Sistemi di Orientamento delle IOL Toriche

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I have no economical interests with this presentation

HUMANITAS
RESEARCH HOSPITAL

Orientamento delle IOL Toriche

- Pianificazione della correzione dell'astigmatismo
- Superfici corneali
- Astigmatismo, cornea ed età
- Conflitti
- Revisione della letteratura
- Risultati personali
- Conclusioni

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IOL Toriche: Come

- Refrazione soggettiva
- Biometria accurata
- Topografia corneale
- Tomografia Scheimpflug
- Aberrometria
- Calcolo accurato IOL
- Marcatura asse
- Accurato allineamento intraoperatorio

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Planning Astigmatism Correction

- Subjective astigmatism
  - May be influenced by lens astigmatism or aberrations
- Corneal astigmatism: Toric IOLs

1. Anterior corneal surface measurement
   - Corneal topography
2. Posterior corneal surface measurement
   - Scheimpflug imaging
3. Aberrometry
   - Verifies internal astigmatism and aberrations
4. Surgically induced astigmatism
   - Know your SIA

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Anterior Corneal Surface Astigmatism

- Major responsible of ocular astigmatism
- Topography measurements:
  - Placido-ring distances
  - Correct head positioning
    - Beware of head tilt (eye: no goniometer !)
    - Expose eye to eliminate nose and eyebrow shadow
  - Tear film irregularities or dry eye may alter images
- Verify reliability: repeat
- Perform topography on all cataract patients (i.e., identify KC)

Ma… c’è dell’altro ?

- Credenza errata no. 1: L’astigmatismo corneale è praticamente stabile
  - L’astigmatismo corneale dei soggetti sani passa da secondo regola (WR) a contro regola (AR) col passare degli anni.
  - -0.30 D in 10 aa
  - L’astigmatismo obliquo e AR aumentano con l’età
  - Azione palpebrale

(Hayashi K, Am J Ophthalmol 2011)
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Posterior Corneal Surface Astigmatism

- Posterior corneal surface contributes to corneal optics in a nonnegligible way
- Generally minor, occasionally high
- Verify !
- Scheimpflug imaging
- Correct head positioning
- Verify reliability: repeat
- Ideally, Scheimpflug on all cataract patients

(Preussner PR, Cataract & Refractive Surgery Today, Jul/Aug 2014)

Ma… c'è dell'altro ?

- Credenza errata no. 2: il potere della superficie corneale posteriore non è importante
  - 0.50 D AR nelle cornee secondo regola (WR)
  - 0.30 D AR nelle cornee contro regola (AR)
- La maggior parte degli occhi ha astigmatismo contro regola in tutte le fasce di età

(Koch D, ASCRS pc)
(Ho JD, Cornea 2010)

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Conflict

1. Check posterior corneal surface astigmatism, and take it into account
2. Slightly less correction of WR anterior corneal astigmatism:
   - Have 0.50 D AR astigmatism in posterior cornea
- Slightly more correction of AR anterior corneal astigmatism:
   - Have 0.30 D AR astigmatism in posterior cornea
- Pentacam and Galilei measurement do not support this yet
- IOL imprecise alignment may play a role

(Koch DD, J Cataract Refract Surg.2013 Dec;39(12):1803-9)

(Holladay JT, Eye World, Aug 2013)

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Astigmatism, Cornea and Age

1. Significative Trend towards AR astigmatism with increase of age both for anterior corneal astigmatism and for total astigmatism (mean: -0.18 D e -0.16 D/5 yrs, respectively)
2. Significative Trend towards WR astigmatism for posterior corneal astigmatism (mean: 0.022 D/5 aa).

