

Long-Term Results of Surface Ablation for High Myopia: the Importance of Smoothing

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High Myopia

More than - 6.00 D

(Curtin BJ, Acta Ophthalmol Suppl. 1988)

- **Refractive Surgery Risks:**
 - Undercorrection
 - Haze (amount of corrected myopia ? surface irregularity ?)
 - Regression (induced corneal curvature gradient)
 - Glare
 - Ectasia (LASIK only)
 - Myopia progression
 - Retinal problems
- **Accurate patient selection**
- **Complex treatment**
- **Careful follow up**

Why Surface Ablation for High Myopia ?

- Higher myopic correction possible
- Less biomechanical effect/structural instability
- Less risk of ectasia vs. LASIK
- Possible better contrast sensitivity
- Treatment of eyes with very steep/flat corneas,
wide pupils

Roberts, C, J Cataract Refract Surg, Jan 2005

Langrova H, Acta Medica, Jan 2003

Shahinian L, J Cataract Refract Surg, Aug 2002

Gambato C, Ophthalmology, Feb 2005

PRK for High Myopia Surgical Technique

- Retrospective study: 2000 - 2006
- Suction ring
- NIDEK EC 5000 excimer laser
- Multiple optical zones
 - Ablation zone (AZ): 4.8 – 7.0 mm
 - Transition zone (TZ): 9.0 –10.0 mm
- Cross-cylinder technique for astigmatism
- Smoothing with masking fluid
- Mitomycin C (on selected cases)

High Myopia: Patient Selection

Exclusion Criteria

General

- no known systemic, metabolic or collagen disease
- patient's unrealistic expectations

Corneal

- insufficient corneal thickness
- ectatic disease (pellucid degeneration, Mooren's ulcer, Terrien's degeneration)
- reduced endothelial cell counts

Ocular

- increased intraocular pressure
- tear deficiency

Materials and Methods

- 100 eyes, 59 patients
- 18 males, 41 females
- Mean age 34.1 ± 8.3 years (range: 21 to 56)
- Corneal thickness: 560.4 ± 30.1

Preoperatively (mean \pm SD):

- VA: 0.87 ± 0.16
- cycloplegic SE : -9.55 D ± 1.79 D
 - (range: -7.50 to -14.25)
- Sphere : -8.86 D ± 1.83 D (range: -7.00 to -14.25)
- Cyl : -1.39 D ± 0.90 D (range: -0.00 to -3.75)

Smoothing

- Corneal regularity: more important than transparency
- Irregularities: induced by ablating beam and ocular motion
- Irregular curvature changes:
 - excessive reparative response
 - increased collagen deposition
 - haze and reduction of desired refractive effect

Vinciguerra P, J Refract Surg 1998

Netto MV, Eye Res 2005

Vinciguerra P, Camesasca F, Refractive Surface Ablation, Slack 2006

Smoothing

- Surgical Technique:
 - Masking fluid (hyaluronic acid 4%), same ablation rate as normal cornea
 - Careful distribution with spatula
 - 10 mm diameter ablation to avoid refractive change
 - 10 Hz frequency to avoid overheating
 - Peaks will appear and be ablated

Vinciguerra P, J Refract Surg 1998

Vinciguerra P, Camesasca F, Refractive Surface Ablation, Slack 2006

Video Smoothing

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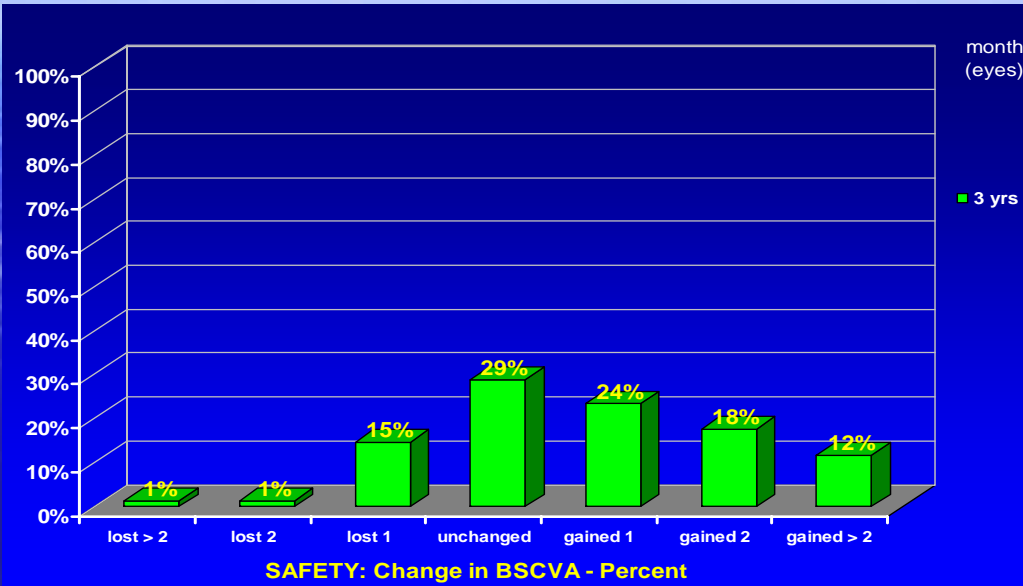
Results

