



El Cairo, 25-26 January 2018

Topographic Patterns of Ectasia and ICRS Implantartion Modalities: Indications and Results

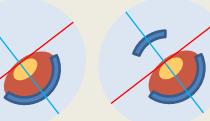
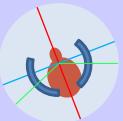
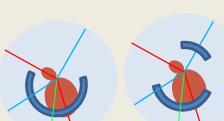


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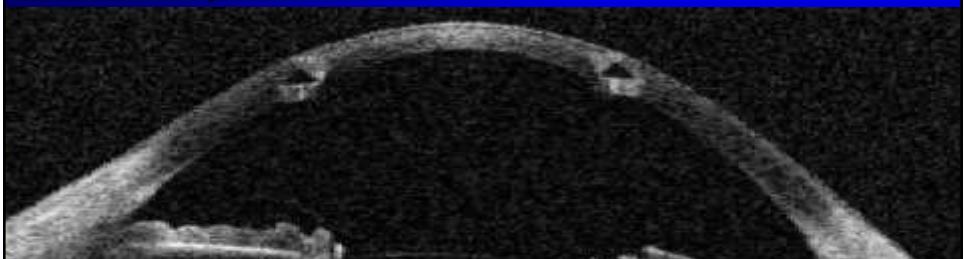
Combining the two criteria: 4+2 types (The SymAx classification)

SA.ANA type	Segments (Symmetric vs. Asymmetric)	Implantation Axis (Axial= same, flat A axis vs. Non-Axial= other axis)
SA	Symmetric 2 ICRS (equal)	Axial (red= plus axis blue= minus axis) 
AA1 AA2	Asymmetric 1 ICRS 2 ICRS(unequal)	Axial (red= plus axis blue= minus axis) 
SNA	Symmetric 2 ICRS (equal)	Non-Axial (green= mid-ICS axis, displaced ≥15° from minus axis) 
ANA1 ANA2	Asymmetric 1 ICRS (wide) 2 ICRS(unequal)	Non-Axial (green= mid-ICS axis, displaced ≥30° from Minus axis → coma axis or intermediate) 

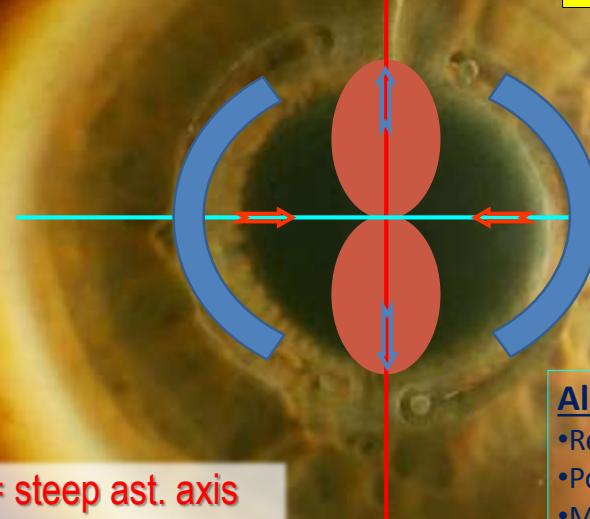
Background: IntraCorneal Ring Segments (ICRS)



- KC variability makes ICRS implantation a complex problem
- What are we trying to correct?
- What is the effect of ICRS on each aspect of correction?
- What is the best combination of ICRS for a particular cornea?



