

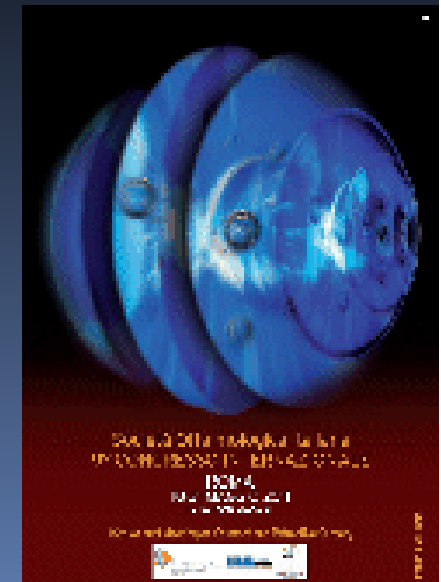
Ocular High Order Aberrations Before and After Implantation of an Aspheric IOL

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I have no financial interest to disclose



Wavefront Measurement

- Measures the optical performance of the entire eye, its aberrations.

- **Built-in human optical high order aberrations**

- **Cornea:**

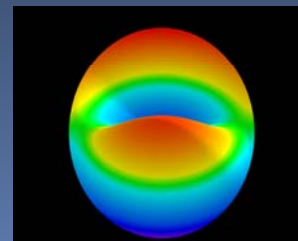
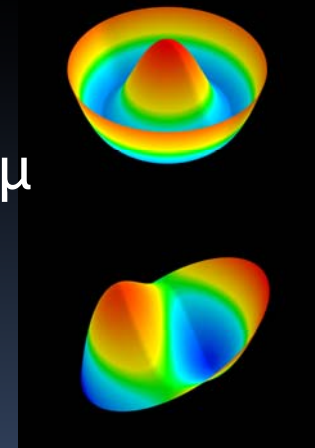
- Spherical aberration (SA), mean $+0.27\mu$

- Horizontal coma

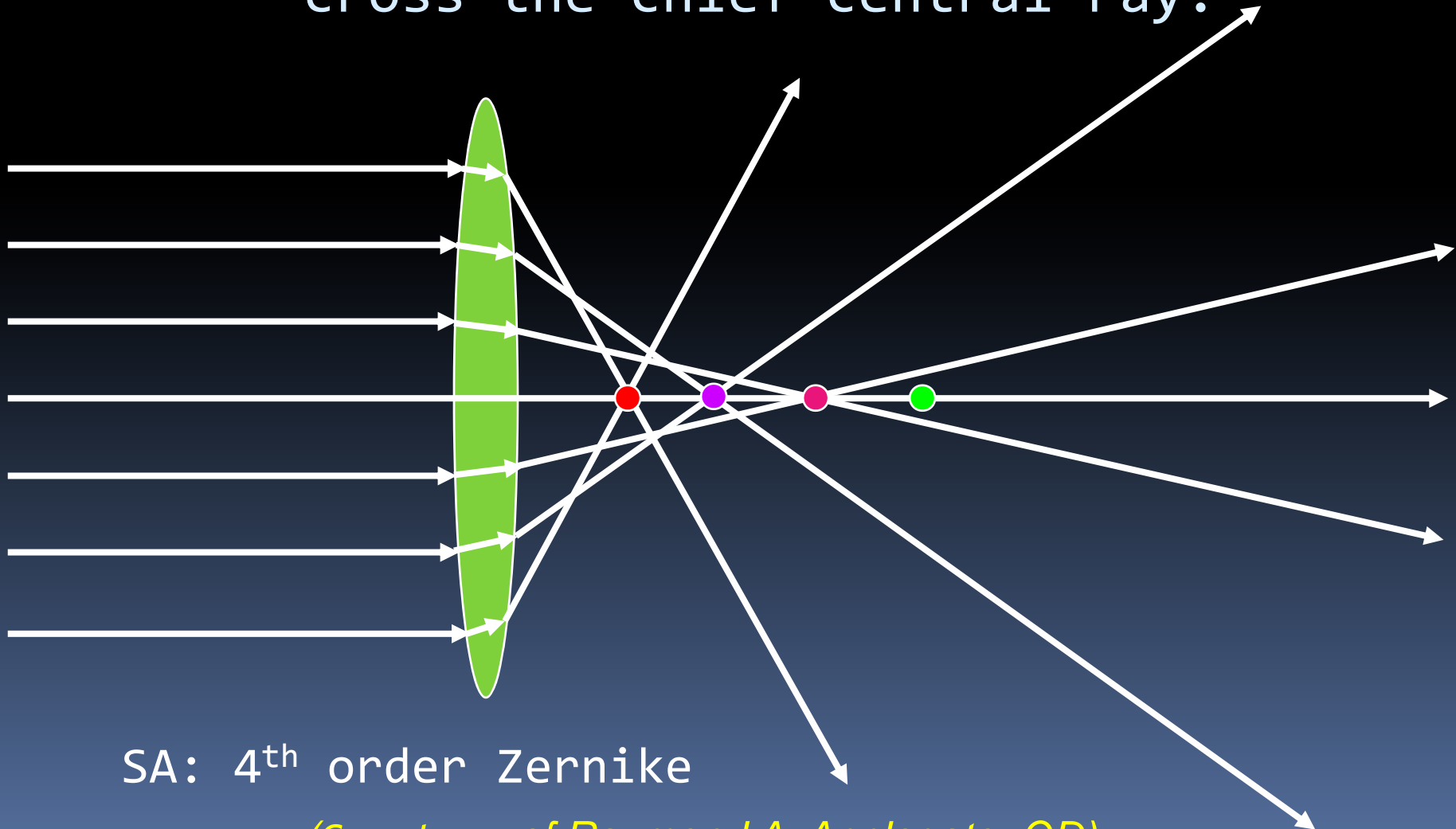
- **Crystalline lens:**

- SA: mean -0.27μ (young), $+0.13\mu$ (60 y.o.)

- Vertical coma



Spherical lens: each zone of the lens has a unique focal length for which all rays cross the chief central ray.