Long-Term Follow-Up: **3.1** \pm 1.6 yrs

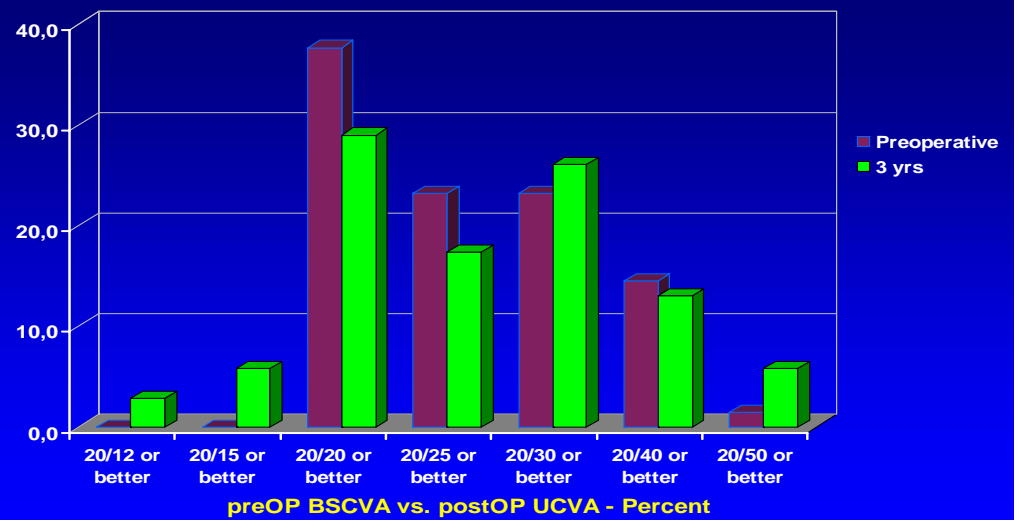
(range 509 - 1920 days)

- VA: **0.9** \pm 0.20
- SE **-0.45** D \pm 0.83 D (range 0.00 to -2.50)
- Sphere: **-0.26** D \pm 0.83 D (-2.50 to +0.25)
- Cyl : **-0.37** D \pm \pm 0.46 D (-0.00 to -1.50)
- Haze (0 to 4+): **0.11** \pm 0.32