(Ho JD, Cornea 2010)

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Review of the Literature

- Cyl reduction: 2.05 D

Preop D	Postop D	Eyes	Toric IOL	Author	Year	Journal	
1.60 ±1.20	0.40 ±0.60	230	AcrySof	Gayton JL	2011	JRS	Simple and complex
1.70 ±0.4	0.4 ±0.4	234	AcrySof	Ahmed II	2010	JCRS	bilateral
4.6 ±2.3	1.12 ±0.9	68	MicroSil	Dick HB	2006	Klin Monbl	
4.00 ±1.10	0.55 ±0.60	19	AcrySof SN60T	Cervantes-Coste G	2012	JRS	
2.39 ±1.48	-0.49 ±0.53	284	AT Lisa 909M	Bellucci R	2013	JCRS	
1.93 ±0.90	0.30 ±0.54	30	Bi-Flex T	Bachernegg A	2013	JCRS	
2.17 ±0.41	0.73 ±0.45	30	AcrySof TT	Toto L	2013	JCRS	

Review of the Literature

- Mean UCVA (2010 -2013): 0.19 logMAR

UCVA logMAR	MOS	Eyes	Toric IOL	Author	Year	Journal
0.33 ± 0.18	13.3	30	AcrySof Toric	Kim MH	2010	KJO
0.2	6	30	AcrySof Toric SN60TT	Koshy JJ	2010	JCRS
0.13 ± 0.10	3	40	AcrySof SN60T	Mingo-Botin D	2010	JCRS
0.23 ± 0.23	4	33	Rayner T-Flex 623T	Entabi M	2011	JCRS
0.16 ±0.22	6	284	AT Lisa 909M	Bellucci R	2013	JCRS
0.11 ±0.09	3	19	AcrySof SN60T	Cervantes-Coste G	2012	JRS
0.05 ±0.12	3	30	Bi-Flex T	Bachernegg A	2013	JCRS
0.20	6	30	AcrySof T	Toto L	2013	JCRS
0.3	3	72	AcrySof SN6At, AT Torbi 709M	Scialdone A	2013	JCRS

Review of the Literature

- IOL Alignement

% > ±5°	% > ±10°	Eyes	Mos	Toric IOL	Author	Year	Journal	
91.1	100	161	6	AcrySof	Ahmed II	2010	JCRS	bilat
90	99	100	1	AcrySof SN60T	Chang DF	2008	JCRS	
70	90	90	1	AA4203	Chang DF	2008	JCRS	
85	99	68	3	MicroSil	Dick HB	2006	Klin M.	
	100	40	2	Tecnis T, AcrySof IQ T	Ferreira TB	2012	JRS	
37.0		26	3	Staar silicone	Chua WH	2012	JCRS	
95.8		284	6	AT Lisa 909M	Bellucci R	2013	JCRS	
61.1		36	3	AcrySof SN6AT	Scialdone A	2013	JCRS	
66.6		36	3	AT Torbi 709 M	Scialdone A	2013	JCRS	