→ SA - Symmetric Axial ICRS ≈ 10%

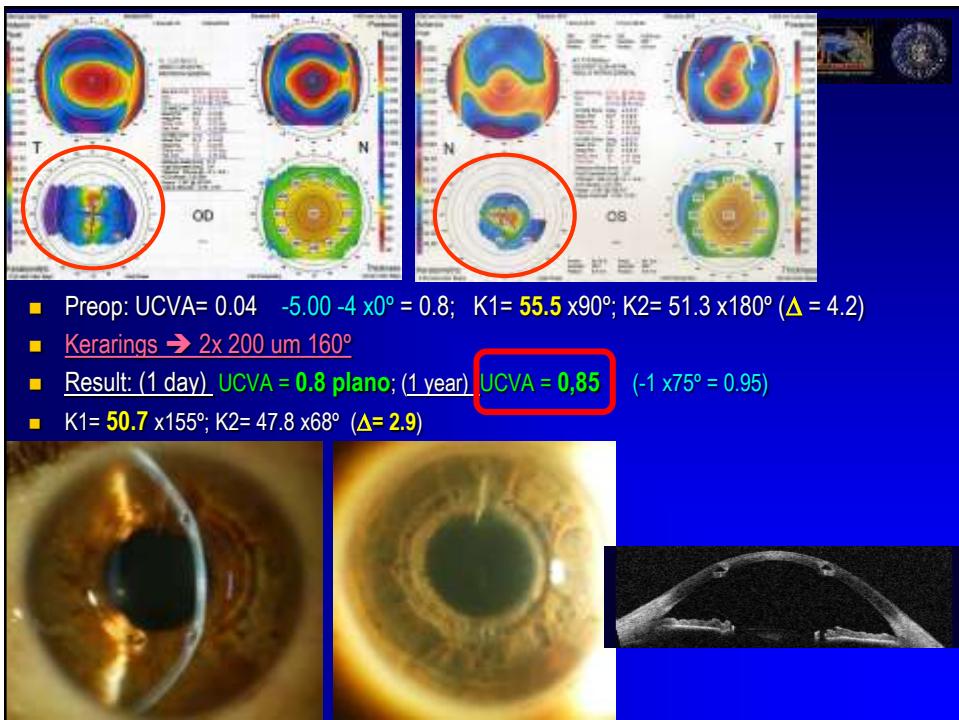


Spherocylindrical effect,
(depending on arc lenght)

Also for:

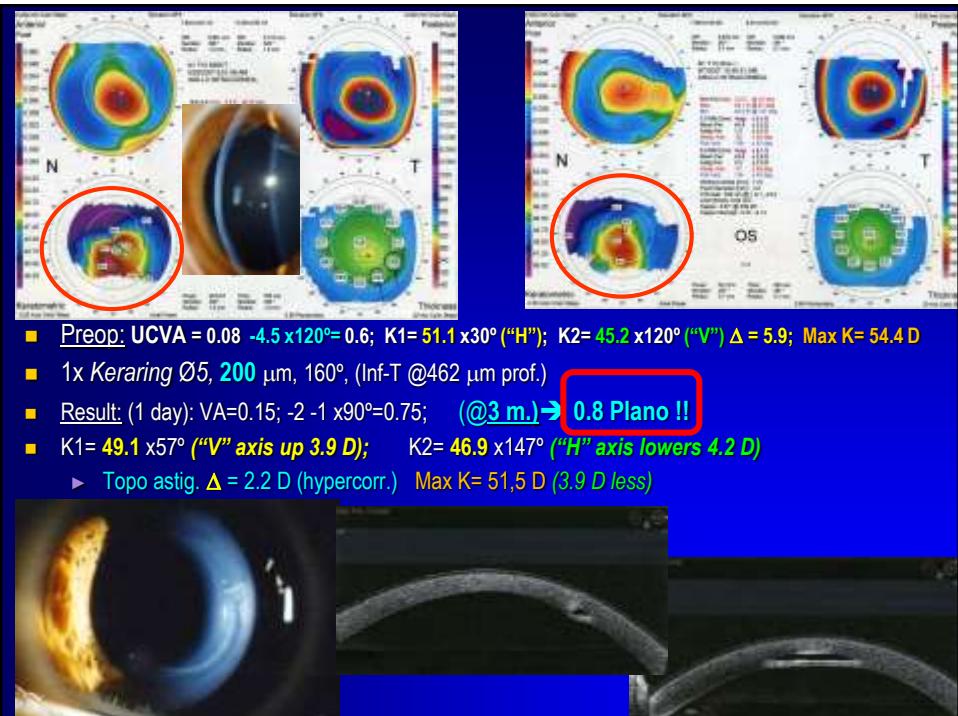
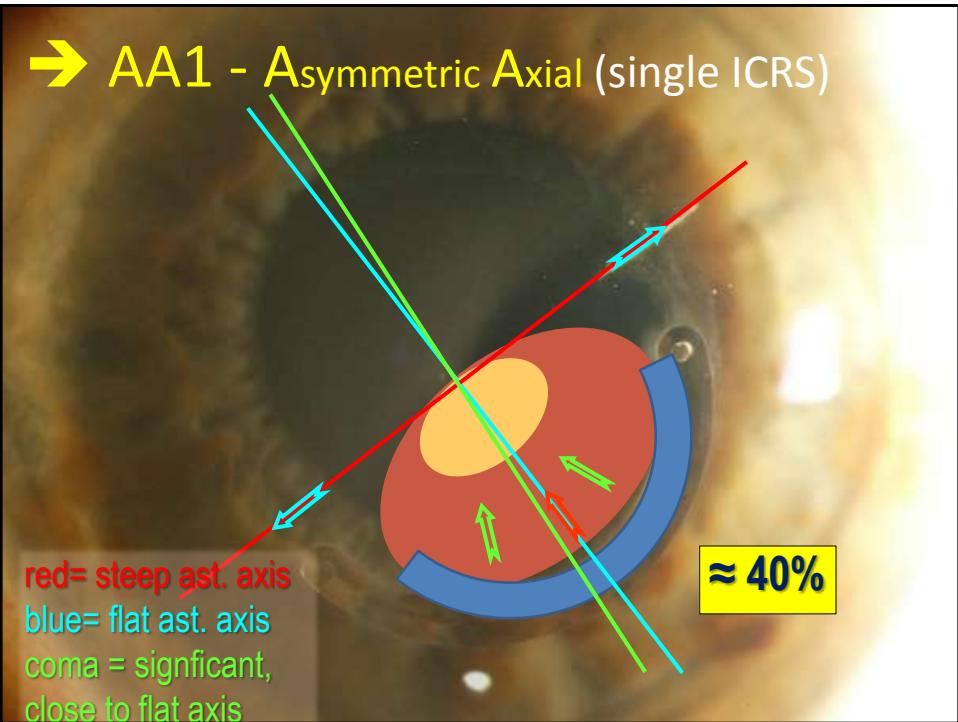
- Regular astigmatism
- Post-PK astigmatism
- Mild myopia >3.5d
- Residual myopia after Rx., thin cornea.

