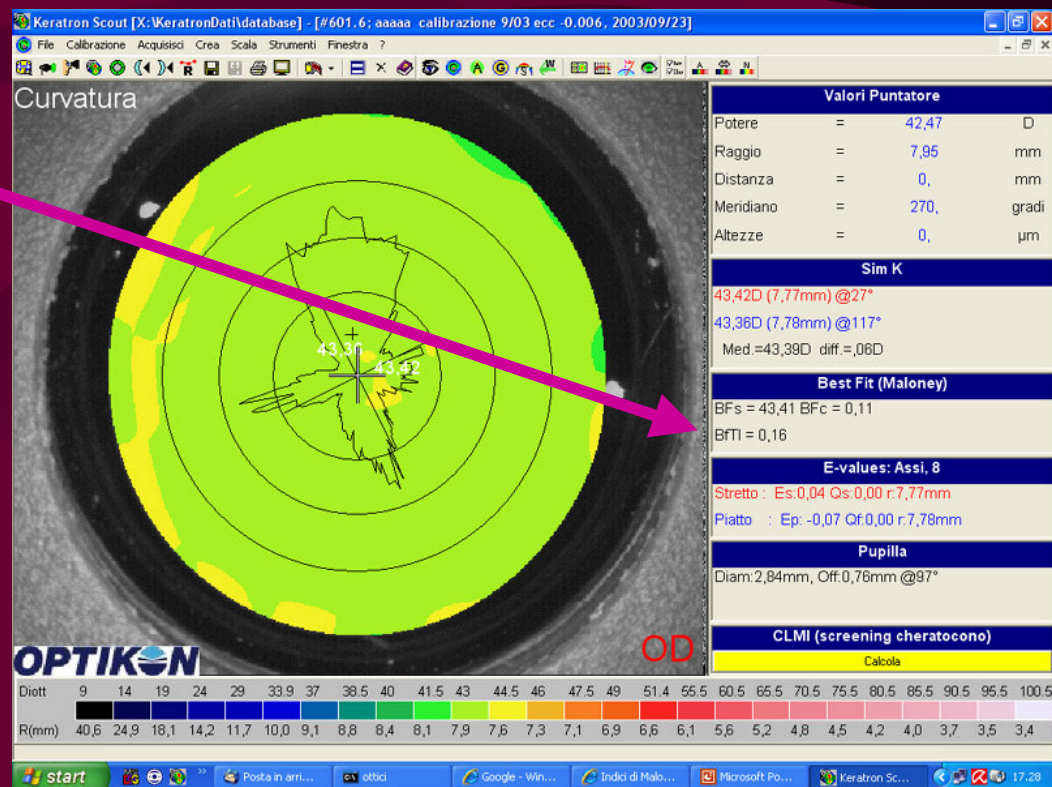
SH Soft K



Pressure balancing holes in limbar position

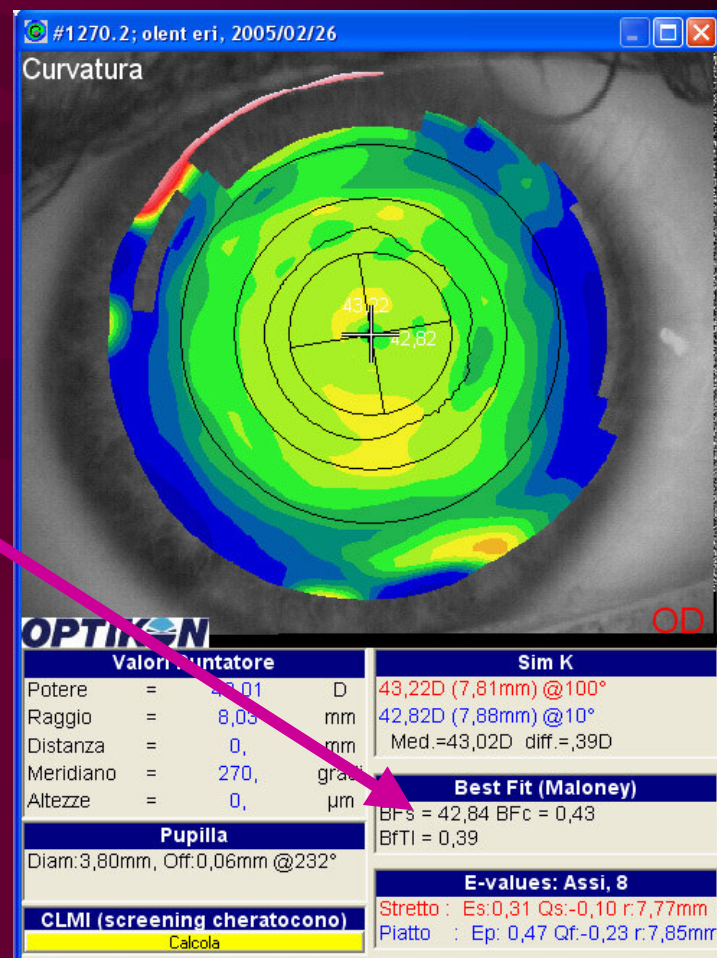
Topographic indexes of Keratron

- Maloney index
- **BfTI** = Irregularity of an ideal spherocylindric surface that approximates the axial map on the central 3mm.
- For a sphere the Bfti it's close to zero



Topographic indexes of Keratron

- Maloney index:
 - o BfTI index:
“normal” patient BfTi
between 0.20 and 0.60

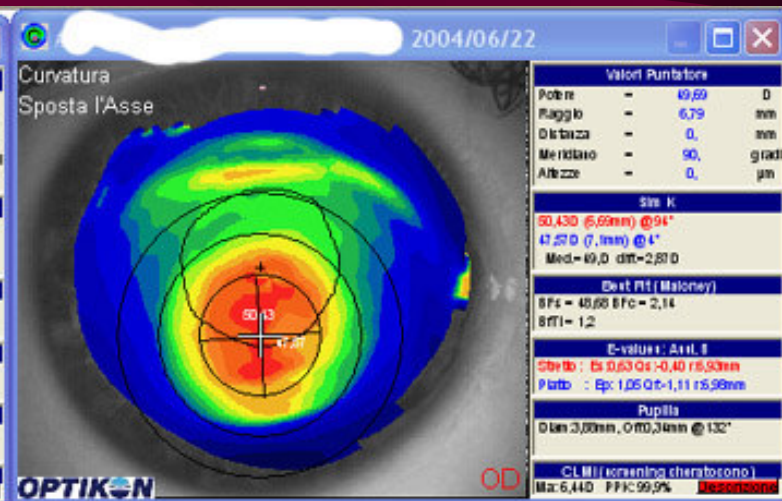
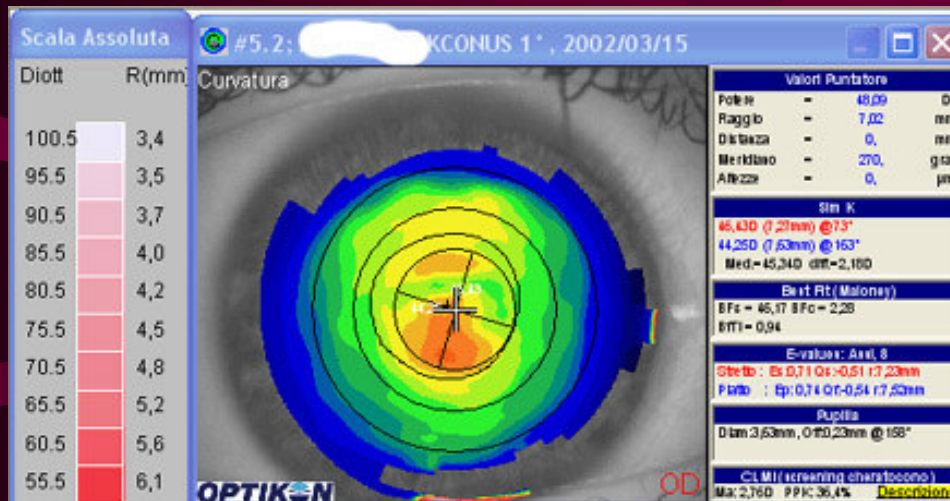