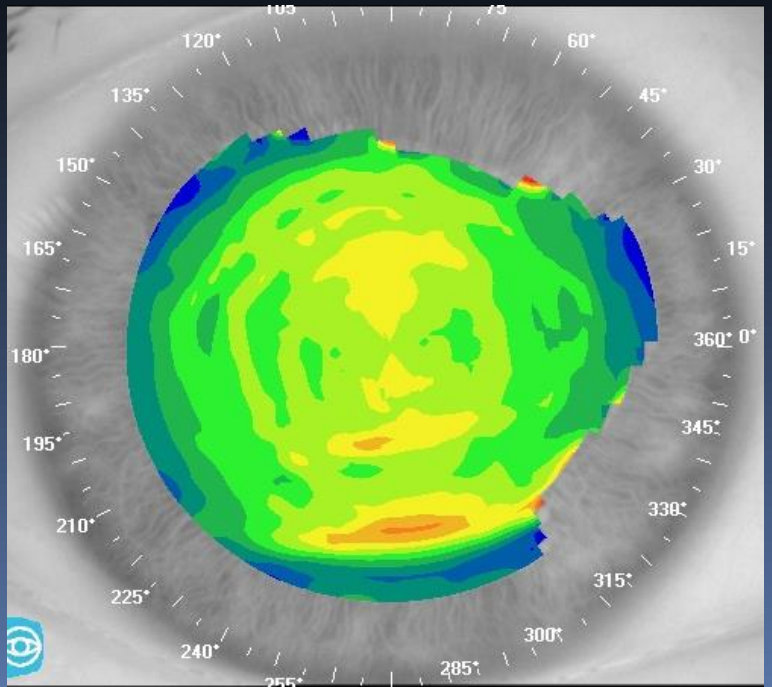
Review of the Literature

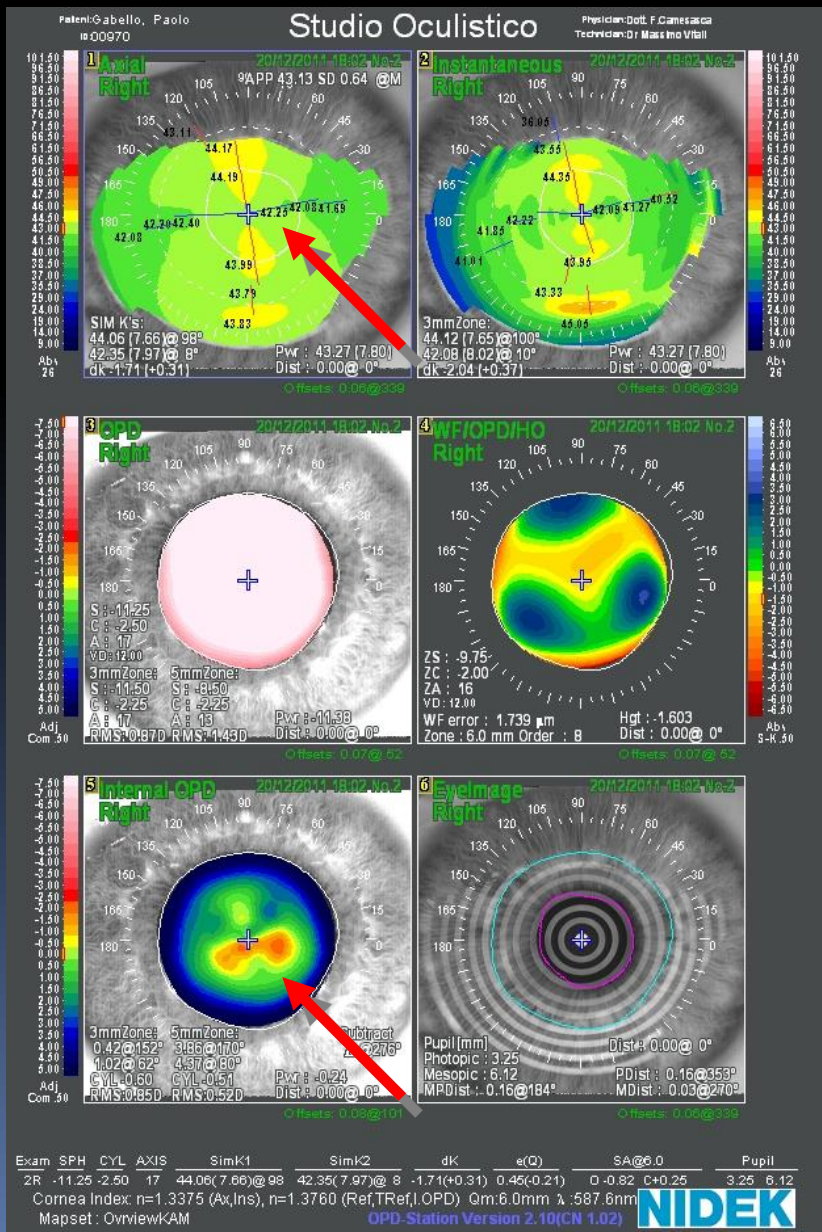
- Mean IOL rotation: 4.45°

Mean rotation °	Eyes	Mos	IOL	Author	Year	Journal	
3.35 ±3.41	100	1	SN60T,	Chang DF	2008	JCRS	
5.56 ±8.49	90	1	AA4203	Chang DF	2008	JCRS	
3.15 ±2.62	20	2	Tecnis	Ferreira TB	2012	JRS	
3.25 ±2.04	20	2	AcrySof IQ T	Ferreira TB	2012	JRS	
4.23 ±4.28	24	3	AcrySof	Chua WH	2012	JCRS	
9.42 ±7.80	26	3	Staar silicone	Chua WH	2012	JCRS	
2.12 ±3.45	30	3	Bi-Flex T	Bachernegg A	2013	JCRS	