red= steep ast. axis
blue= flat ast. axis
coma = minimal

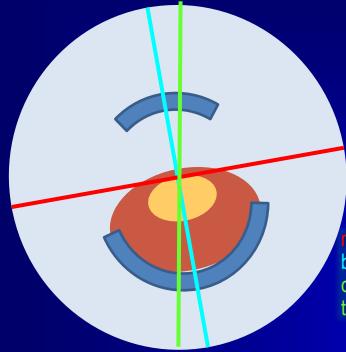


Asymmetric Ectasia, “Moustache”
or “Croissant” pattern
(markedly displaced, infero-temporal)

red= steep ast. axis
blue= flat ast. axis
coma = significant,
close to flat axis

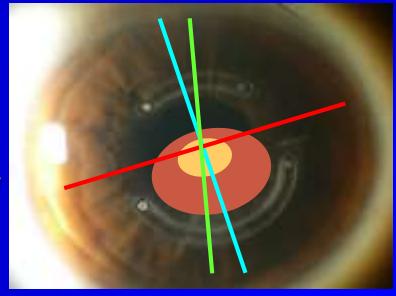
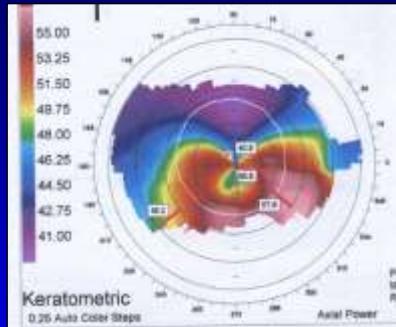


Asymmetric Axial (higher power)