Topographic indexes of Keratron

- Glossario: Indici di Maloney
- Gli indici Bf TI

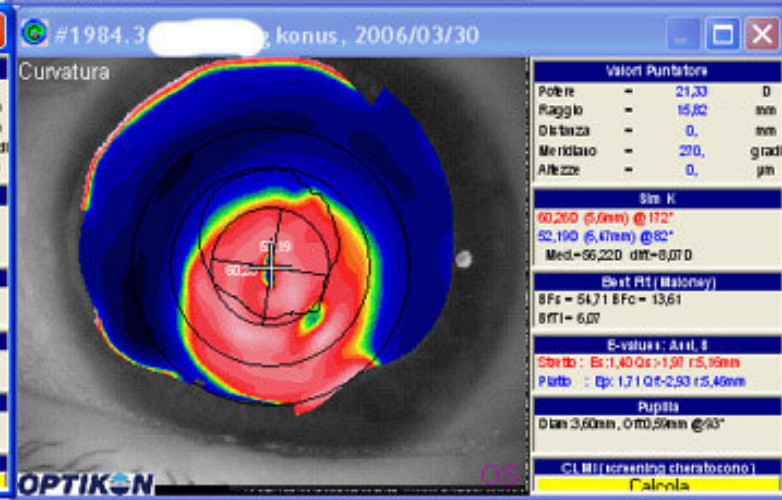
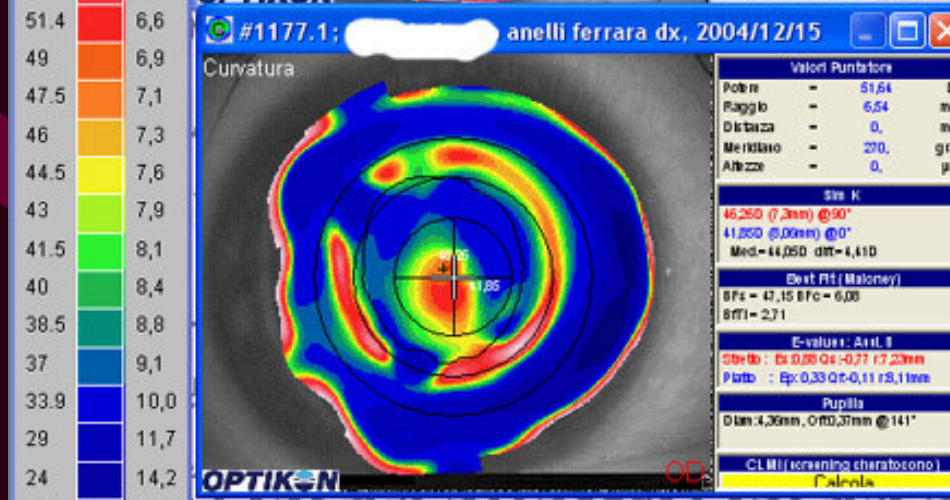
- Pz. "Kc da lieve a severo"
- BfTi > 0.80 a 6.00 e oltre

BfTi
0.94



BfTi
1.2

BfTi
2.71



BfTi
6.07

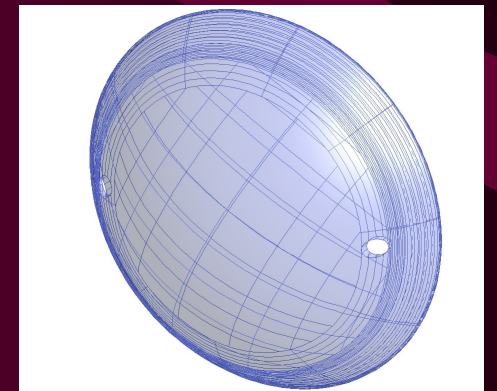
Gli indici topografici del Keratron

- Maloney index:
- BfTI index of corneal irregularity
 - Clinically we notice that in “normal” corneas the BfTi index is between 0,20 and 0,60. With the increase of the BfTi (from 0,6 to 0,8) there is a decrease of visual quality (Visus 10/10 but decrease of contrast sensitivity with low luminosity).
 - If BfTi is >0.80 we notice a decrease of contrast sensitivity with low luminosity and a decrease of visual acuity (with high contrast).

Report Case

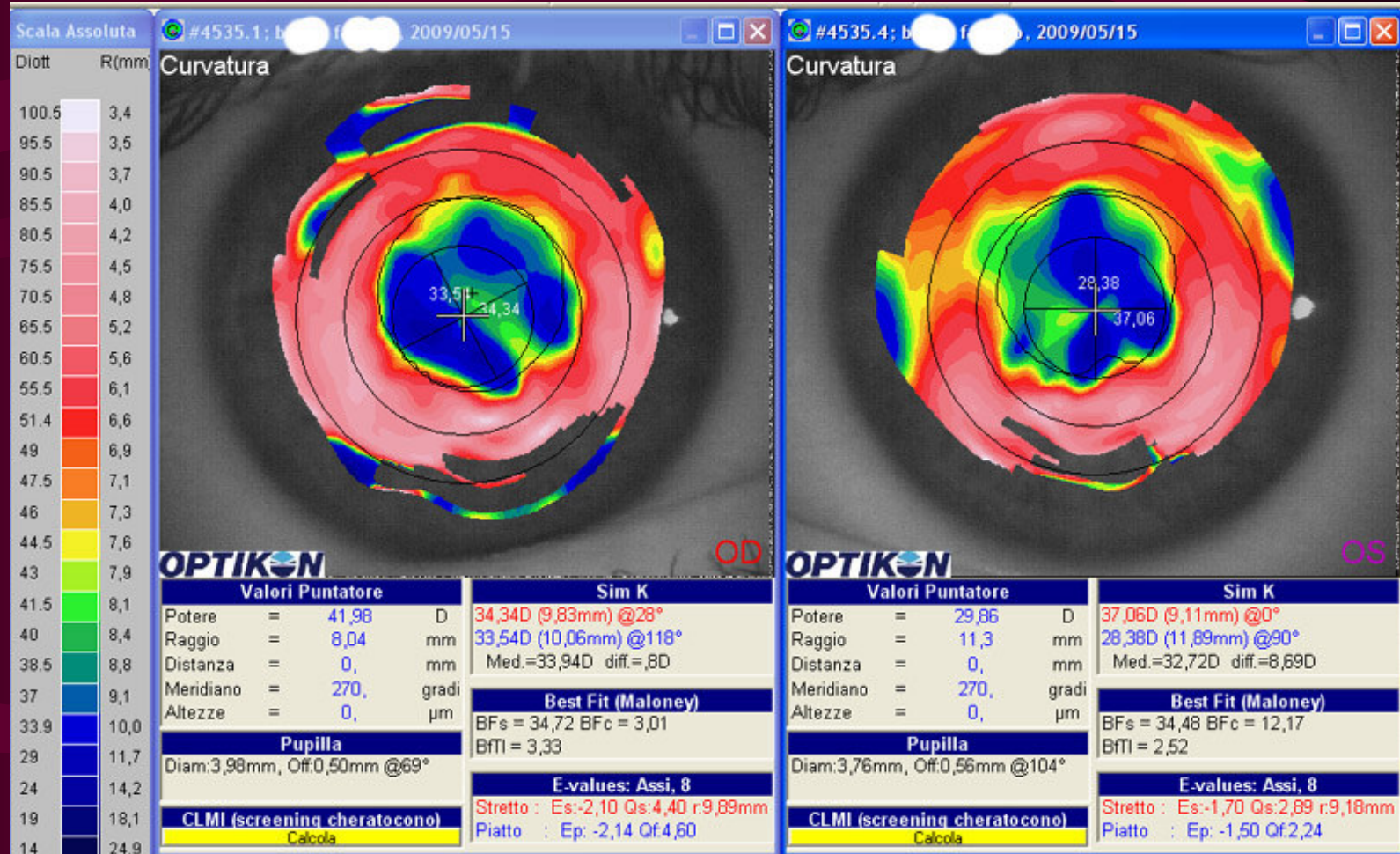
1) Radial Keratotomy

2) Keratoconus



- F.B. diver. 36 years old. RK in 1994 **Report case 1) B.F.**
- Spectacle BCVA
- R cil -3.00 x110 visus 6/10+ L $+0.50$ cil -6.00 x 95 visus 4/10-
- Can't drive in the evening
- Doesn't tolerate Rgp. Need a good visus in order to maintain his license.
- Topography: R cil $0.80D$ **BfTi 3.33**
- Topography : L cil **$8.68D$** **BfTi 2.52**

WITHOUT LAC



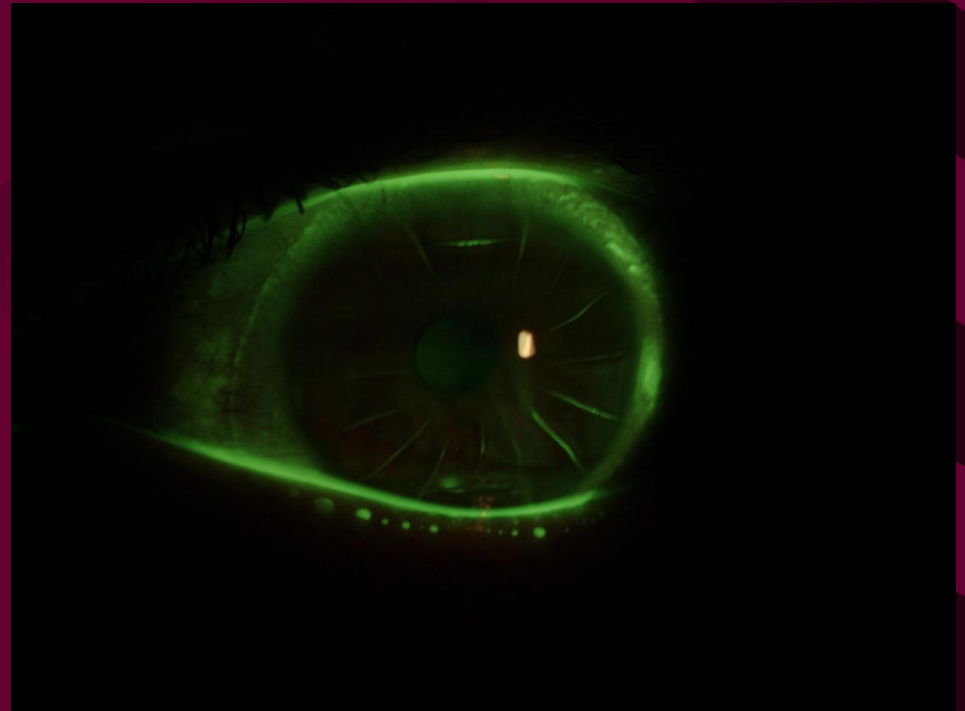
Report case 1) B.F.