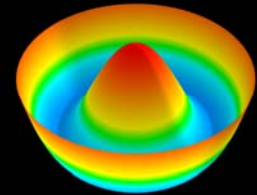
SA: 4th order Zernike

(Courtesy of Raymond A Applegate, OD)

Aspheric IOLs - Rational

- Designed to improved functional vision

- Reduce the total amount of SA



- Thus improve contrast

sensitivity and reduce halos and

glare

(Holladay JT, Quality of Vision. Slack Inc., 2007)

(Kohnen T, Ophthalmology, 2009)

(Dick HB, Curr Opinion Ophthalmol, 2009)

(van Gaalen KW, J Cataract Refract Surg, 2010)

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Aspheric IOLs vs Spherical IOLs

Literature

- Aspheric IOLs provide:
 - Lower SA
 - Better **photopic** contrast sensitivity
 - Better **mesopic** contrast sensitivity

(Nanavaty MA, J Cataract Refract Surg 2010)

(Assaf A, J Cataract Refract Surg, 2010)

(Baumeister M, J Cataract Refract Surg, 2009)

(Xing XJ, Zhonghua Yan Ke Za Zhi, 2010)

(Trueb PR, Ophthalmology 2009) fabrizio@comesasca.com

Aspheric IOLs vs Spherical IOLs

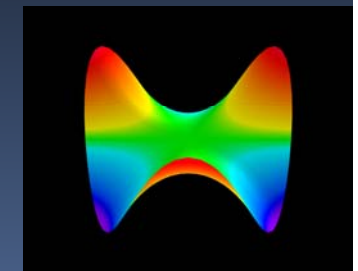
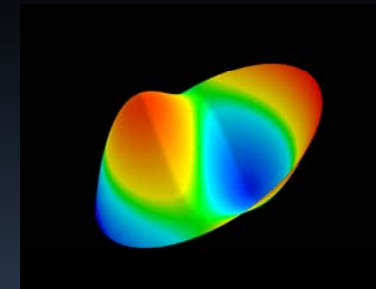
- Not influenced by **tilt/decentration** within norm (risk of induced vertical coma), even if four-point haptic are more stable
- No difference or reduced **3rd order Zernike aberrations** (vertical coma, trefoil)
- Reduced depth of focus ?

(van Gaalen KW, *J Cataract Refract Surg*, 2010)

(Kohnen T, *Ophthalmology*, 2009)

(Nanavaty MA, *J Cataract Refract Surg*, 2009)

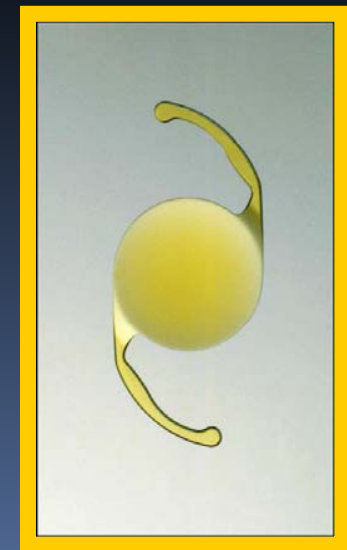
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Aim of the Study

To prospectively evaluate total, corneal and internal ocular aberrations before and after implantation of an aspheric IOL

- Alcon Acrysof IQ SN60WF
 1. Aspheric (prolate) posterior optic surface
 2. Negative mean spherical aberration
 $Z(4, 0)$ of -0.2μ
 3. Blue light filter



NIDEK OPD Scan

1. Aberrometer measuring dynamic skyscopy-derived wavefront in a reproducible way
2. Calculates optical pathway difference
3. 1440 data points within 0.4 sec
4. Integrated, registered corneal topographer (0.2 sec)
5. Used for determining actual corneal SA and aspheric IOL type targeting zero total postoperative SA

(Solomon JD, J Refract Surg 2010)

Materials and Methods

1. Cataract eyes with < -6.00 D, $< +3.00$ D, < 1.50 D cyl
2. No diabetes, glaucoma, previous ocular surgery, uveitis, ARMD
3. 24 eyes, 18 pts (10 males, 8 females)
4. Complete ophthalmological examination
5. Aberrometry with NIDEK OPD in mesopic conditions

Materials and Methods

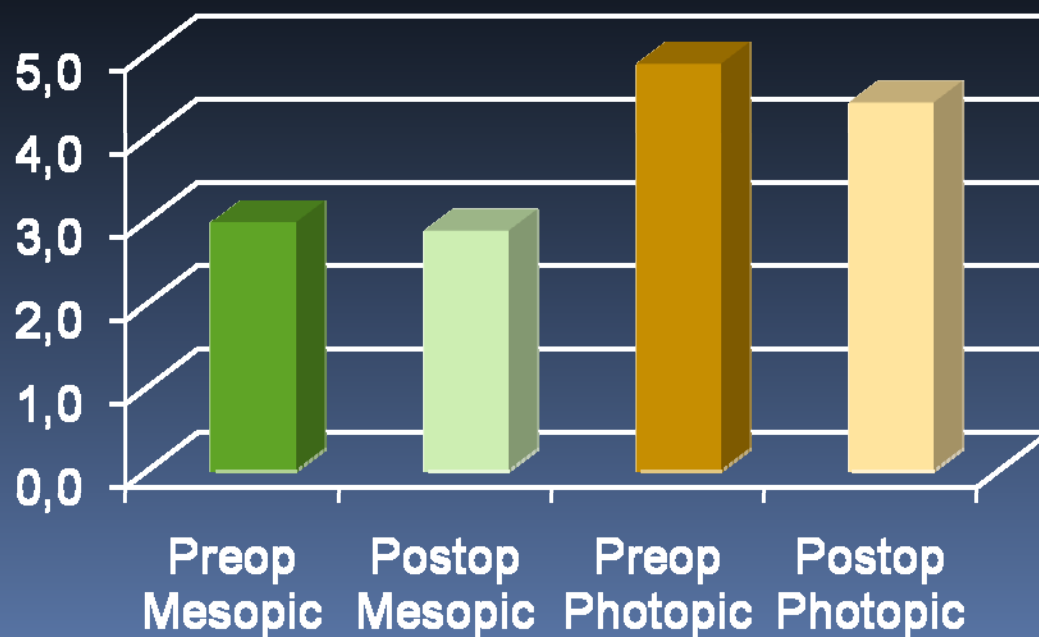
6. Unventful topical anesthesia cataract surgery, 3.2 mm incision, no suture
7. Smaller-than-optic CCC + phaco (Alcon Infinity) + in-the-bag implantation
8. Alcon Acrysof IQ SN60WF aspheric IOL
9. Three weeks: complete ophthalmological examination, NIDEK OPD aberrometry