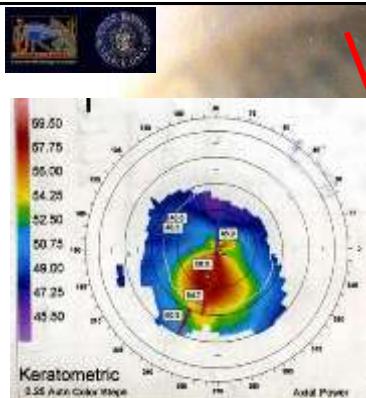
$\approx 30\%$

red= steep ast. axis
blue= flat ast. axis
coma = significant,
towards flat axis



- Same as AA1, BUT:
- *Higher cylinder or sphere combinations*
- → Additive effect of ICS thickness/width
- *Remember:* Coma corrected by asymmetry
- → Upper ICS must be smaller/thinner

“Snowman” pattern
(Paracentral or intermediately eccentric ectasia, relatively orthogonal)

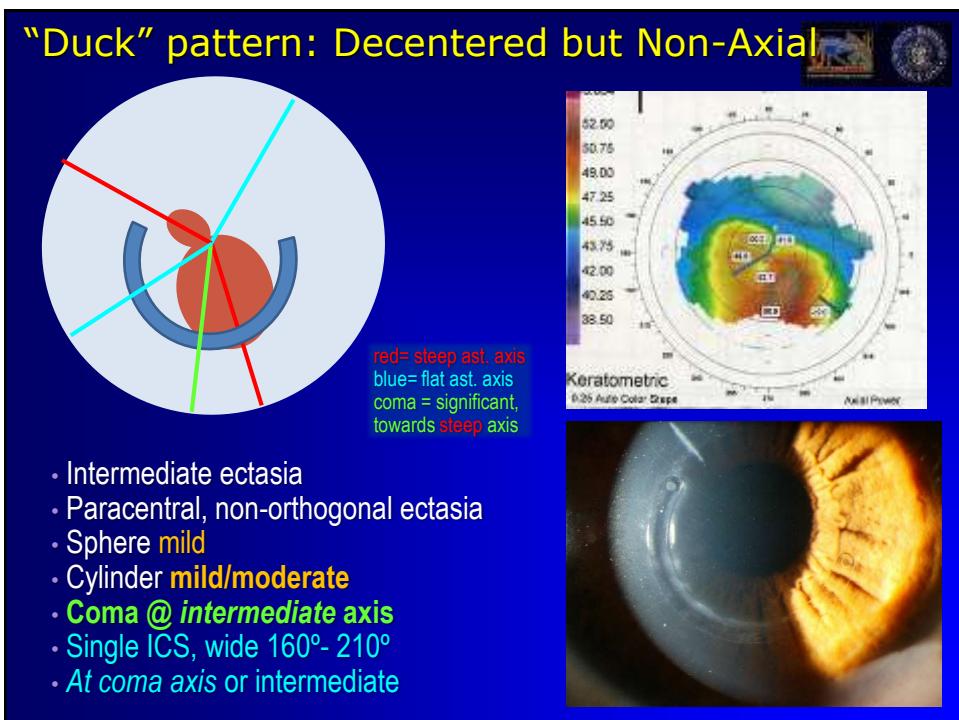
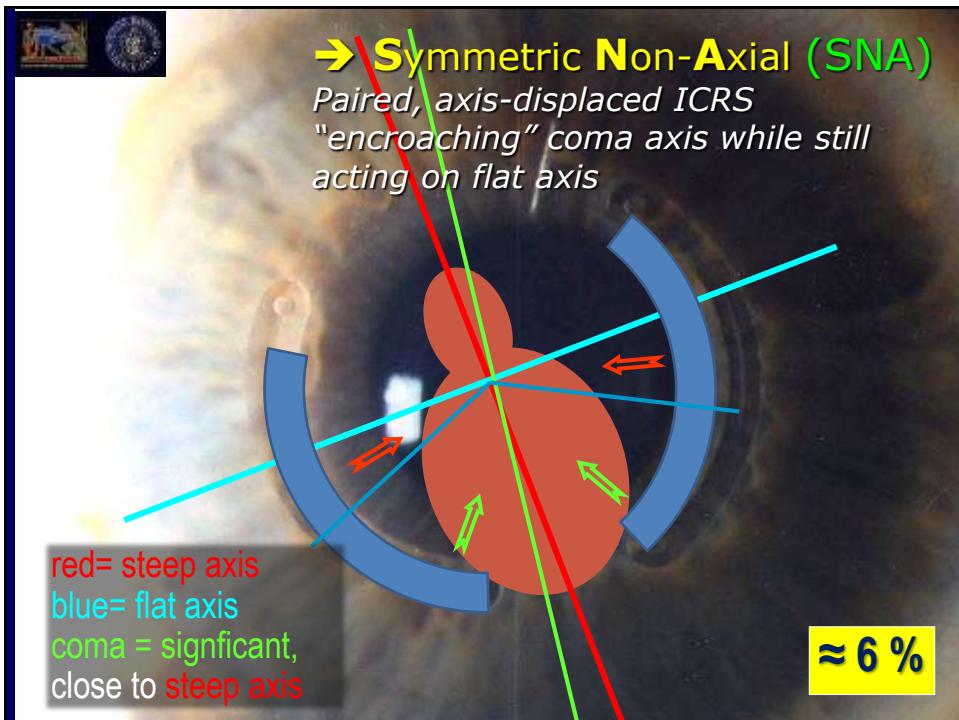