RK in 1994

R



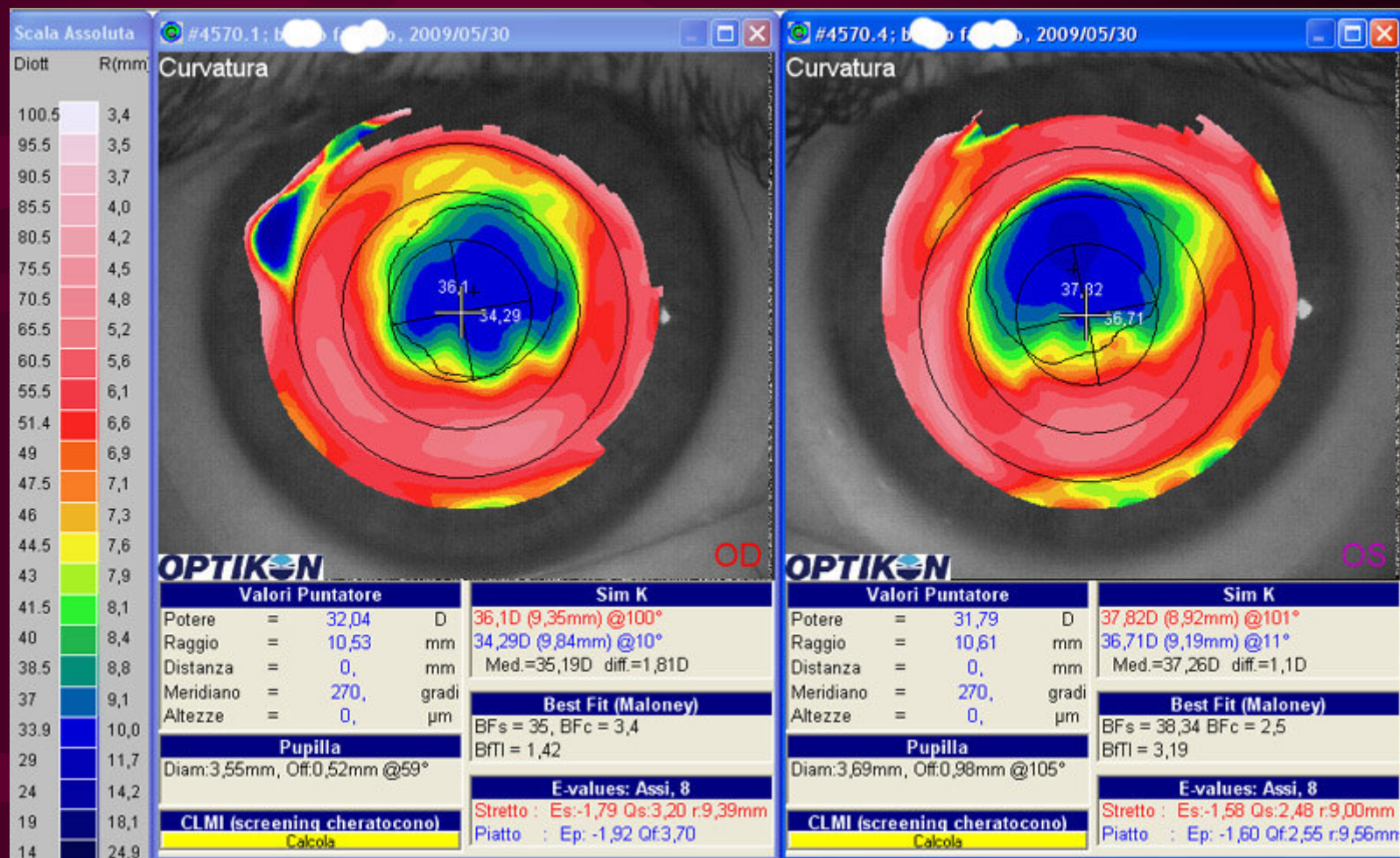
L



Report case 1) B.F.

- R - SH Soft K bc 7.60 Sf.-7.00 V. 9/10
- L - SH Soft K Toric 7.90 Sf.-1.50 cil.-6.00 x 85 V. 7/10-
- Topography:
- R without cl BfTi 3.33 With cl SH Soft K BfTi 1.42
- L without cl Cil. 8.69D With cl SH Soft K Toric Cil. 1.10D

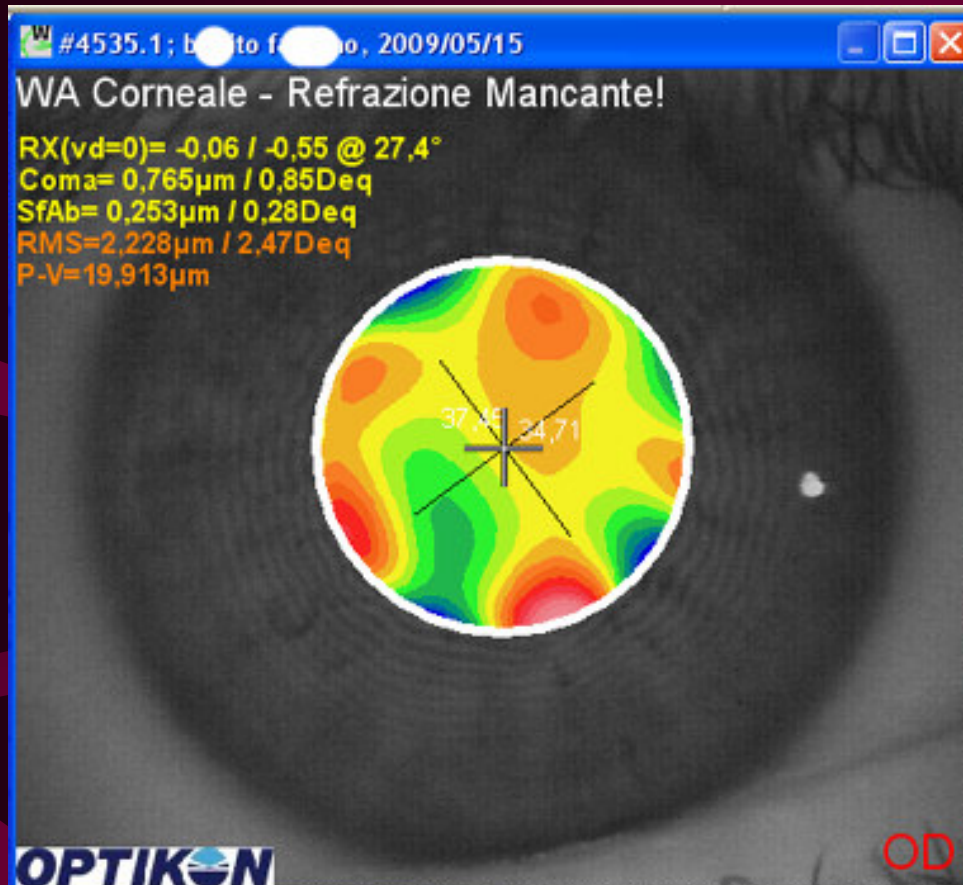
Topography with
Contact lenses in situ.
Index are
improved



Report case 1) B.F. Corneal WA Right eye

Without contact lens

With Soft K contact lens in situ



OPTIKON

Zernike	Micron	Dioptrie	Asse*	Descrizic
z(2, 0)	0,303	-0,34	---	Defocus
z(2, ±2)	0,352	-0,55	27,	Astigmat
z(3, ±1)	0,765	0,85	236,	Coma
z(3, ±3)	1,065	1,18	58,	Trifoglio
z(4, 0)	0,253	0,28	---	Aberrazi
z(4, ±2)	0,284	0,31	17,	Asigmati
z(4, ±4)	0,722	0,8	12,	Quadrifo
z(5, ±1)	0,229	0,25	13,	Coma se
z(5, ±3)	0,102	0,11	90,	Trifoglio