Determinazione dell’Asse

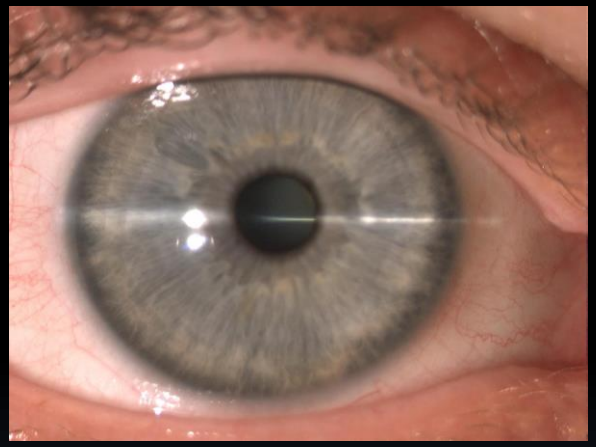
- Astigmatismo soggettivo:
  - Astigmatismo cornea
  - Astigmatismo cristallino
- VOD 0.65 -5.00 -1.50 (175)

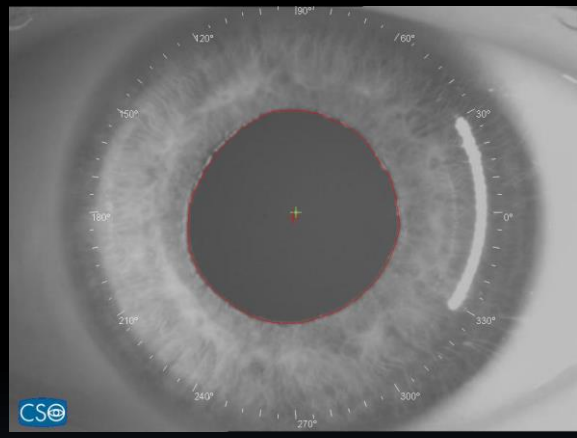


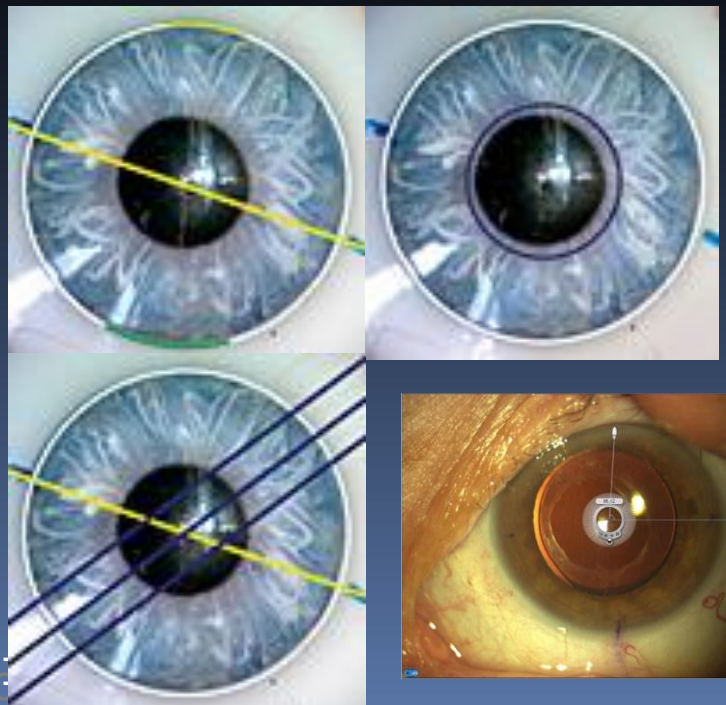


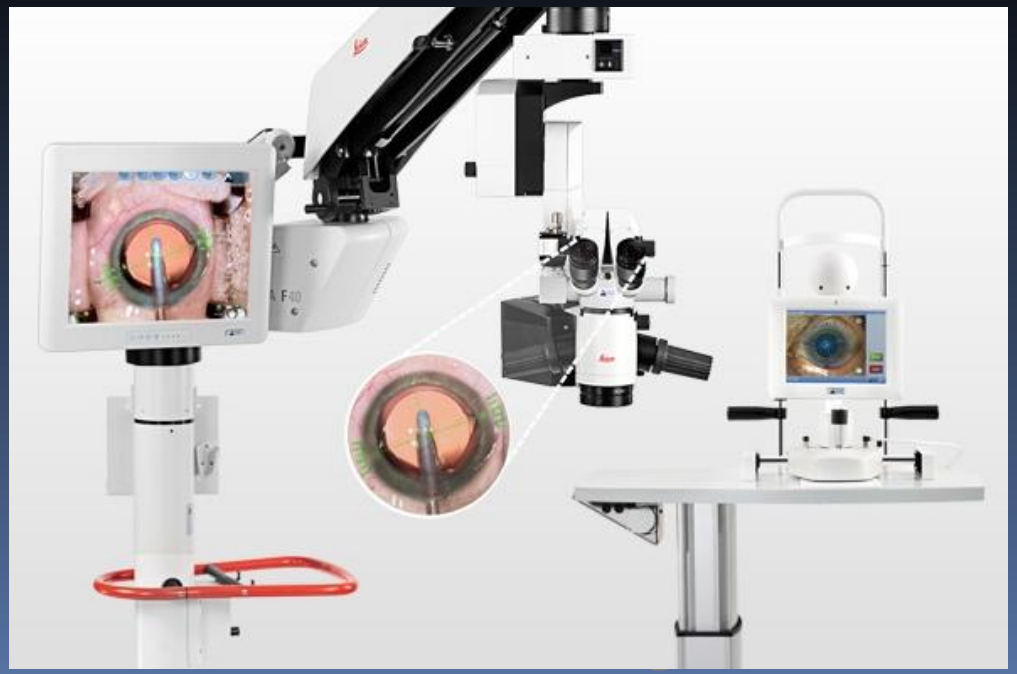
Posizionamento Corretto

- Acquisizione:
  - Pattern irideo
  - Pattern limbare
- Sistemi:
  - Callisto & Z-Align
  - SMI SG3000
  - Haag-Streit OTAS









Allineamento Errato

- L’allineamento errato induce:
  - Ipermetropizzazione
  - Astigmatismo residuo
  - Rotazione dell’asse

Jin H, J Cataract Refract Surg 2010 Dec;36(12):2061-72

Errori di Calcolo della IOL

- La presenza di un residuo astigmatico è legata a:
  - Obiettivo necessariamente non pari a zero imposto dai poteri delle IOL con intervalli di 0.5 D in sph e cyl
  - Precisione nella determinazione dell'asse
  - Astigmatismo indotto dall'incisione (SIA)
  - Sottostima del potere del cyl al piano corneale, generata dalle formule di calcolo dei produttori

Visser N, Invest Ophthalmol Vis Sci 2012 Apr 6;53(4):1865-73.

Goggin M, Arch Ophthalmol 2011 Aug;129(8):1004-8.

Errori di Metodica

- La comune procedura di marcatura con inchiostro può indurre un errore di circa 5°
  - Errore di marcatura
  - Errore di verifica con goniometro (scala in 10°)
- L'errore diviene tanto più rilevante quanto più elevato è l'astigmatismo