Results

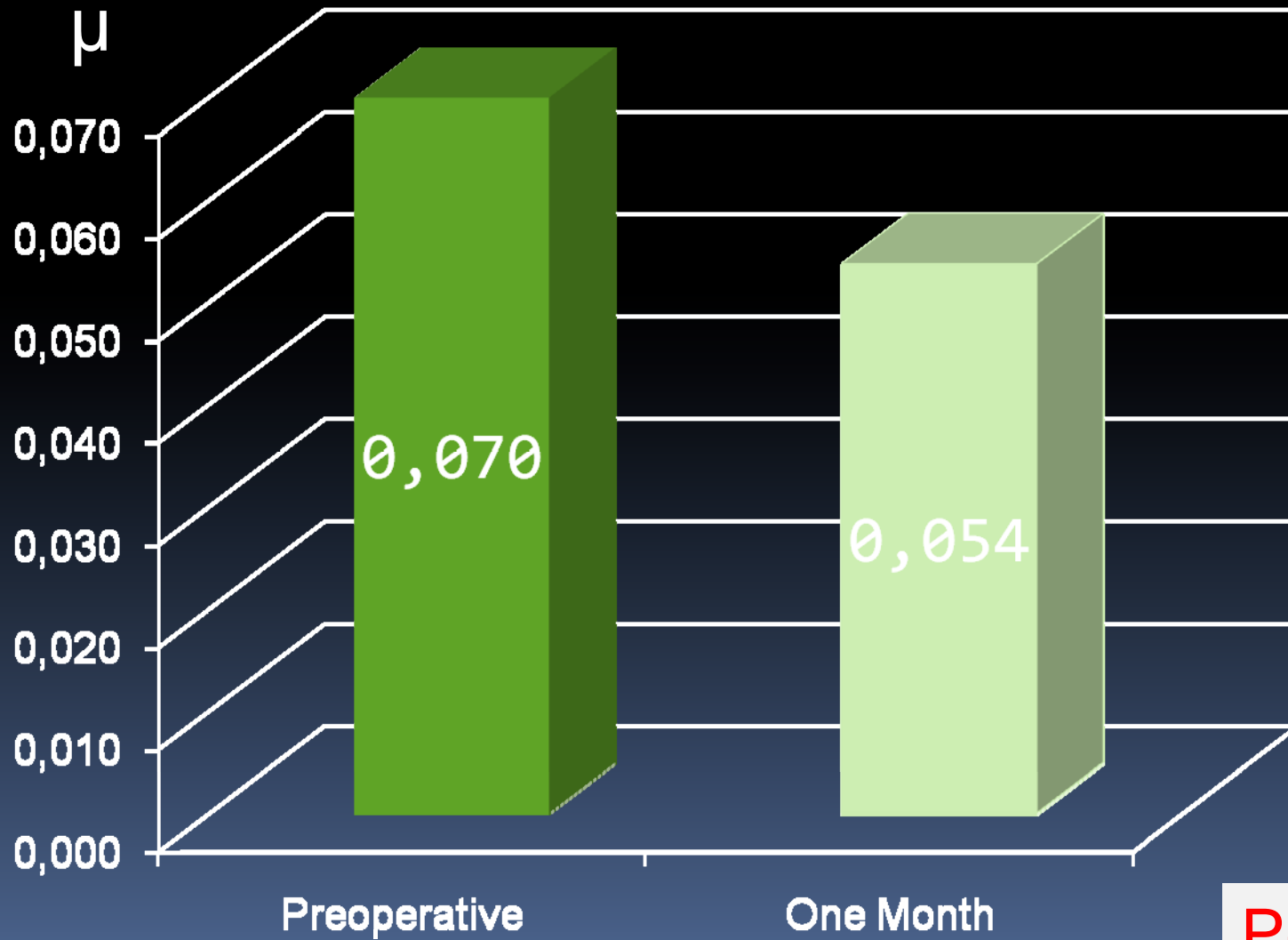
- Mean follow up: 20.9 ± 10.6 days
- Alcon SN60WF: mean 20.30 ± 4.33 D (max 29.0 D, min 13.0 D)
- Preoperative BSCVA: 0.24 ± 0.22 LogMar
-1.31 D \pm 2.92 D SE
- Postoperative BSCVA: 0.05 ± 0.84
LogMar -0.92 D \pm 1.45 D SE
- Postoperative UCVA: 0.15 ± 0.68 LogMar

Results

6. Wavefront aberrations were reconstructed using 3rd through 6th order Zernike polynomial decompositions for a 4.5 mm pupil