Polinomi di Zernike

0,0x0°

Ord. radiale n=2

Coma n=3

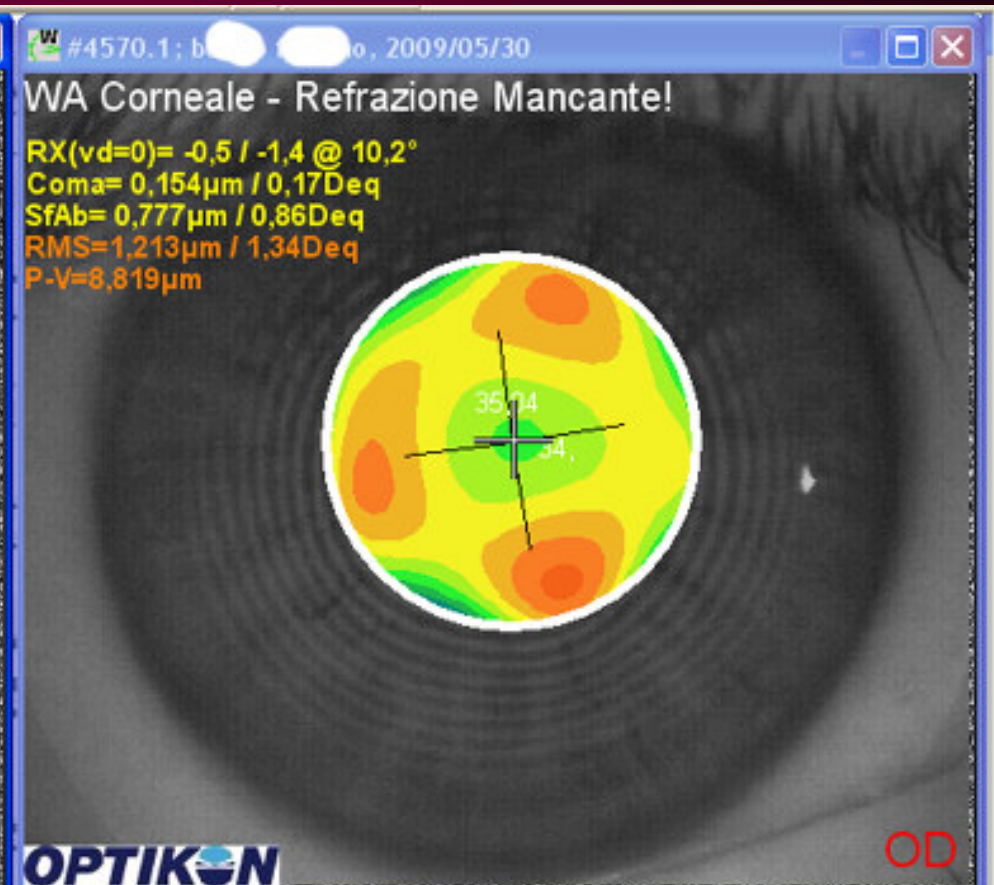
SfAb n=4

n=5

n=6

Freq.=-7-6-5-4-3-2-1 0 1 2 3 4 5 6 7

Pupilla(mm) 5



OPTIKON

Zernike	Micron	Dioptrie	Asse*	Descrizic
z(2, 0)	1,077	-1,19	---	Defocus
z(2, ±2)	0,891	-1,4	10,	Astigmat
z(3, ±1)	0,154	0,17	33,	Coma
z(3, ±3)	0,713	0,79	65,	Trifoglio
z(4, 0)	0,777	0,86	---	Aberrazi
z(4, ±2)	0,217	0,24	7,	Asigmati
z(4, ±4)	0,28	0,31	10,	Quadrifc
z(5, ±1)	0,064	0,07	64,	Coma se
z(5, ±3)	0,107	0,12	107,	Trifoglio

Polinomi di Zernike

0,0x0°

Ord. radiale n=2

Coma n=3

SfAb n=4

n=5

n=6

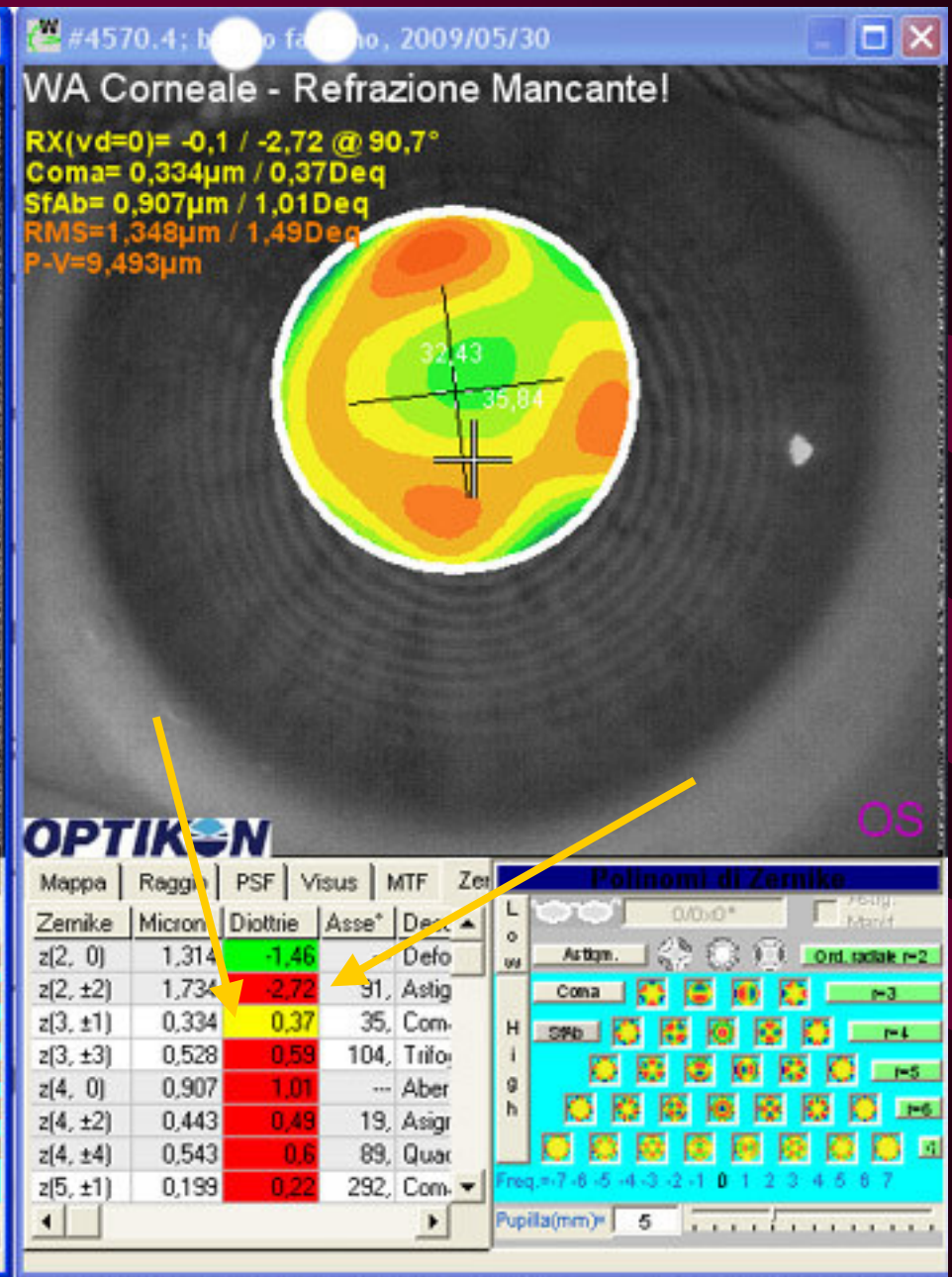
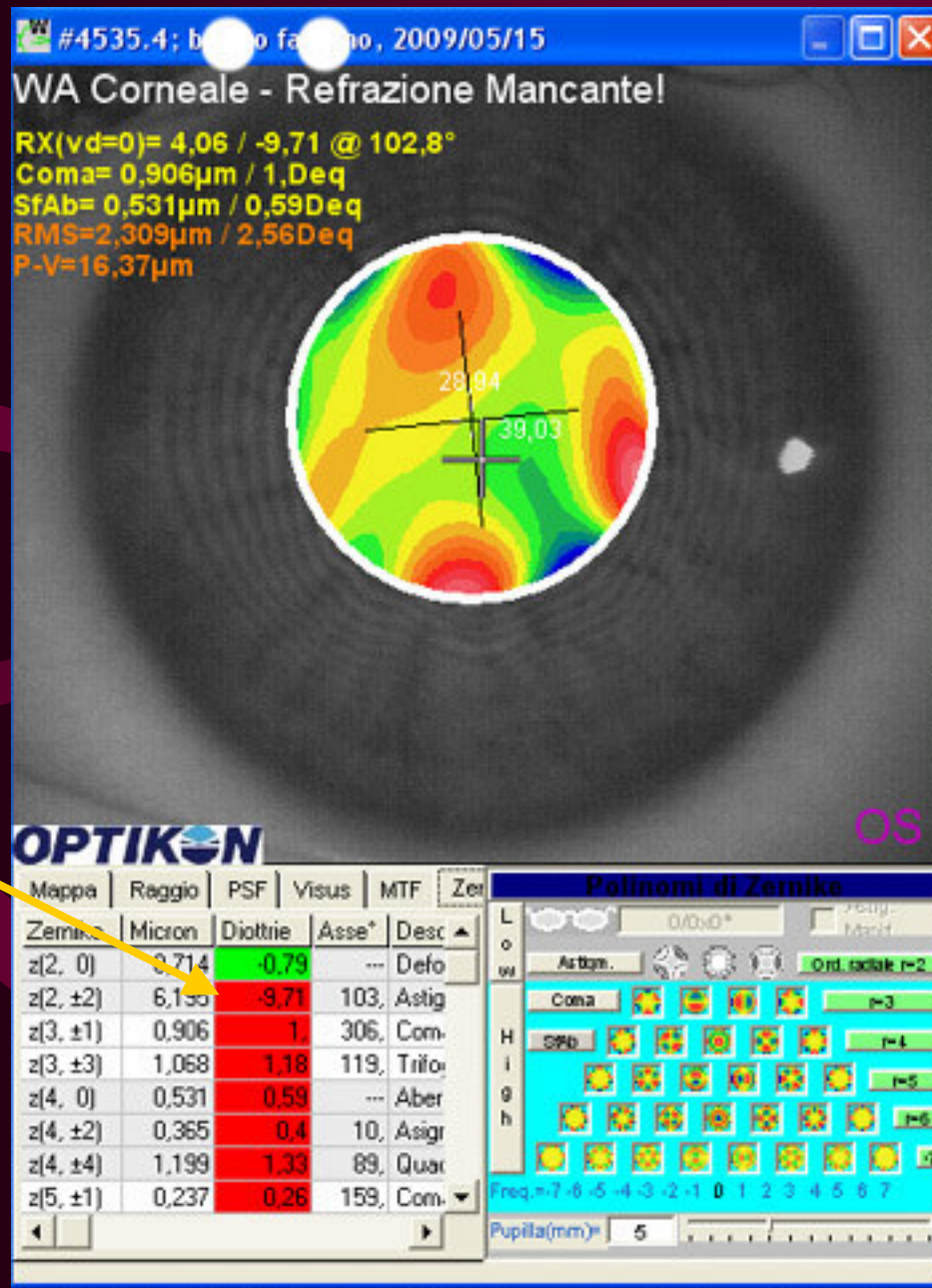
Freq.=-7-6-5-4-3-2-1 0 1 2 3 4 5 6 7