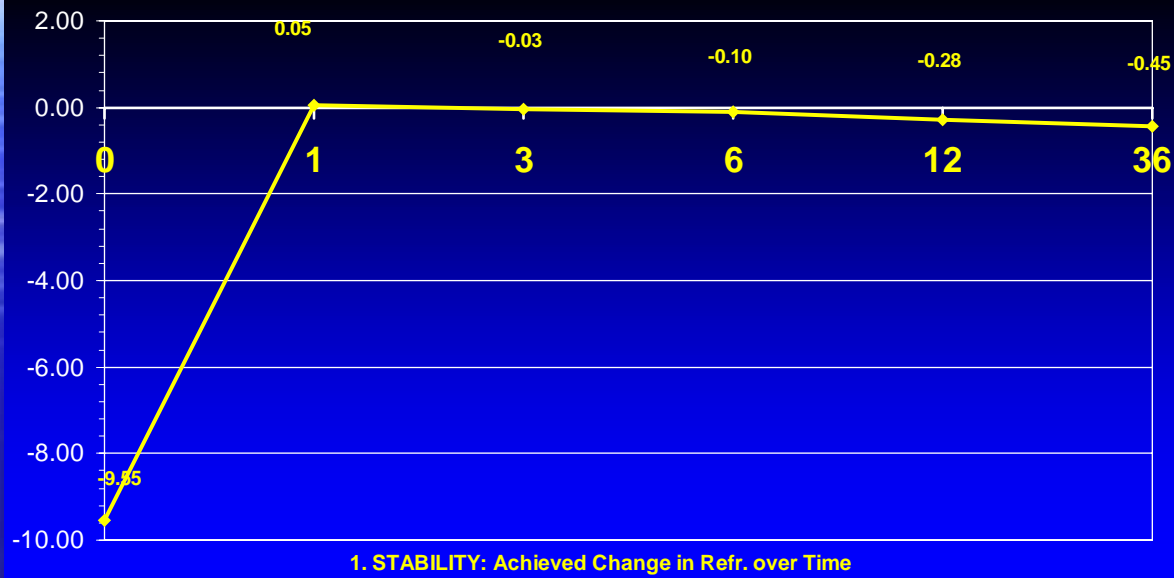
Safety



Efficacy



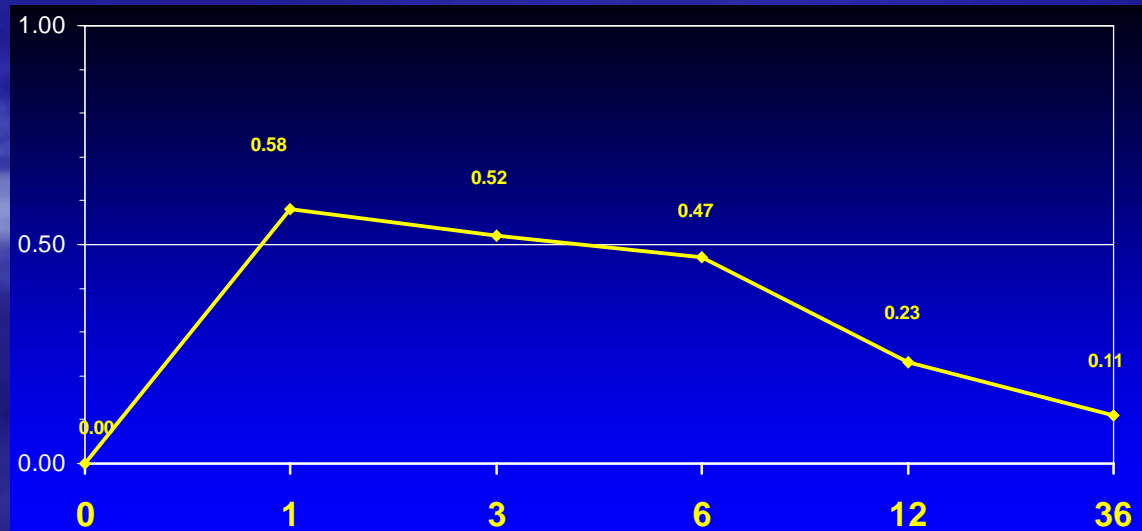
Refractive Stability



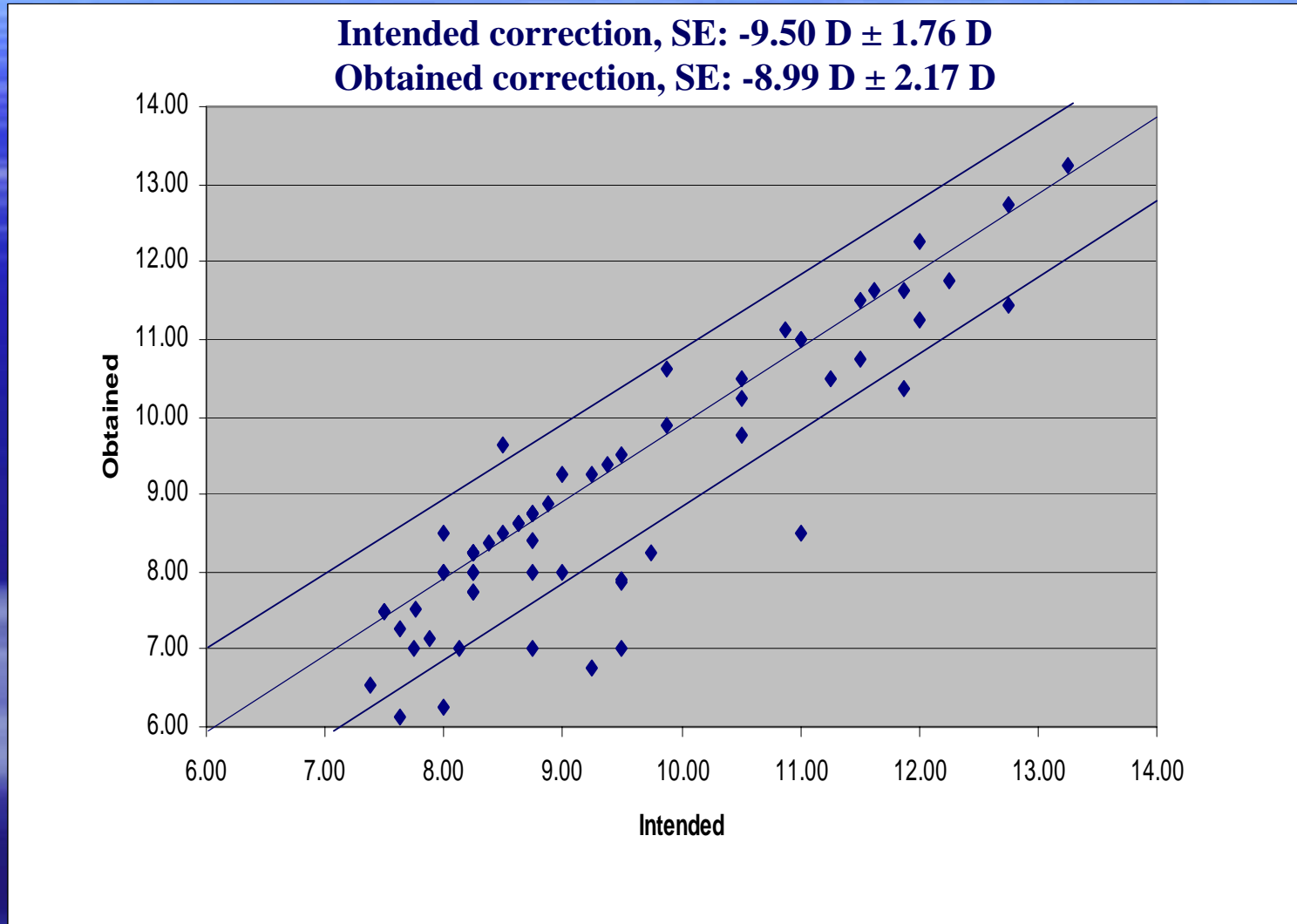