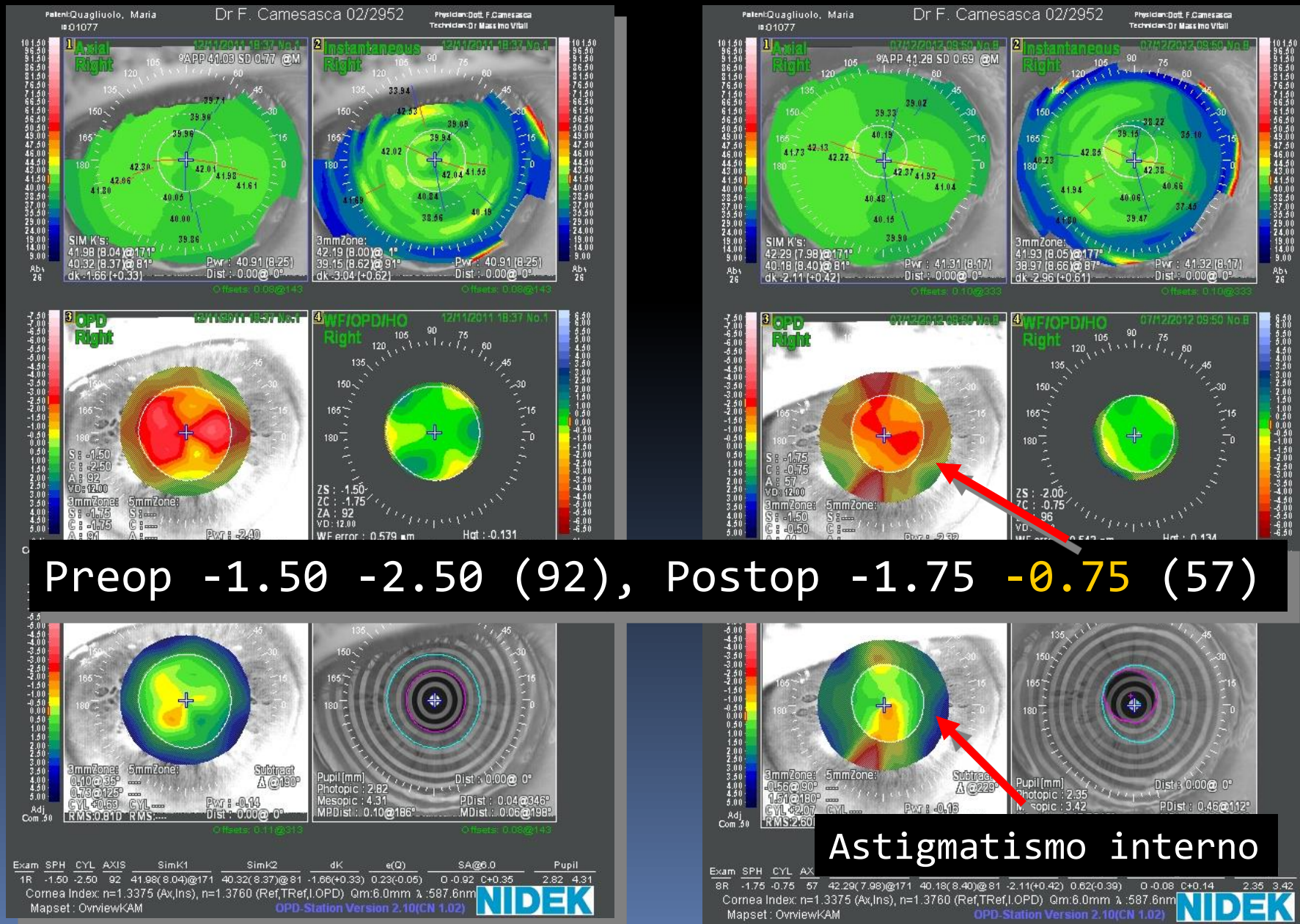
Visser N, J Cataract Refract Surg 2011 Aug;37(8):1394-402.

Altri Fattori

- Un astigmatismo residuo dopo impianto di IOL torica può esser generato da molti fattori
  - Calcolo della IOL:
    - Effetto del potere sferico
    - Effetto della profondità della camera anteriore
    - Astigmatismo corneale posteriore
    - Pupilla ampia
    - Rotazione della IOL
- Una rotazione inferiore ai 10° induce meno di 0.50 D di errore refrattivo, ed è quindi tollerabile
- Effettuare anche pupillometria nei pazienti più giovani

Visser N, J Cataract Refract Surg 2012 Oct;28(10):729-32.
Felipe A, J Cataract Refract Surg 2011 Oct;37(10):1895-901