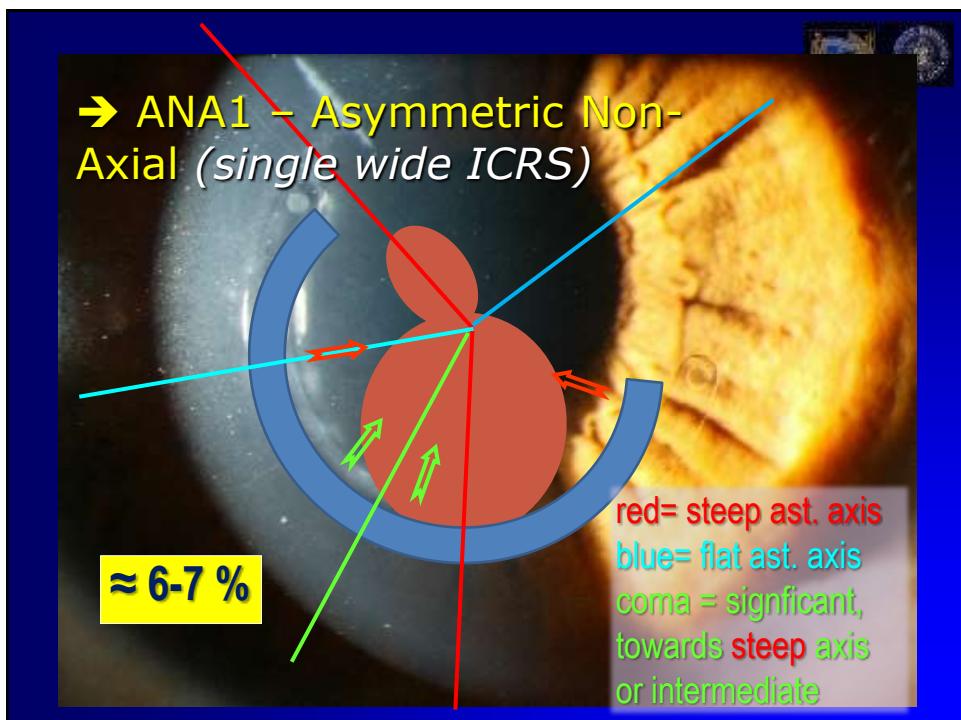
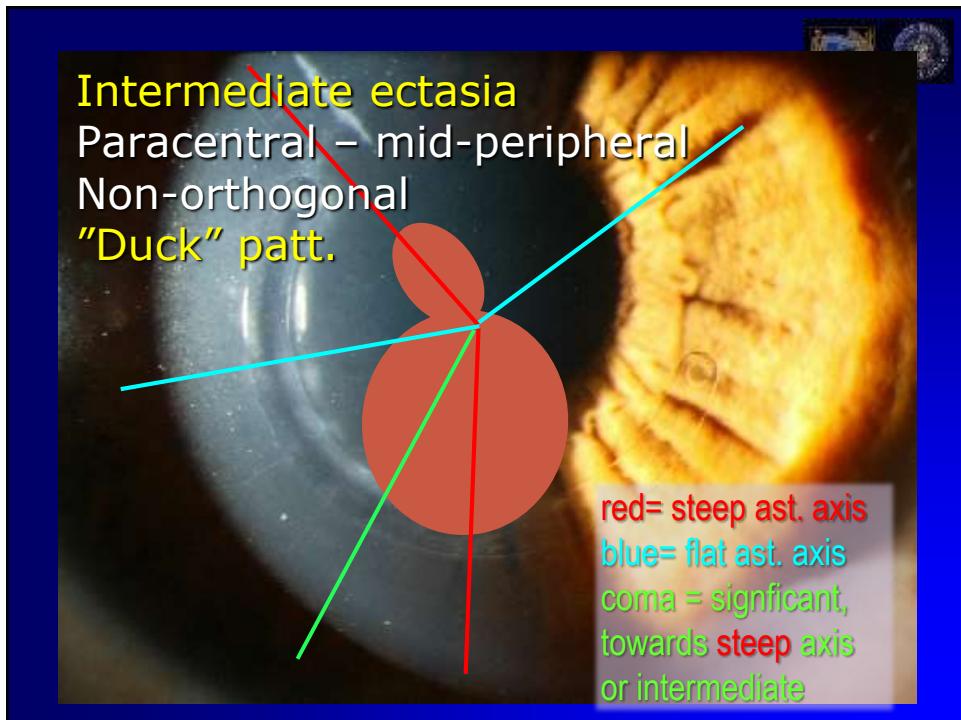
red= steep axis
blue= flat axis
coma = significant,
close to steep axis