Haze

(Epstein D, Ophthalmology 1994)

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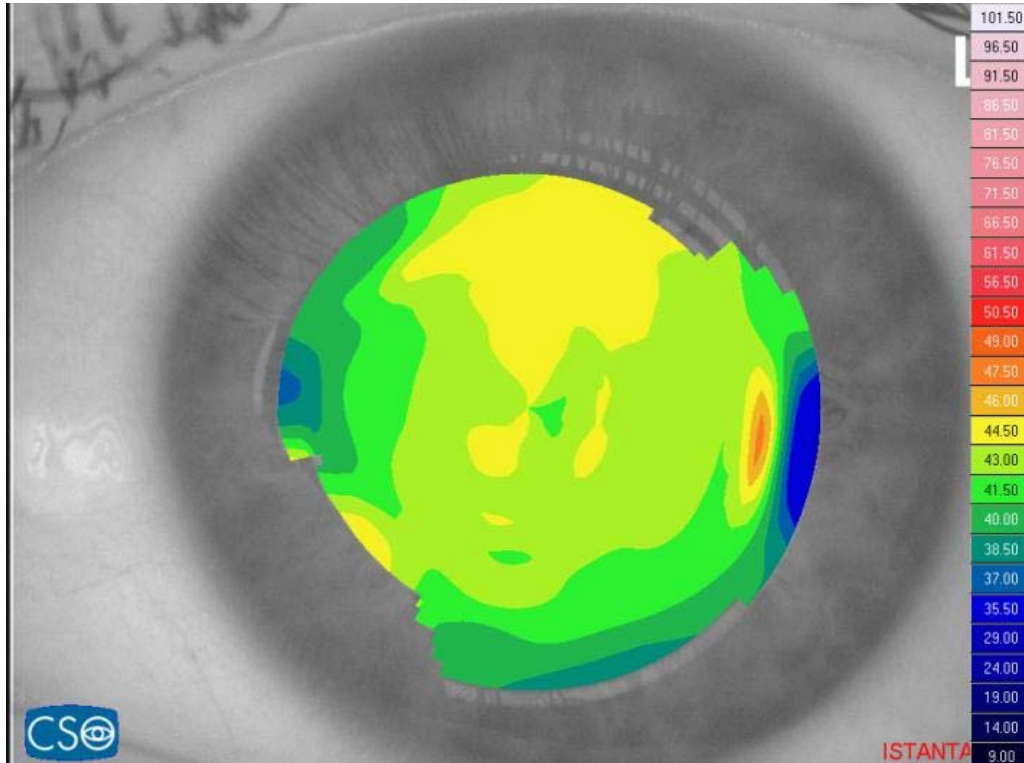