Pupilla(mm) 5

Report case 1) B.F. Corneal WA Left eye

Without contact lens

With Soft K contact lens in situ

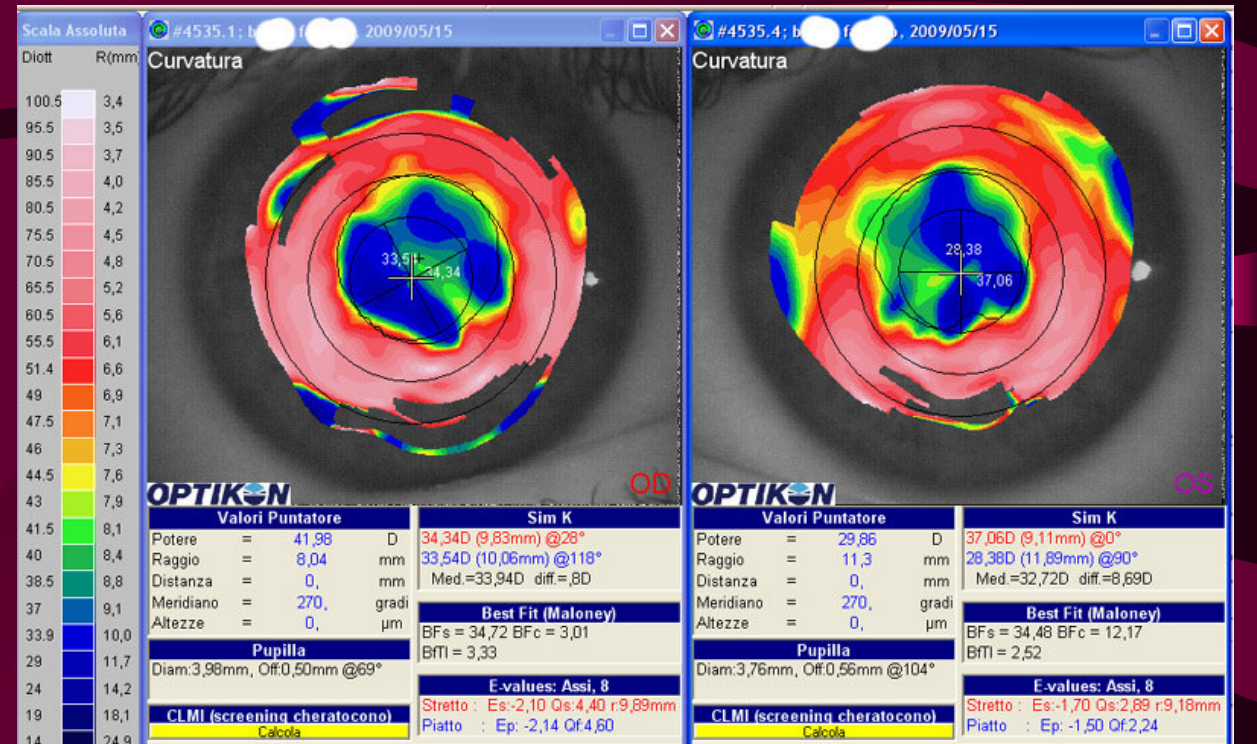


Report case 1) B.F.

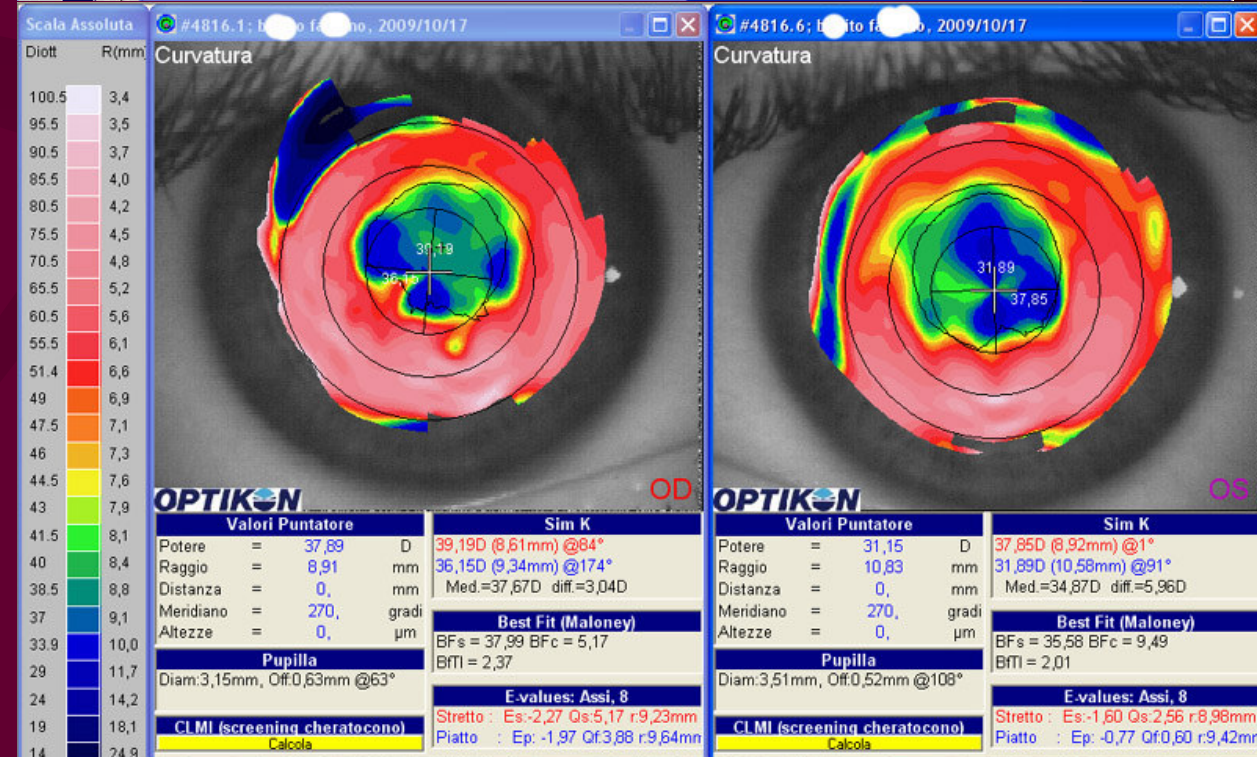
After removal?

- Warpage or Molding ?

Topography without lens



Topography without lens after 8h daily wear



Report Case 1) B.F.