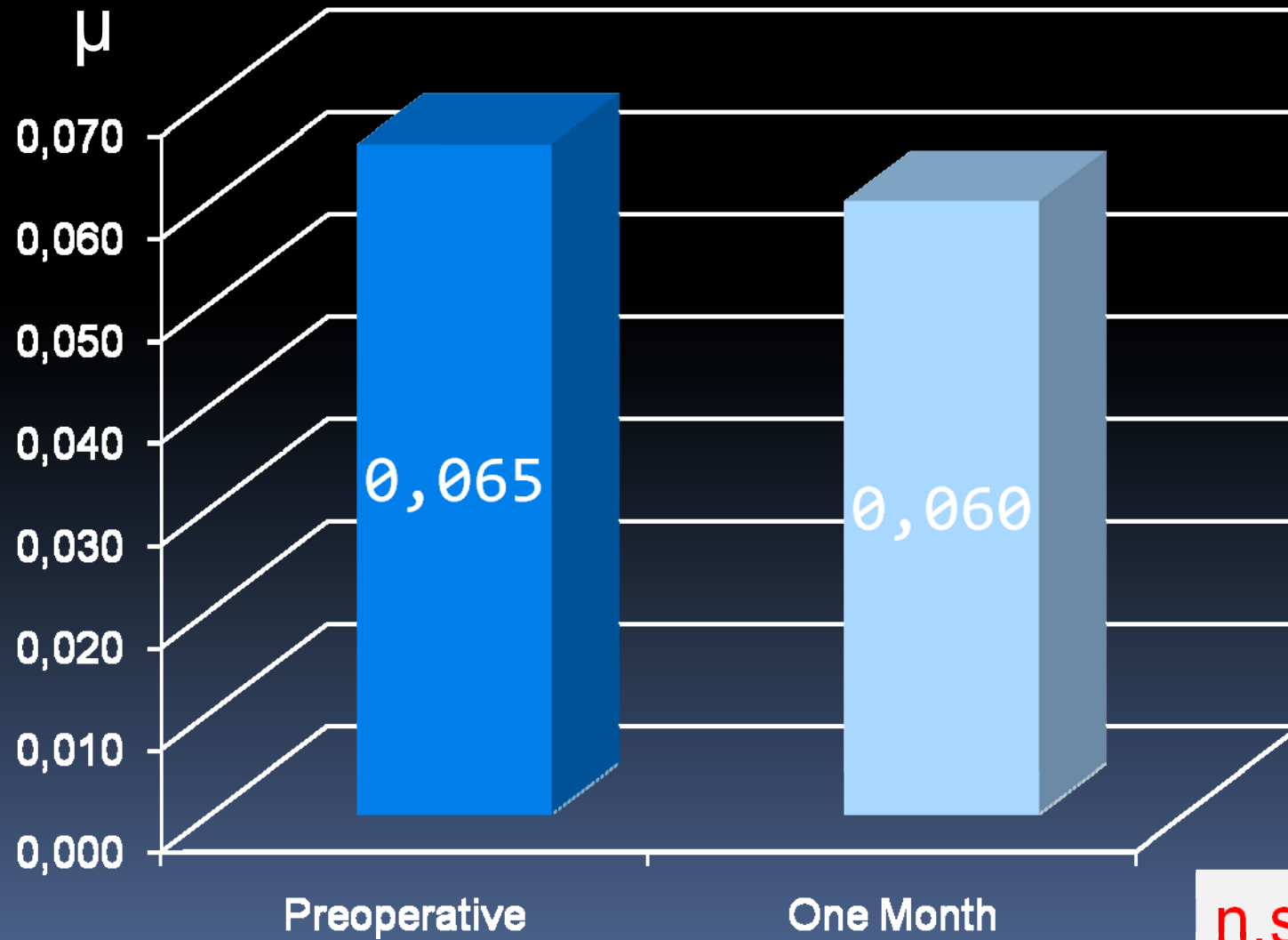


Total SA

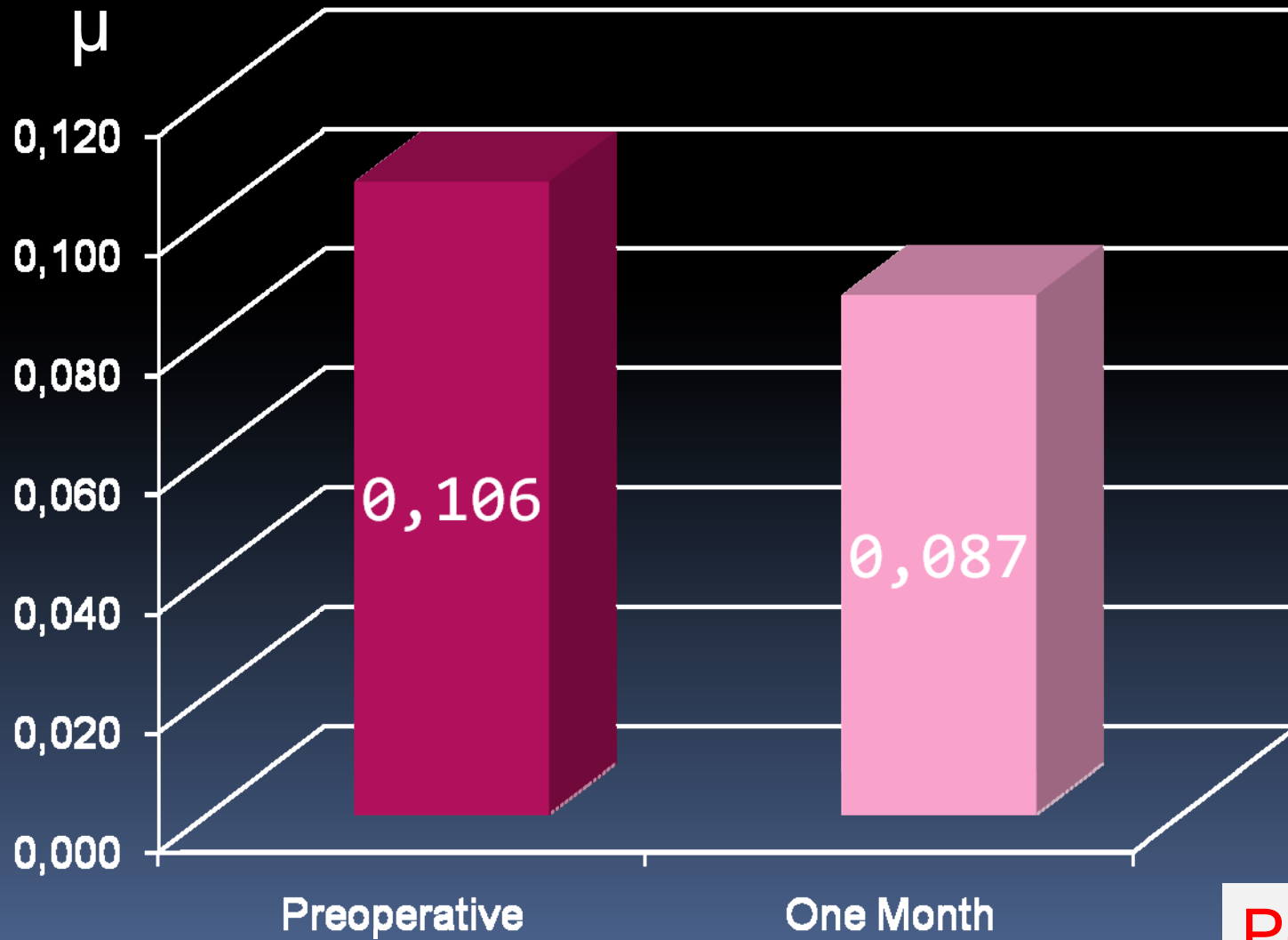