Intended vs. Obtained



Case 1

RM, OS, 34 y.o. female
-8.75 -1.50 (180)

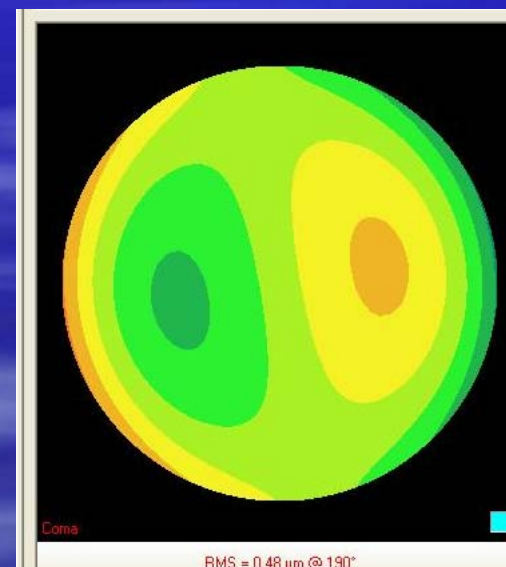
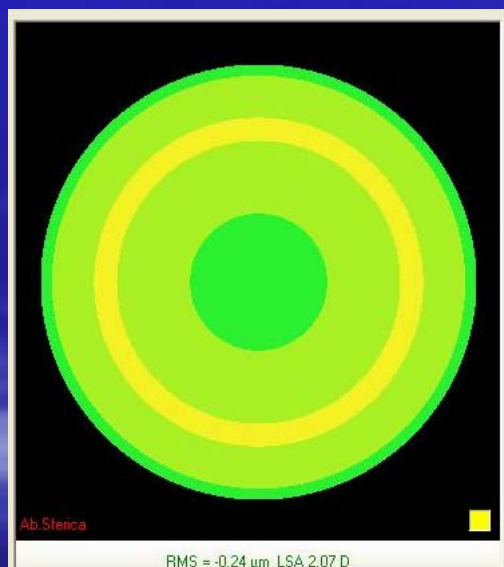
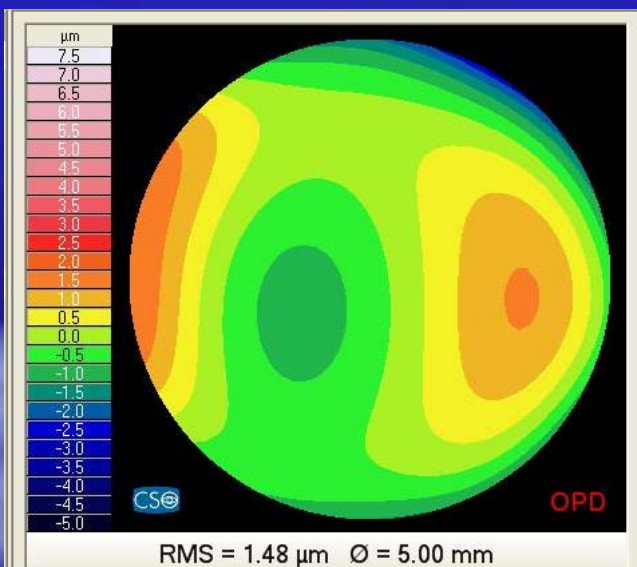
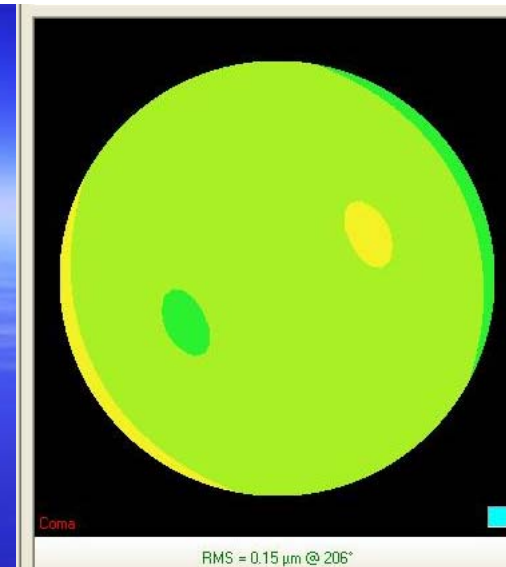
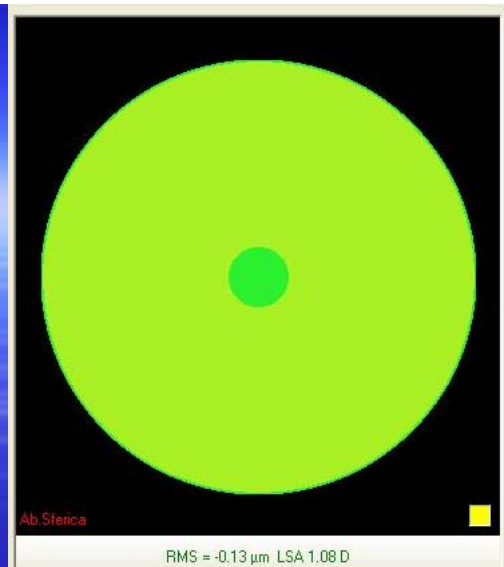
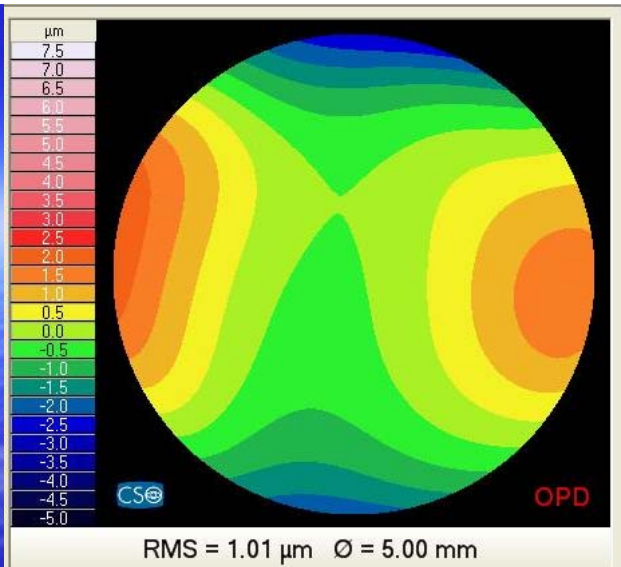