Conclusions

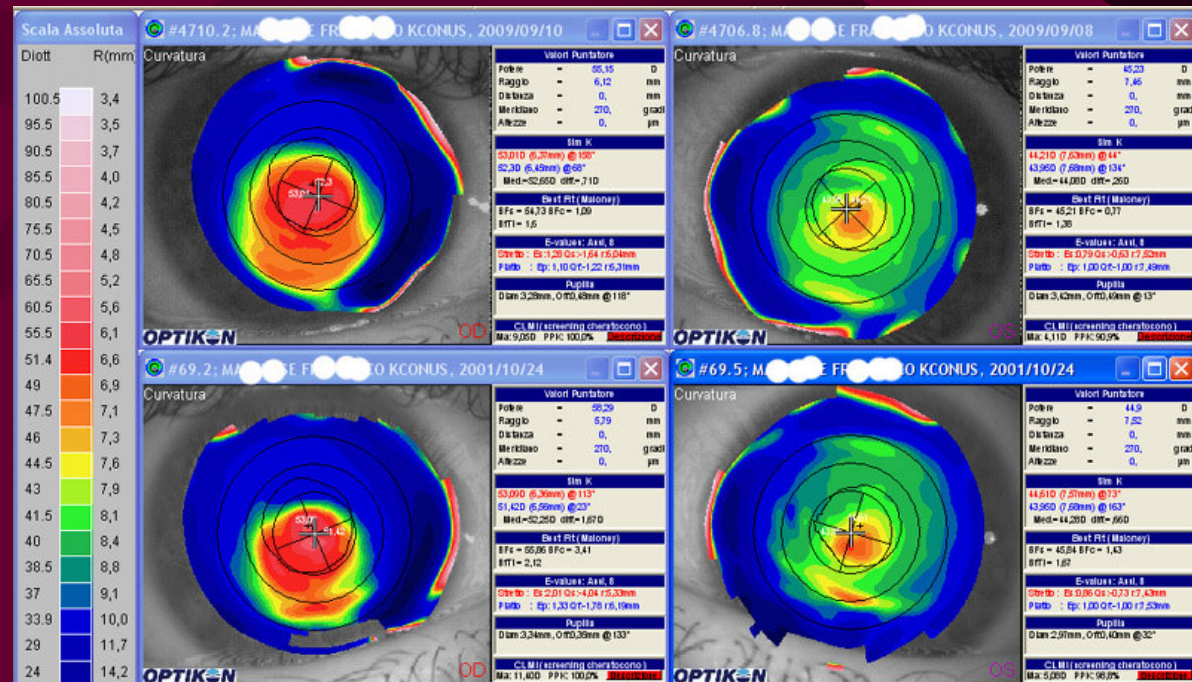
- Patient is satisfied and use Sh soft K contact lenses up to 10h per day.
- Patient has been educated on hygiene standards and on lenses maintenance.
- He was able to maintain his driving license.
- Ha can drive in the evening in safety.
- More exams needed in future to evaluate eyes wellness.



Report case 2) M.F

- M.F. salesman 40years old
- Kc stable, can't drive with spectacle cause of low visus and lens reflections
- Spectacle BCVA :
 - o Dx +1.00 cil -2.50 x25 visus 3/10
 - o Sx +1.50 cil -0.50 x 150 visus 9/10-
- Can't tolerate RGP, he used an Hybrid "Janus" lens (only in the Right eye) that is no more available
- Topography: R cil 1.670D BfTi 2.12 Class. Amsler 2° Moderate
- Topography: L cil. 0.66D BfTi 1.67 Class. Amsler 1° Low

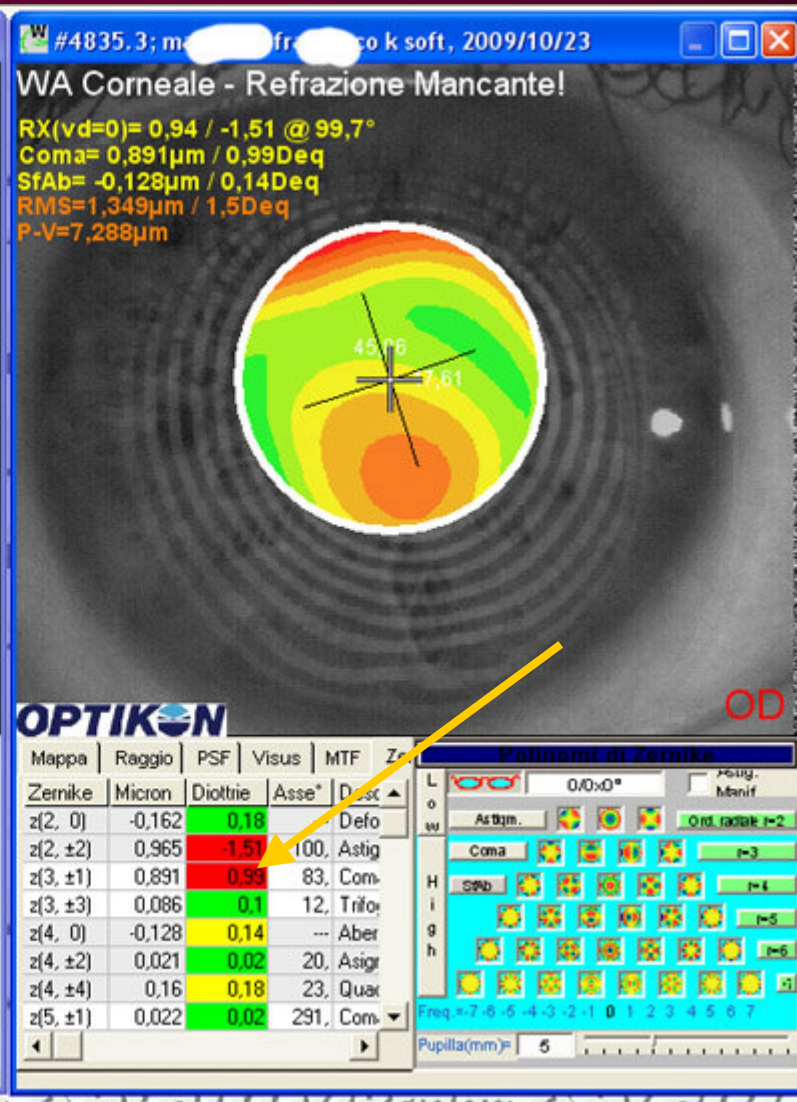
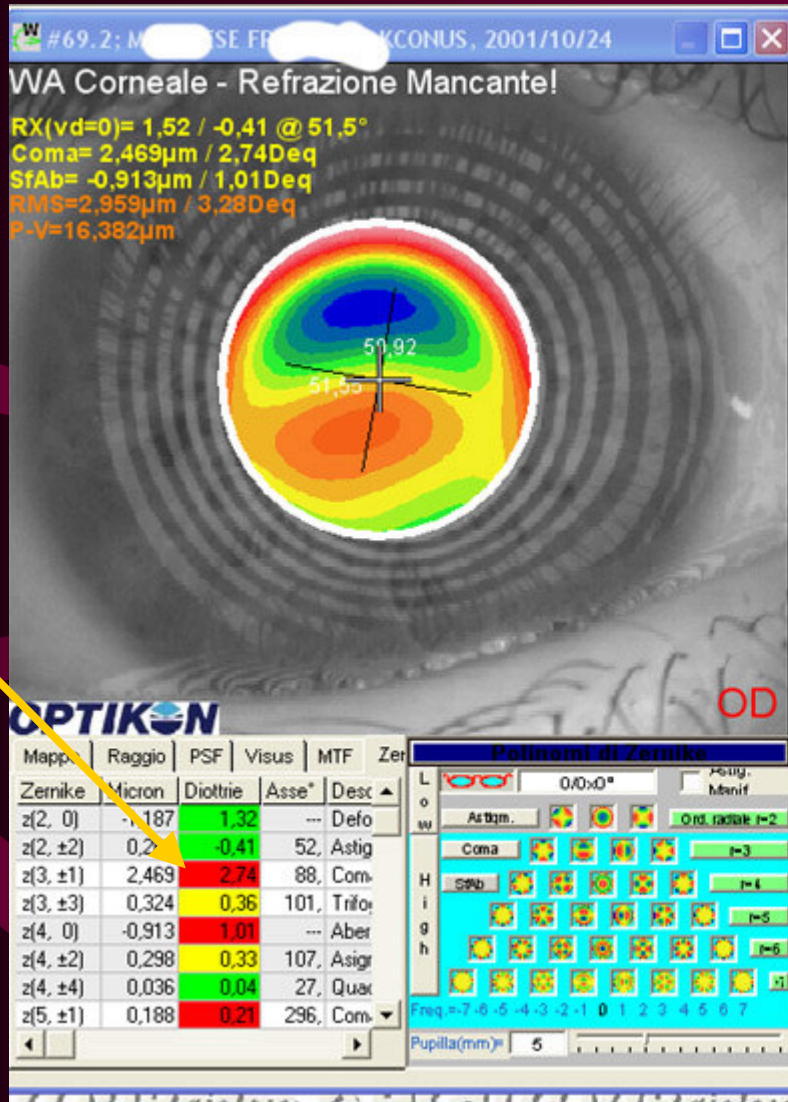
Stable Kc
Years 2009 vs 2001