P < .05

Corneal SA

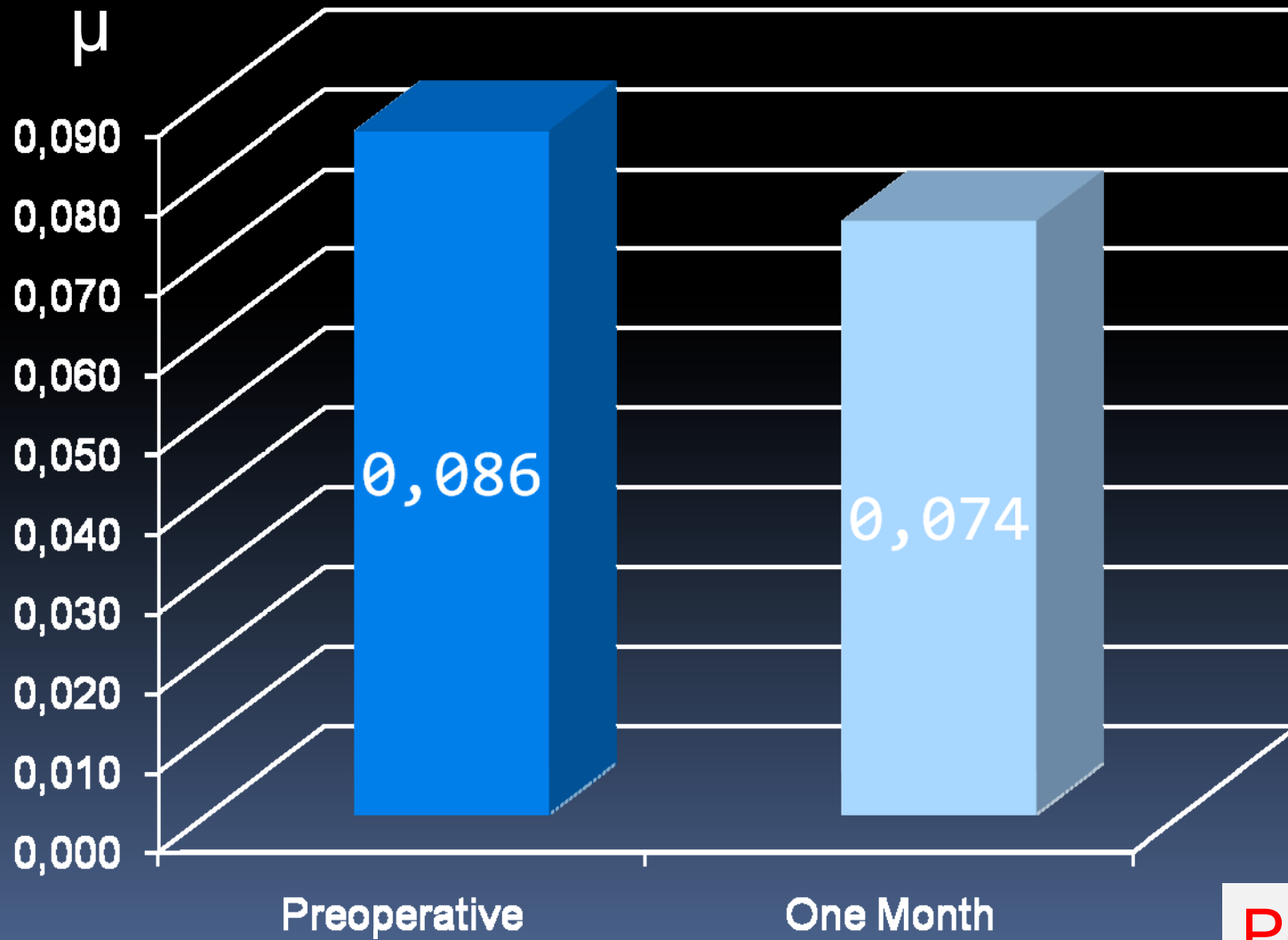


Internal SA