3 years
1.0 -0.75

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ISTANTA



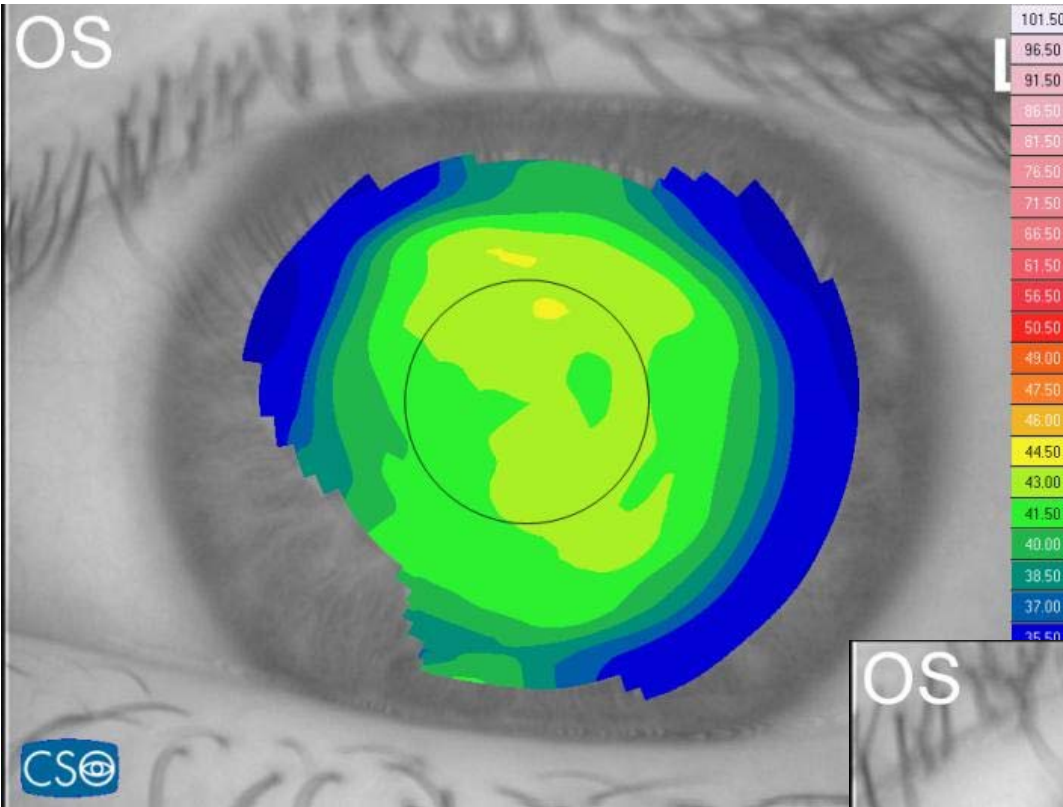
Corneal, 5 mm pupil

Case 1

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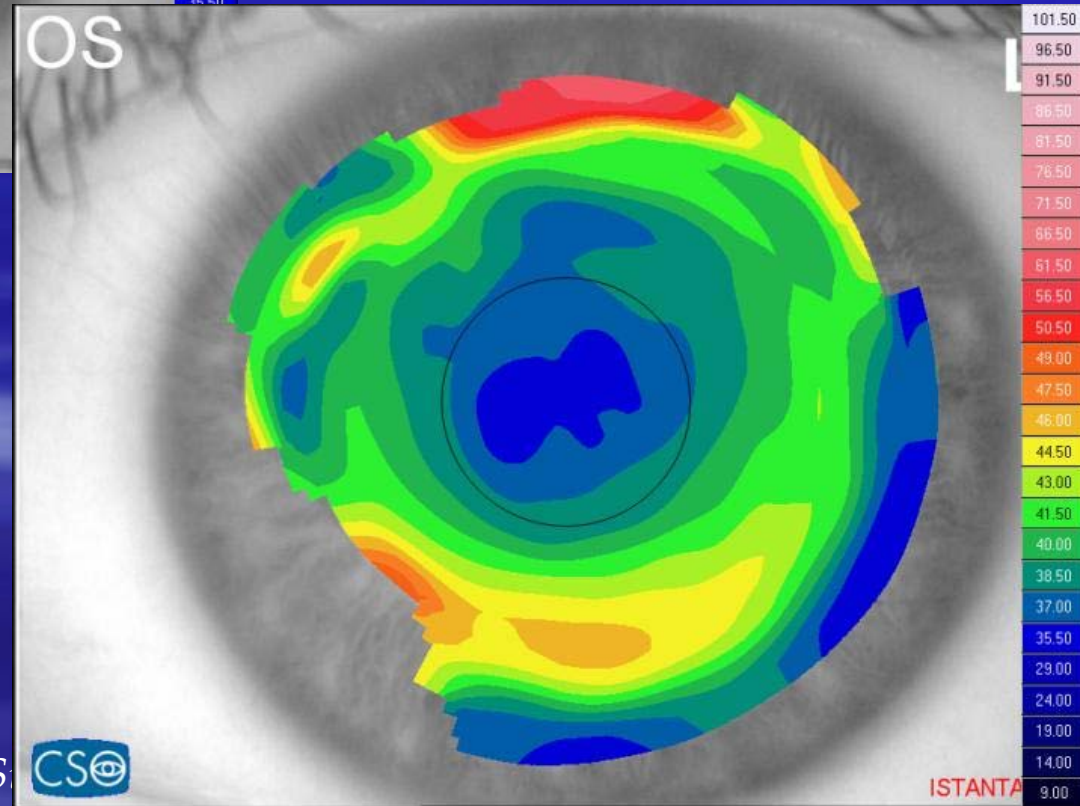