Coma towards steep axis

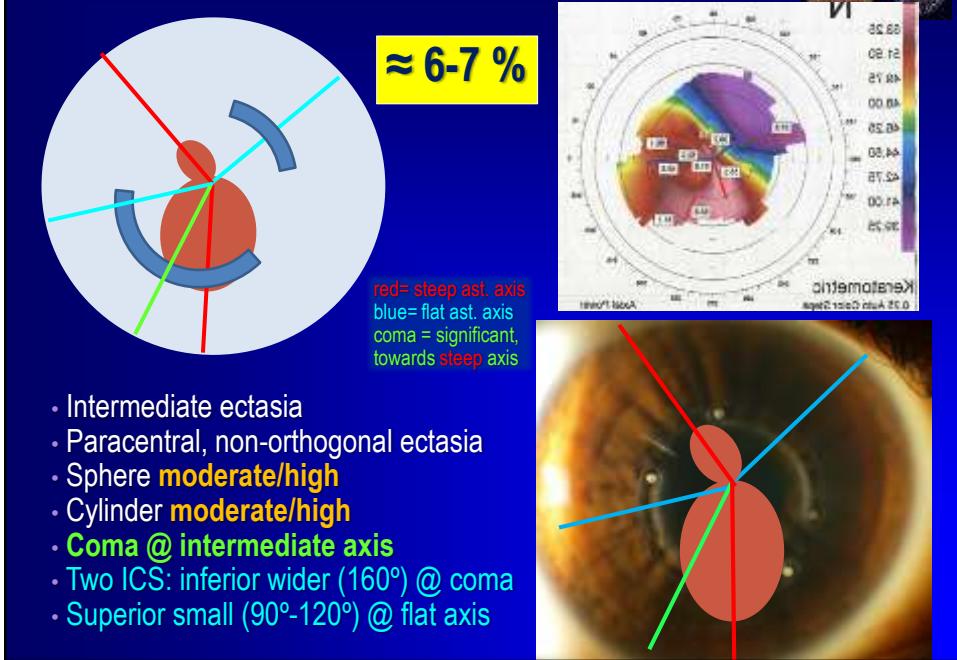
Difficult choice:

- if ICRS implanted @coma axis → will increase astigmatism
- if implanted @flat axis: no correction of coma





Asymmetric Non-Axial (higher power)