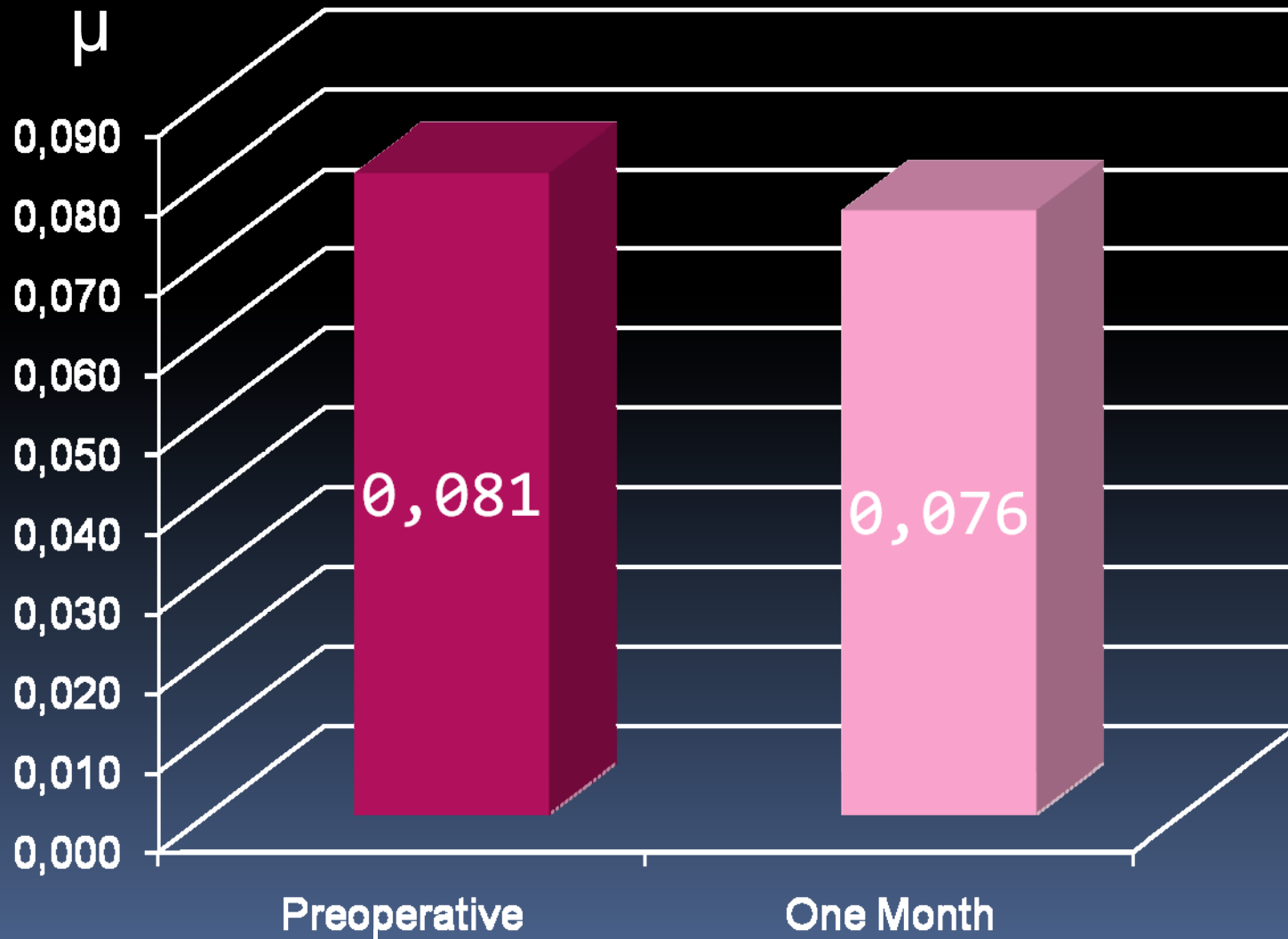
P < .05

Total Coma



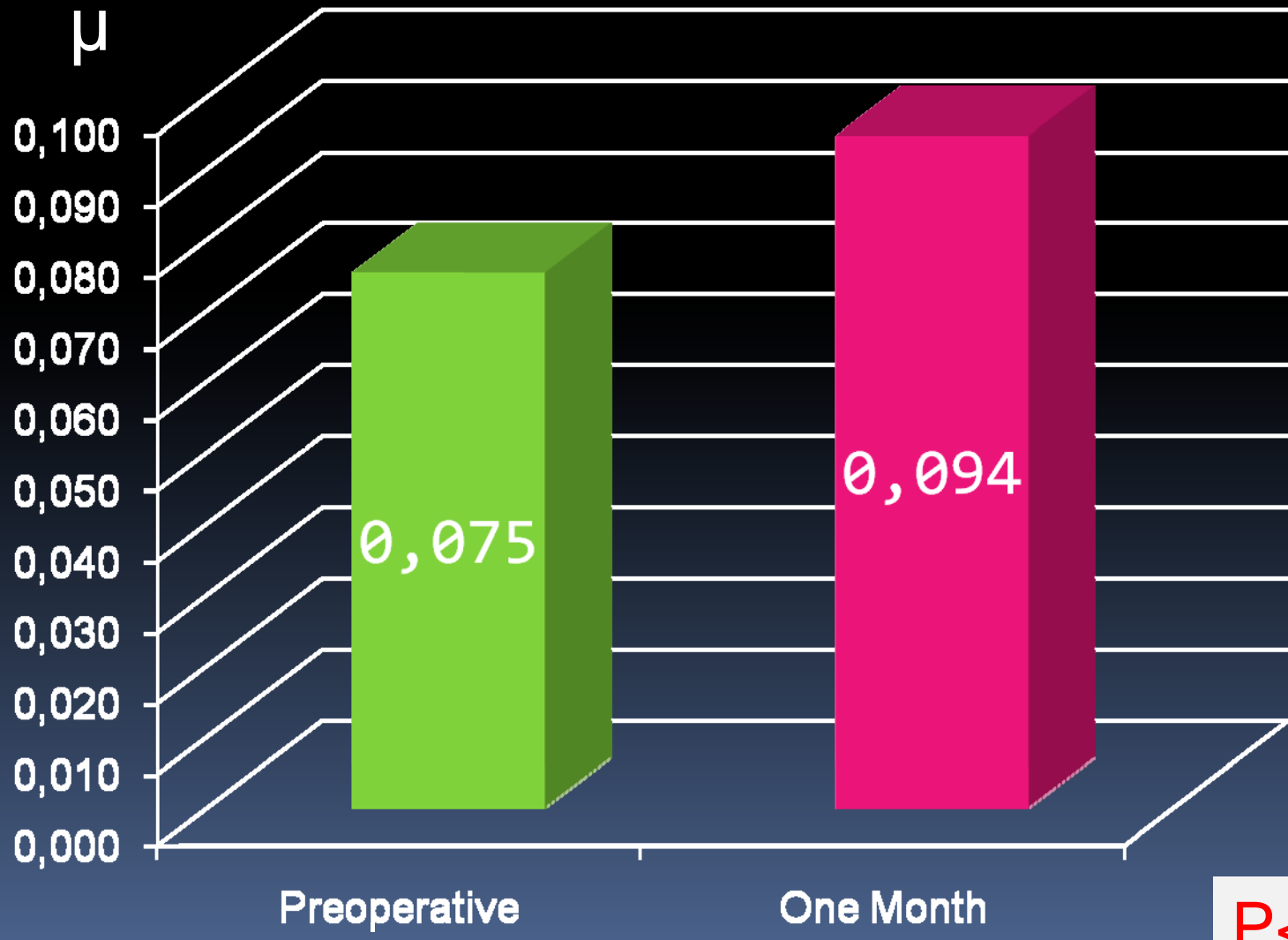