Report case 2) M.F. WA Corneale Od Zernike

Without lens

With Soft K lens in situ



Report case 2) M.F. WA Corneale Od Visus

Without lens

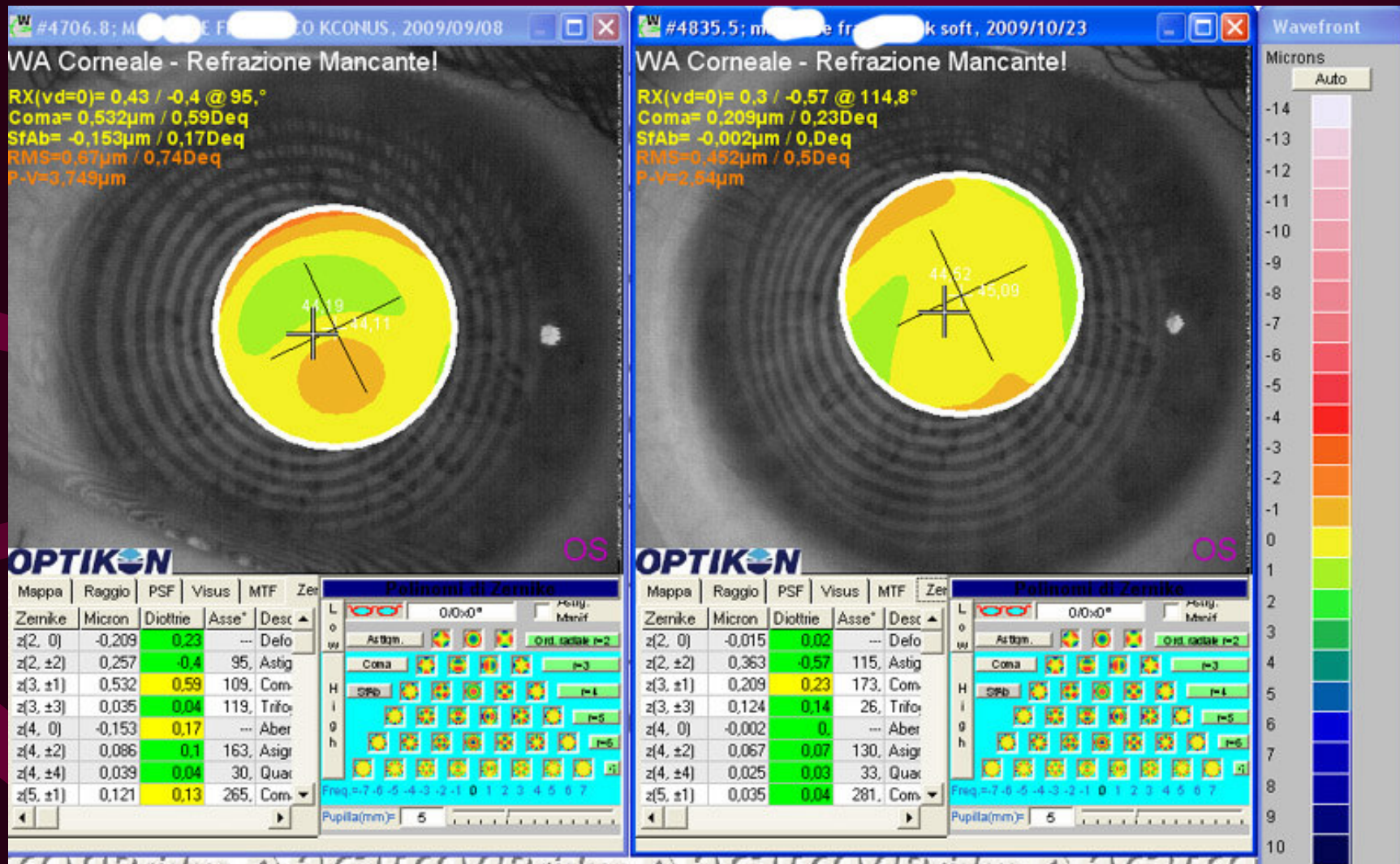
With Soft K lens in situ



Report case 2) B.F. WA Corneale Os Zernike

Without lens

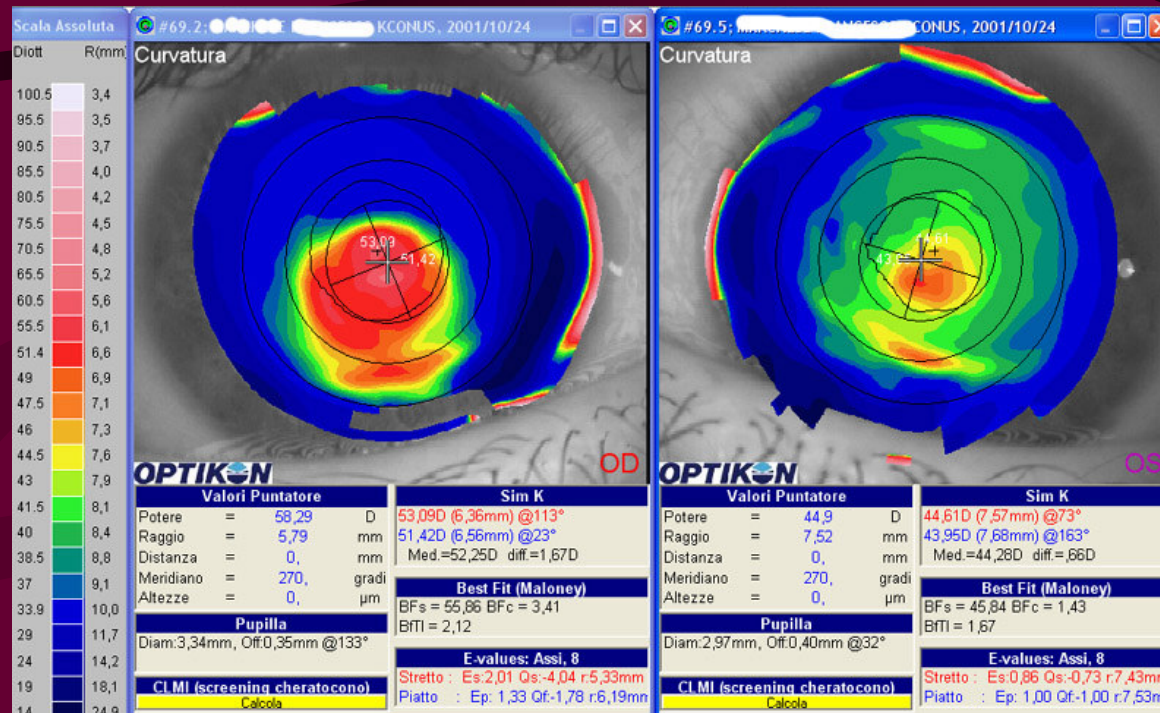
With Soft K lens in situ



Report case 2) M.F.