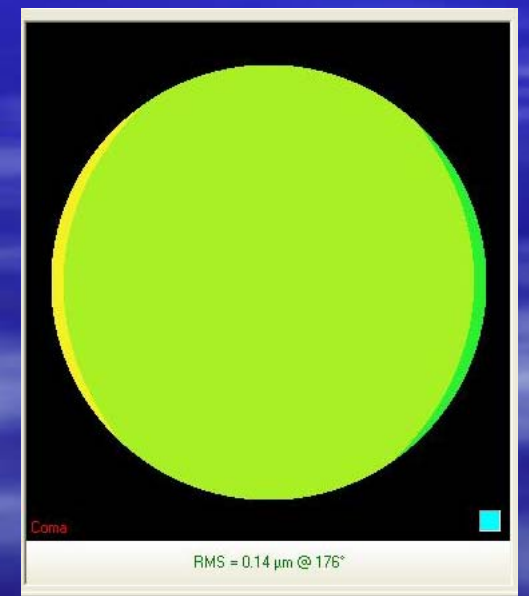
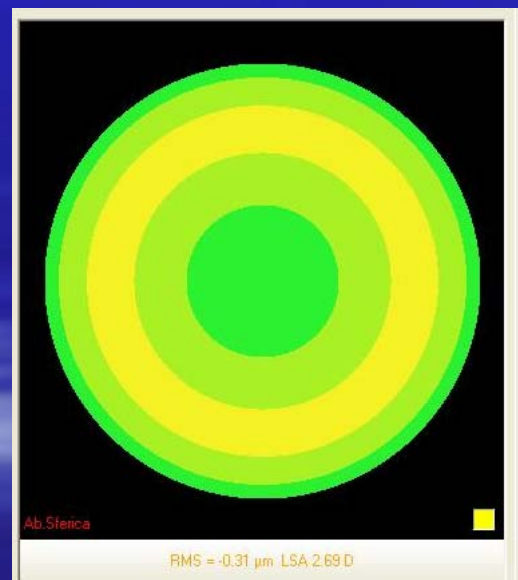
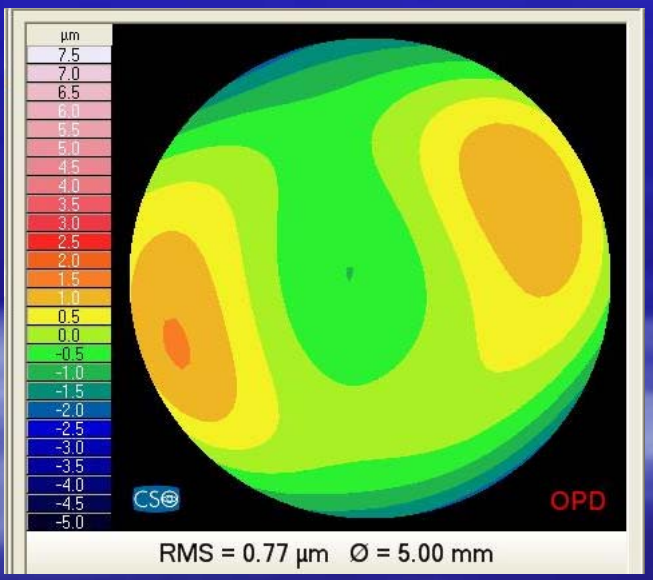
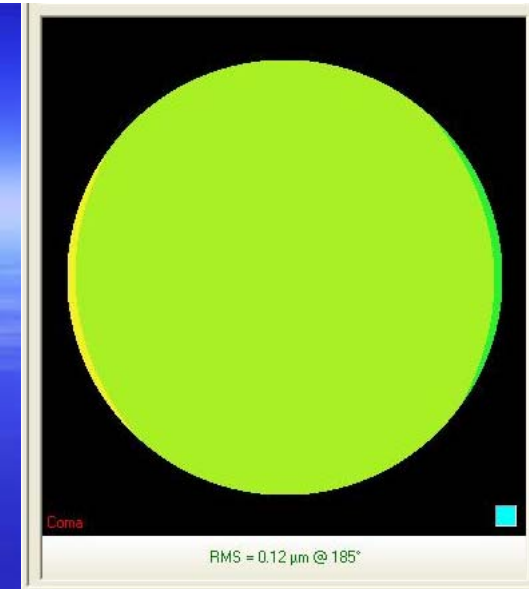
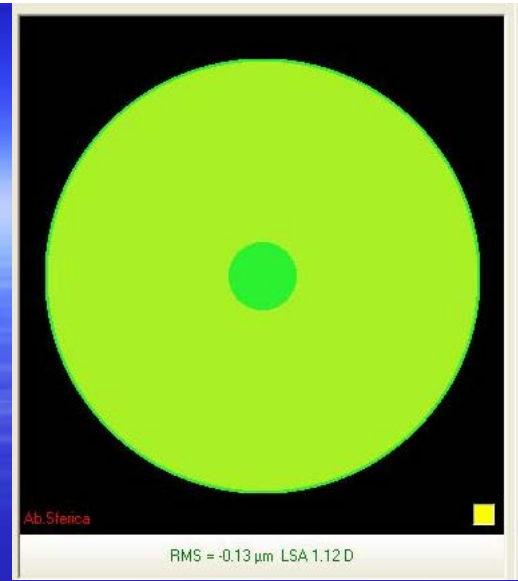
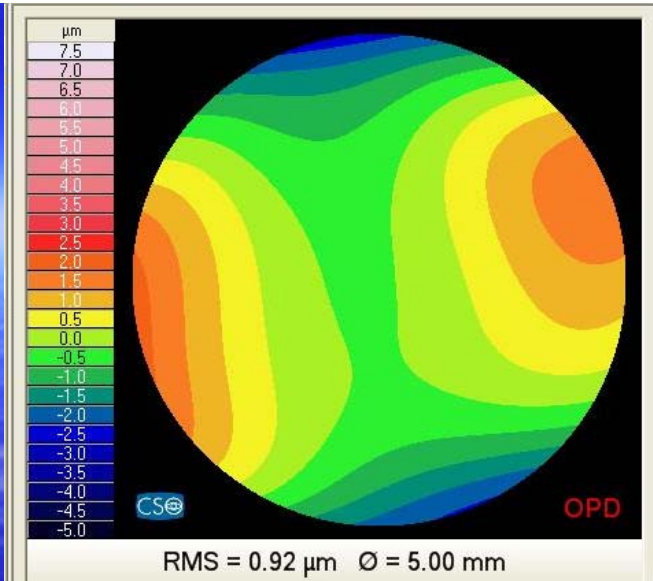
Case 2