$P < .05$

Corneal Coma

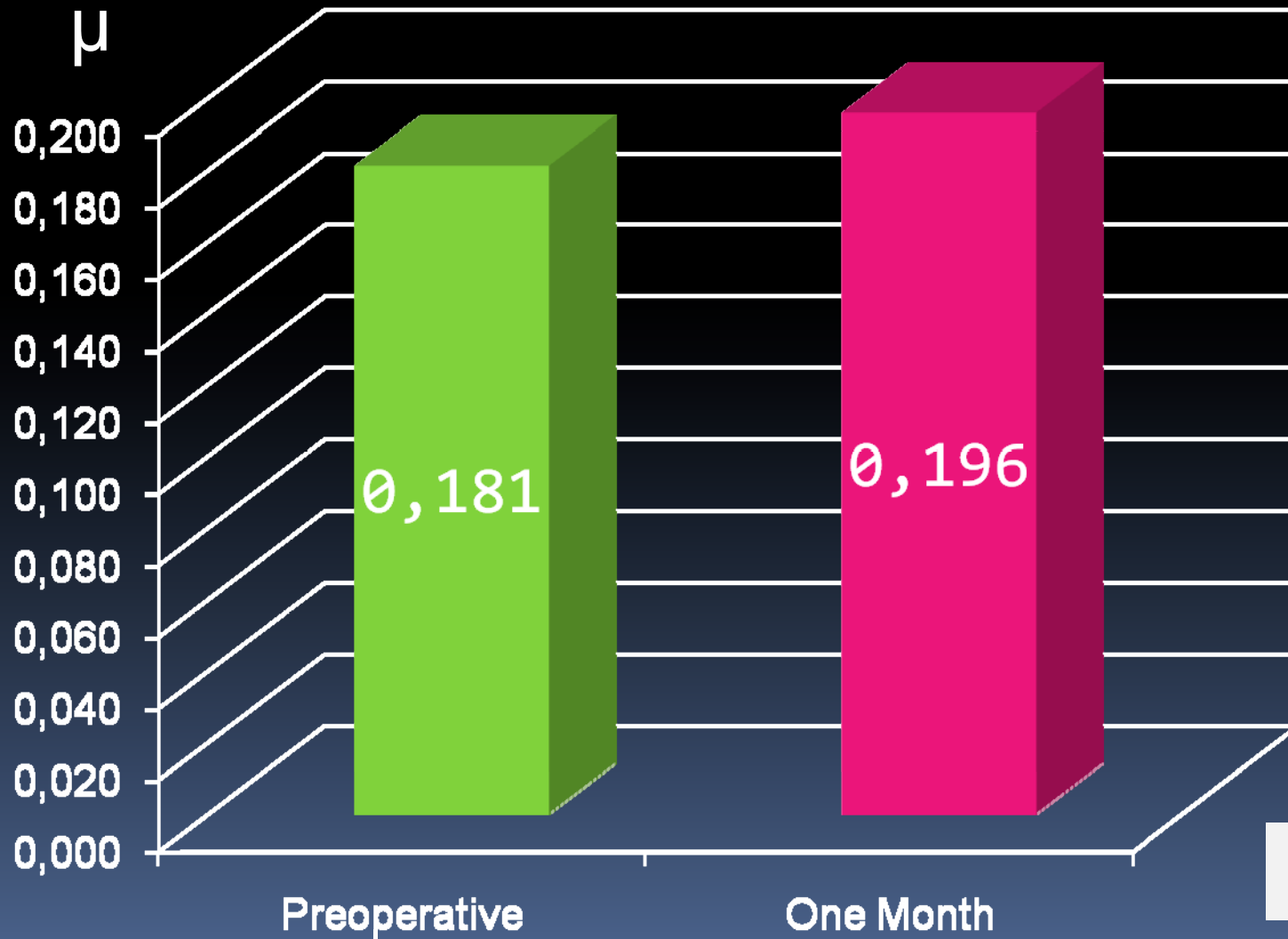


n.s.