The SymAx classification: Actual frequencies in 1097 cases

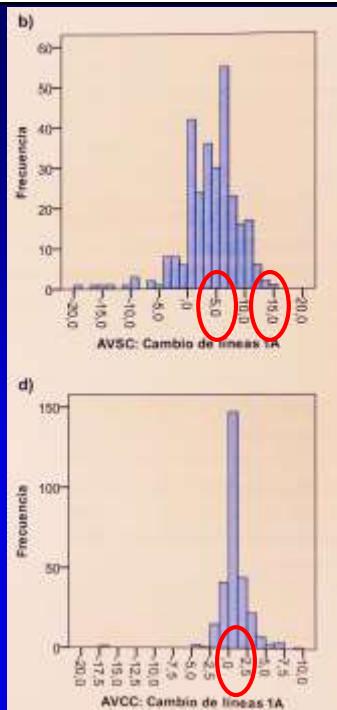
SA.ANA type	Segments (Symmetric vs. Asymmetric)	Implantation Axis (Axial= same, flat A axis vs. Non-Axial= other axis)	Frequency found (n=1097)
SA	Symmetric 2 ICRS (equal)	Axial (red= plus axis blue= minus axis)	9.96%
AA1 AA2	Asymmetric 1 ICRS 2 ICRS(unequal)	Axial (red= plus axis blue= minus axis)	39.58% 28.31% (Total 67.89%)
SNA	Symmetric 2 ICRS (equal)	Non-Axial (green= mid-ICS axis, displaced $\geq 15^\circ$ from minus axis)	5.77%
ANA1 ANA2	Asymmetric 1 ICRS (wide) 2 ICRS(unequal)	Non-Axial (green= mid-ICS axis, displaced $\geq 30^\circ$ from Minus axis → coma axis or intermediate)	6.16% 4.98% (Total 11.14%)

Results: VA@1y. (N=517)

$$\text{Cambio n.º líneas} = -1 \times \frac{\text{LogMAR}_{\text{preoperatorio}} - \text{LogMAR}_{\text{postoperatorio}}}{0.1}$$

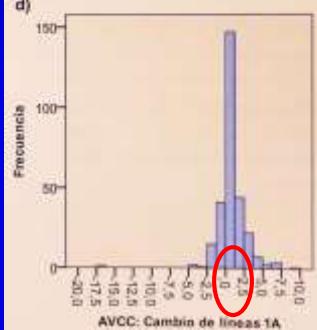
■ UCVA:

- Average gain: 6 lines
- Up to 15 lines gain



■ BSCVA:

- Average gain: 1 line
- Up to 7.5 lines gain



Results: VA progression

- UCVA stable since 6 m.

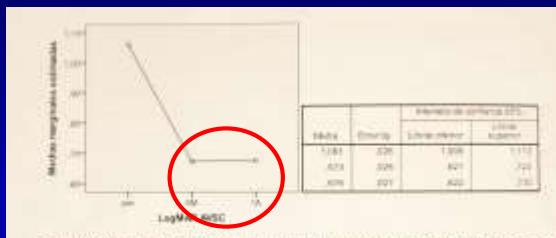


Figura V.7. Medida de la Agudeza visual sin corrección en LogMAR (LogMAR AVSC) desde preoperatorio (pre), hasta 6 meses (6M) y 1 año (1A) tras la cirugía. (MLG medidas repetidas; N=250; Suma de cuadrados=24.932; g=2; F=128.596; p<0.001).

- BSCVA keeps progressing from 6 to 12 m.

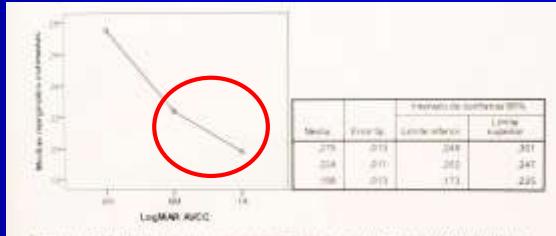
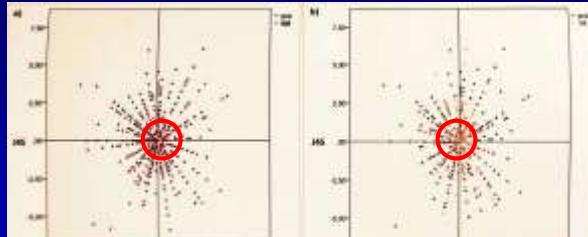


Figura V.8. Medida de la Agudeza visual con corrección en LogMAR (LogMAR AVCC) desde preoperatorio (pre), hasta 6 meses (6M) y 1 año (1A) tras la cirugía. (MLG medidas repetidas; N=257; Suma de cuadrados=0.790; g=2; F= 27.015; p<0.001).