SP, OS, 43 y.o. female
-11.50

2.2 years
1.0 -0.50 -0.50 (175)

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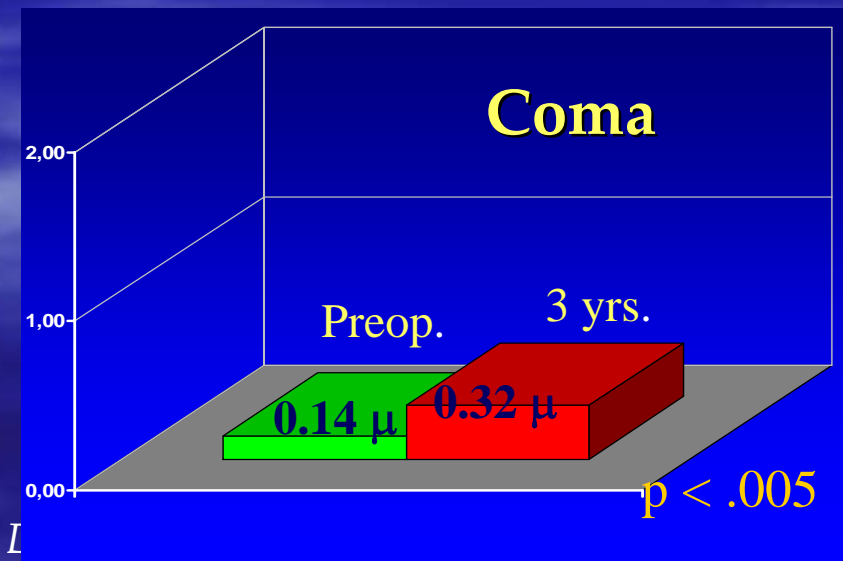
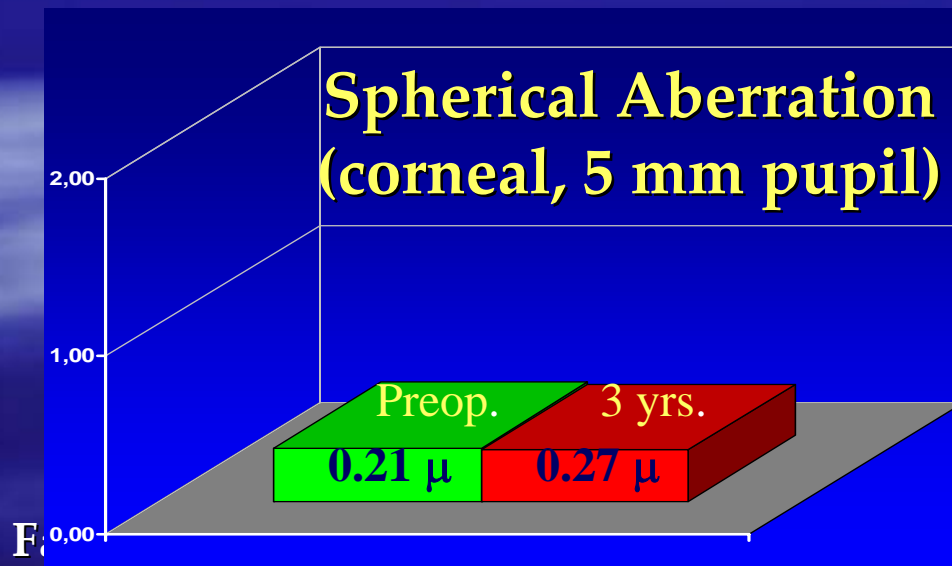
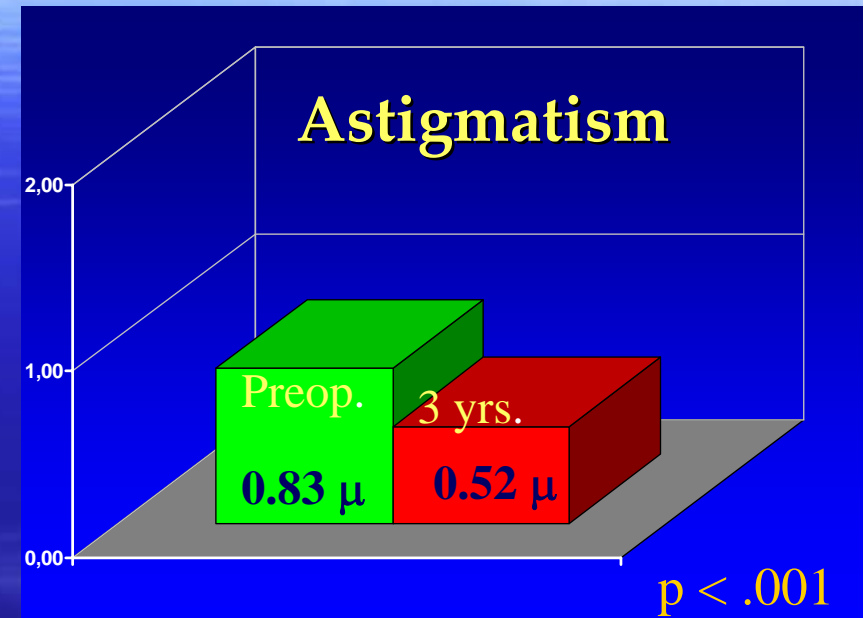
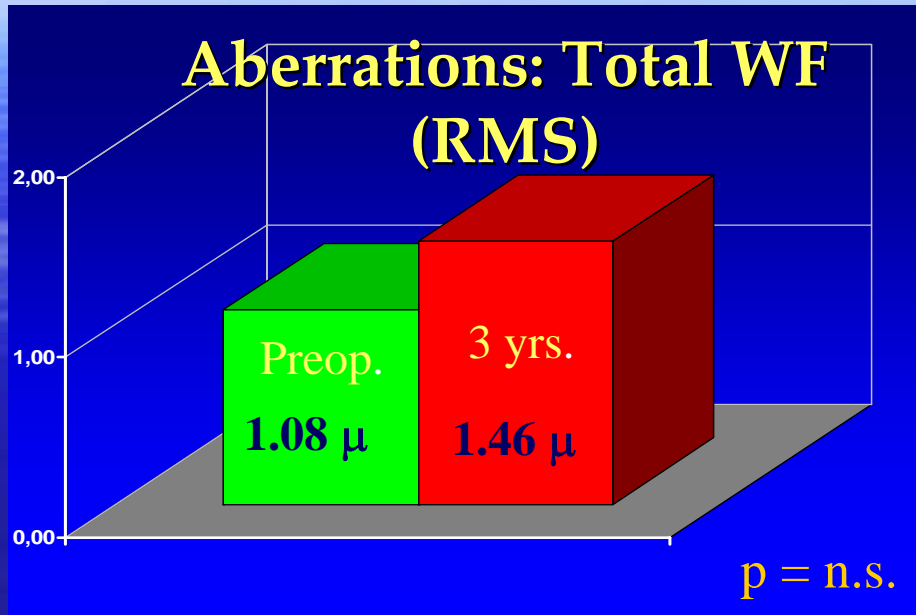
Corneal, 5 mm pupil

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Aberrometry

(5 mm pupil)



Aberrations

- Large **AZ (7 – 5 mm)** and **TZ (10 – 8 mm)** diameter minimizes postoperative spherical aberration increase
- Coma (appropriate centration) increased

Complications

- **Retreatments:**
 - 2 **hypercorrected** eyes (**2%**) (same patient, 67 y.o.)
- No ectasia
- Corneal **haze**: 0.11 ± 0.32 at year 3
- **No** retinal detachment

High Myopia

- Wide AZ, TZ, and multizone approach created a transition zone:
 - More peripheral (less **spherical aberration**)
 - More gradual (less collagen deposition and **regression**)
- Knowledge integrated in modern custom ablation profiles
- **Smoothing** creates a regular surface, decreasing haze formation and regression
- Long term stability even with thin corneas...

Nepomuceno RL, J Cataract Refract Surg, Feb 2005

Vinciguerra P, Cataract and Refractive Surg, Jan 2005

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Surface Ablation for High Myopia *Conclusions*

- The most happy patients
- High level of accuracy
- No ectasia
- Smoothing:
 - Modulation of corneal healing process
 - No regression
 - Limited or absent haze

*(Gambato C, Ophthalmology, 2006
Wilson, SE, Exp Eye Res, 2006)*