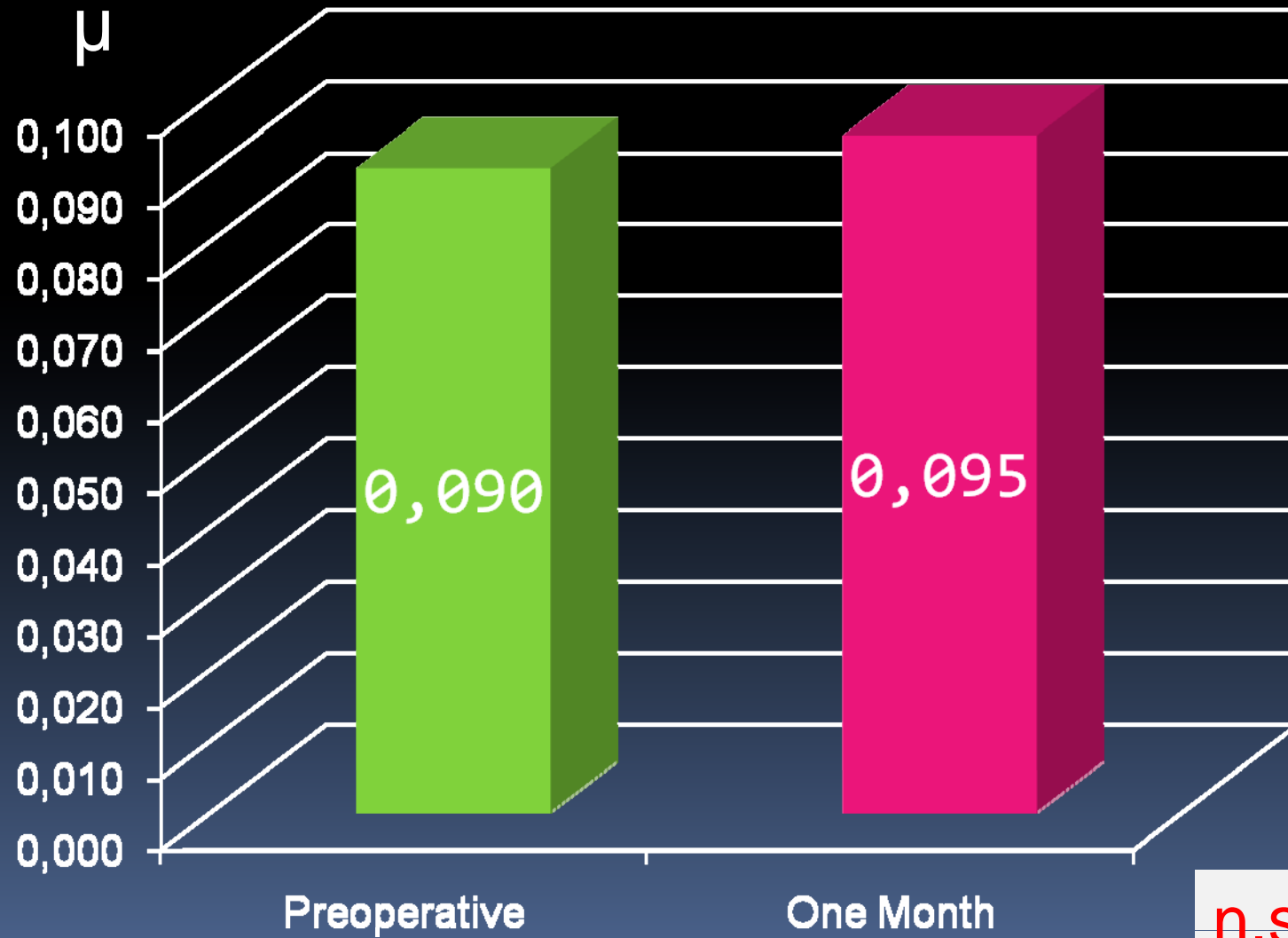
Internal Coma



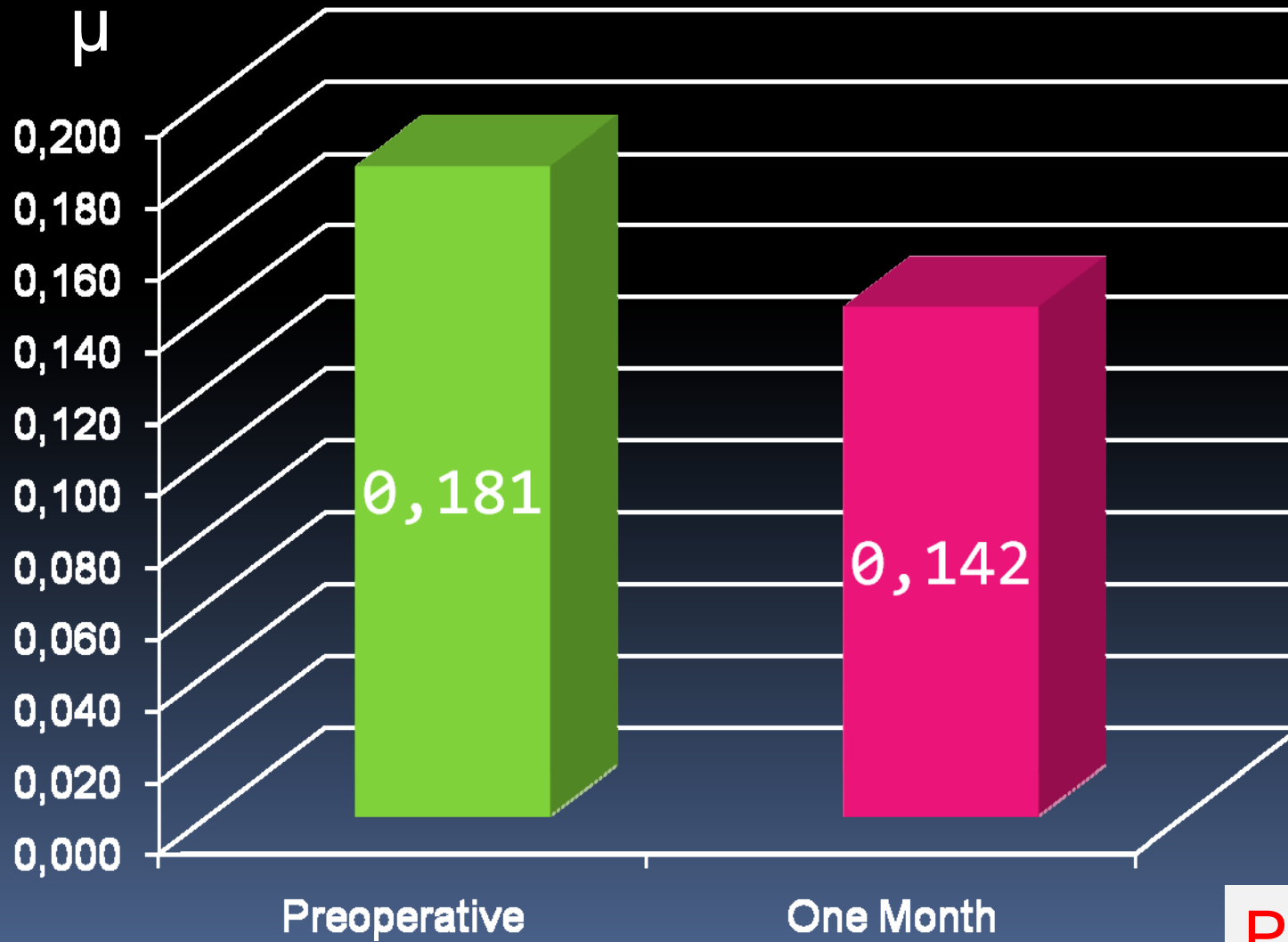
Total Trefoil



Corneal Trefoil



Internal Trefoil



P < .05

Aspheric IOLs

1. Tecnis Z9003 vs Acrysof IQ vs Akreos ADAPT-A0. First one lowers significantly SA and improves contrast sensitivity mesopic/photopic. Comparable visual quality
(Lee KM, Acta Ophthalmol 2011)

1. Aspheric IOLs induce less vertical coma than spherical IOLs
(Nanavaty MA, J Cataract Refract Surg 2010)

Acrysof IQ SN60WF

1. Acrysof IQ lowers SA and improved contrast sensitivity when compared to spherical IOLs

(Mester U, J Refract Surg, 2008)

(Kohnen T, Ophthalmology 2009)

(Nanavaty MA, J Cataract Refract Surg, 2009)

(Landers J, Clin Exp Optom, 2010)

(Trueb PR, Ophthalmology, 2009)

(Rekas M, Eur J Ophthalmol, 2008)

(Awwad ST, Eur J Ophthalmol, 2007)

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Acrysof IQ SN60WF

2. Impact on patient's subjective visual acuity remains elusive (high-contrast photopic BCVA)

(Trueb PR, Ophthalmology, 2009)

(Landers J, Clin Exp Optom, 2010)

Conclusions

- Given that corneal SA remains stable, aspheric IOL **lowers** age-related **increase in SA**
- Cataract-induced increase in **internal trefoil** is eliminated
- Limited increase in **internal coma** possibly related to tilt
- IOL safe and reliable

- Further studies are required to ascertain if some spherical aberration is **favourable** (increased depth of focus) or **unfavourable** (i.e., it induces a myopic shift)

(van Gaalen KW, J Cataract Refract Surg 2010)

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Recommendations

- Targeting corneal wavefront

- may produce favourable results

(Packer M, J Refract Surg, 2009)

- tilt, decentration and defocus may influence total HOA, increasing coma-like aberrations

(Solomon JD, J Refract Surg, 2010)

(van Gaalen KW, J Cataract Refract Surg 2010)

Thank you for your attention !