Results: Astigmatism

■ Efficacy: Polar plots

- Preop. (black)
- @6 m. (red)
- @ 1 y. (yellow)

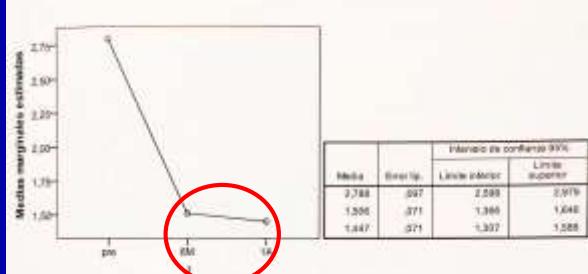


6 m.

1 a.

■ Stability: curve

- Preop.
- @6m.
- @ 1 y.



Room for Creativity



Room for creativity...

Red = ast. + axis
Blue = ast. - axis
Coma = marked,
± towards + axis

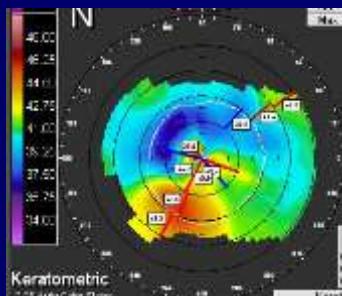
- Peripheral ectasia, orthogonal
- (Early Kcone vs. Pellucid?)
- Mild sphere; Mild/Moderate astigmatism
- AVSC= 0.1; -2.0 -2.5@160° = 0.85
- SimK= 41.5 / 45.8 ($\Delta = 4.3\text{D}$, Orbscan) Max=49.1
- Coma \pm vertical @260° (= astig. + axis)
- Rx: 1x INTACS 450 μm /150° inf @260° (80°)

Result after 1st, lower implant

Red = ast. + axis
Blue = ast. - axis
Coma = marked,
± towards + axis

- After 1st ICRS: Astigm. (R) increased -2,5 \rightarrow -5 D (7 D SimK Orbscan)
- UCVA improved 0.1 \rightarrow 0.4 !! (BSCVA: -5@160° = 0.85)
- Coma (prl. vertical) reduced 0.90 μm \rightarrow 0.20 μm (iTrace)
- Pattern changed \rightarrow bowtie + central y symmetric \rightarrow

Result after 2x90°/150um additional implants (ANA3)



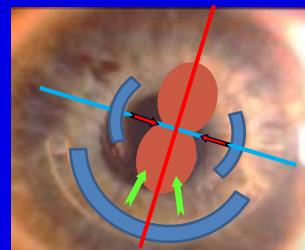
- AVSC:

- @ day 1 = 0.65 PLANO
- @24 mo. = 0.85 PLANO

- Topo. = residual astigmatism (SimK) = 2.6 D@132°

- Combined effects in 2 phases:

1. *Centering* ➔ ↓↓ coma (↑↑ astig.)
2. ↑↑ flat axis ➔ ↓↓ Astigmatism



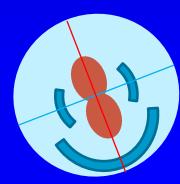
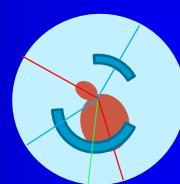
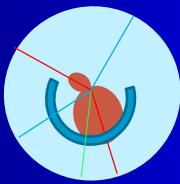
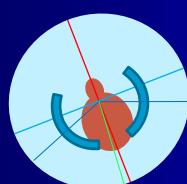
Perspectives

- *SymAx classification of implant modalities* ➔ opens new possibilities:

- Better classification of keratoconus & other ectasia
- To refine (or redefine) indications for ICRS
- To develop better ICRS Nomograms

- *Testing/confirmation of basic theory (mechanism of action)*

- **Independent address of astigmatism and coma**
(decentration), esp. non-axial (ANA) types



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