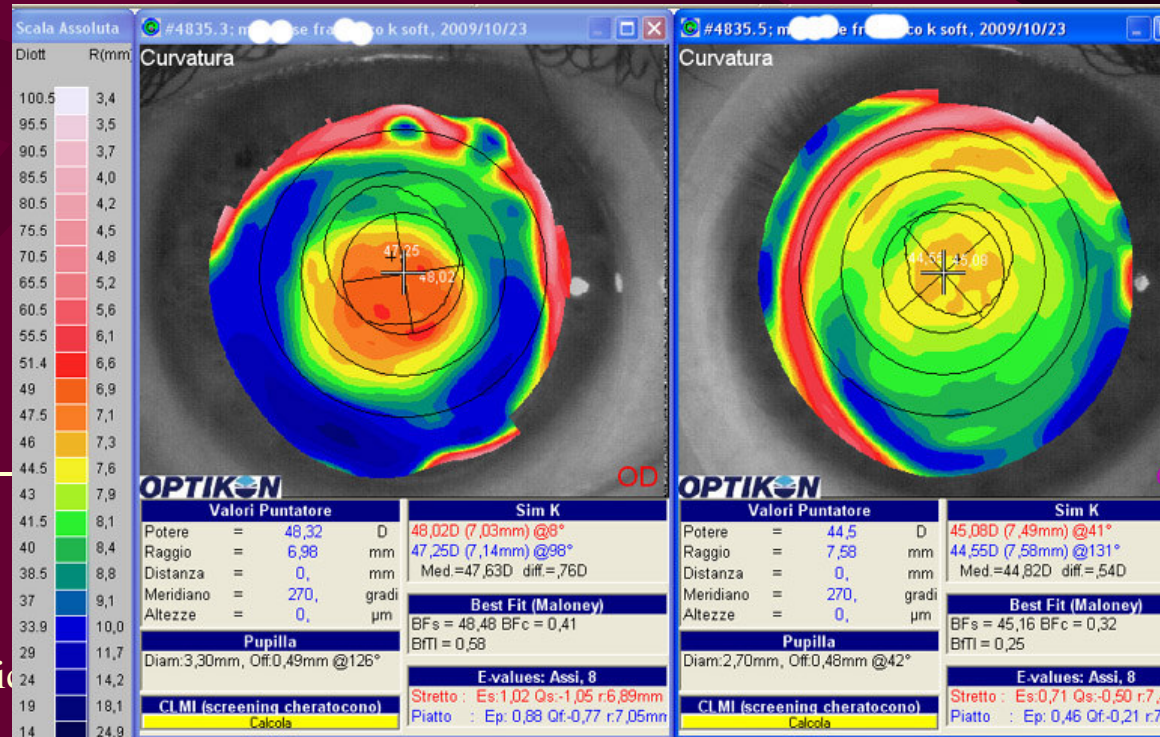
Topography without lens

- R cil 1.670D BfTi 2.12
- L cil. 0.66D BfTi 1.67



Topography With SH SK lens in situ

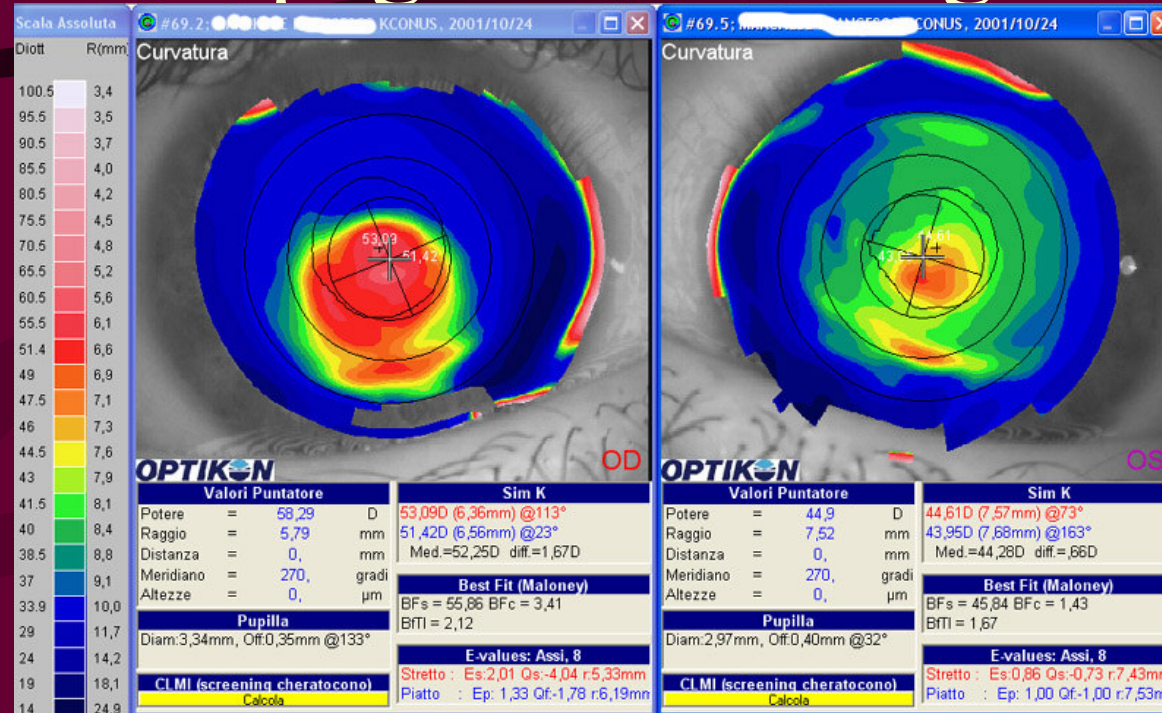
- R SH Soft K Rb 7.60 Sf.-2.50 v. 8/10
Topography index: cil 0.76D BfTi 0.58
- L SH Soft K Rb 7.90 Sf.+1.50 V. 10/10
Topography index: cil 0.54D BfTi 0.25



Report case 2) M.F. Warpage or Molding?

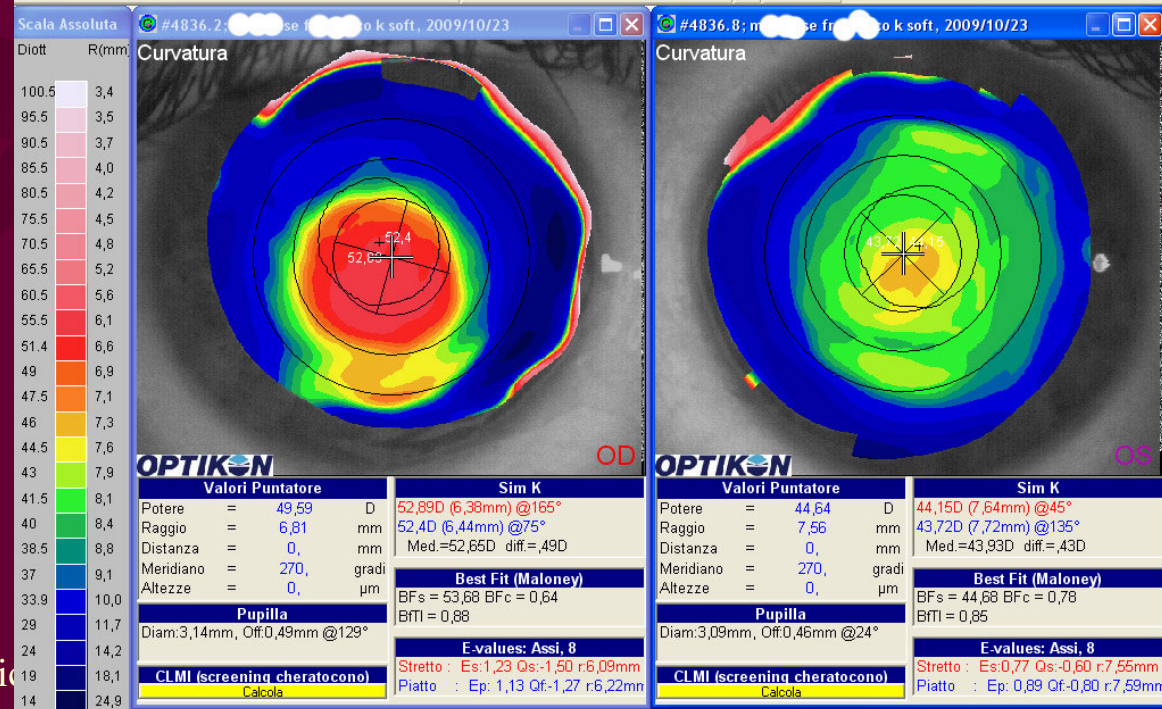
Topography before lens

- R cil 1.670D BfTi 2.12
- L cil. 0.66D BfTi 1.67



Topography without lens after 10 hours of use

- R cil 0.49D BfTi 0.88
- L cil. 0.43D BfTi 0.85



Report Case 2) M.F.

Conclusions

- Patient is satisfied and uses Sh soft K contact lenses up to 10h per day. Those are tolerated more than previous hybrid “Janus” lenses
- Patient has been educated on hygiene standards and on lenses maintenance.
- After removing the lenses M.F. feels a better “vision” with spectacle lenses for corneal “molding”.
- He feels safar while he’s driving and he can read books without glasses.
- More exams needed in future to evaluate eyes wellness.



Technical Analysis

Soft contact lenses with central thicknesses thinner than common soft lenses are not an innovation but these are not used because of the low Dk of the traditional hydrogel lenses

Today we have the possibility of building these particular type of lenses in SiHi, with a Dk three times higher, and with high precision lathe.

CONCLUSIONS

Even though Rgp lenses are the first choice, there are particular cases where SiHi Soft K lenses have to be evaluated as a valid alternative:

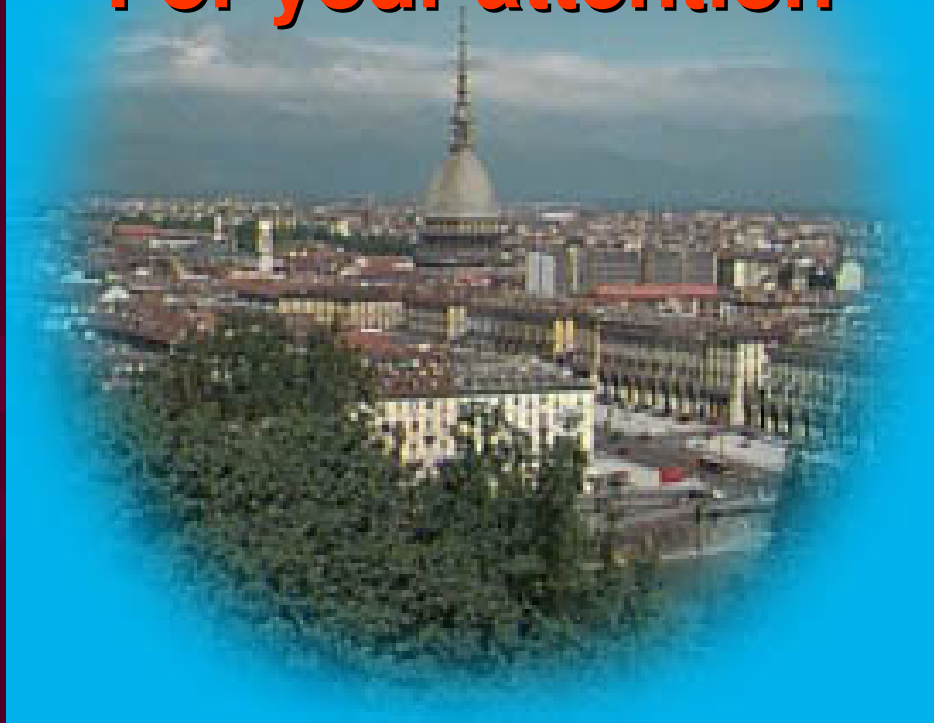
- Intolerance to Rgp
- Unilateral Keratoconus ($< 4^\circ$ Amsler)
- Bilateral Keratoconus ($< 4^\circ$ Amsler)
- Keratoconus with central and round ectasia
- Post surgery and irregular corneas
- Patient with Kc, post graft or IC to practice sports



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Thank you
For your attention



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BIBLIOGRAPHY

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- Lupelli L., Fletcher R., Rossi A.L., Contattologia: una guida clinica, ed. Medical Books 2004, pag.377- 381-382.
- Barequet I. et al. A New Soft Contact Lens to Correct Irregular Astigmatism. Tel Aviv University. 2003
- Gerber A, Soft K lenses as an additional treatment option for keratoconus. Hassad College. 2003
- Griffiths M. et al. Masking of irregular corneal topography with contact lens. CLAO 1998: 24. 76-81

Recommended web pages

- ✓ www.siliconehydrogels.org
- ✓ www.soflexcontacts.stick.tyco.co.il
- ✓ www.ultravision.co.uk