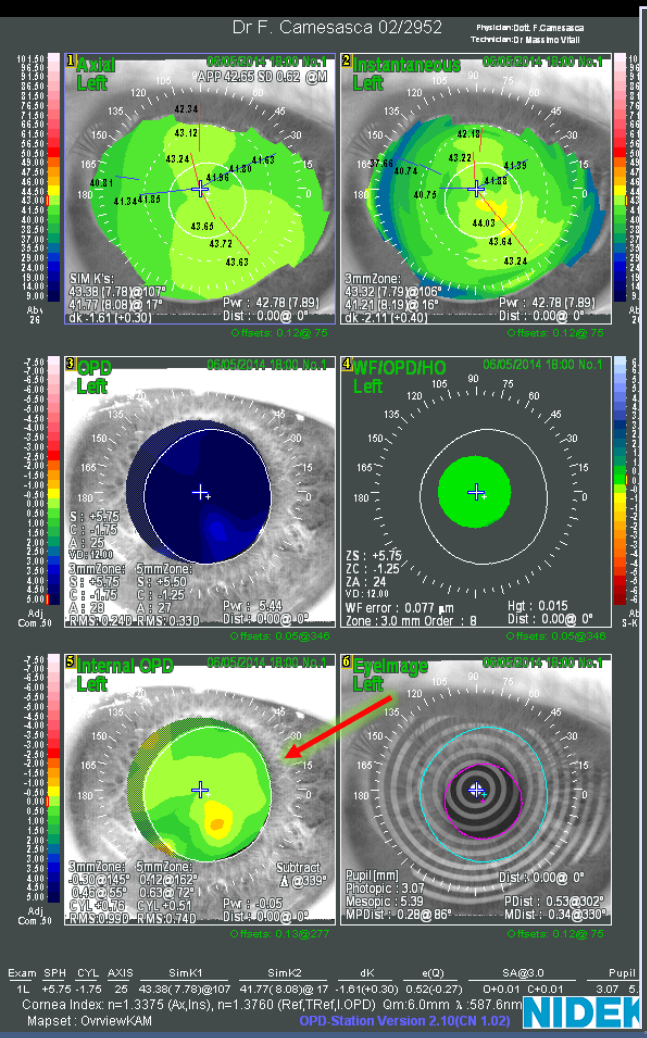
Astigmatismo Residuo



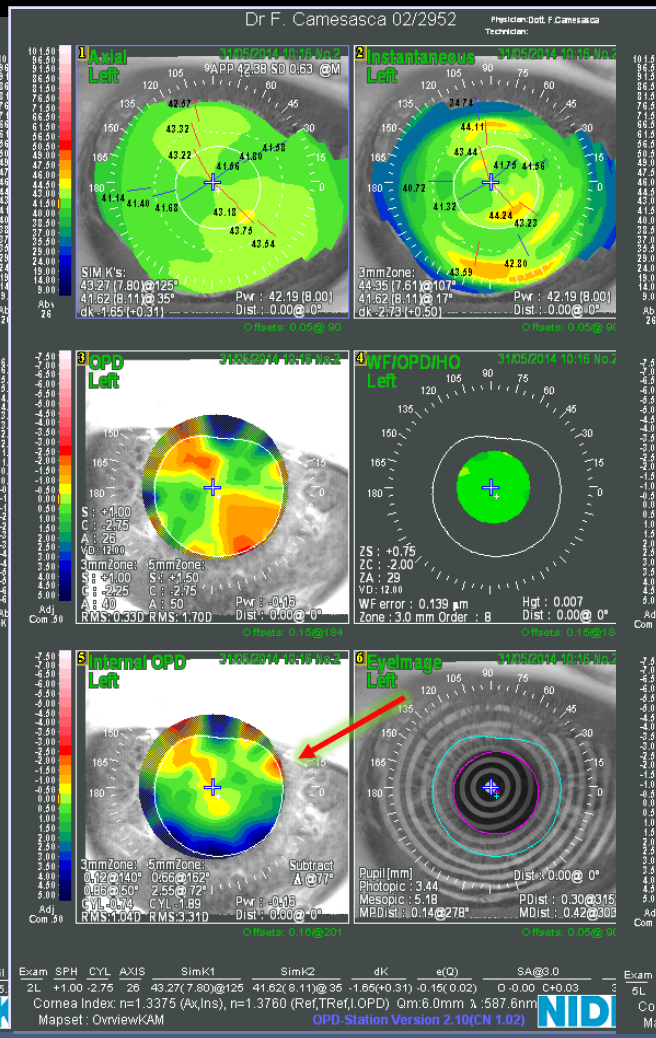
Ho un Astigmatismo Residuo…

- Valutare soddisfazione paziente
- Analizzare:
  - Astigmatismo topografico
  - Calcolo potere IOL
  - Posizione asse IOL
  - Diametro pupillare
- Analisi vettoriale (Alpin)
  - Definizione astigmatismo indotto e sue cause
- Se necessario, ruotare IOL

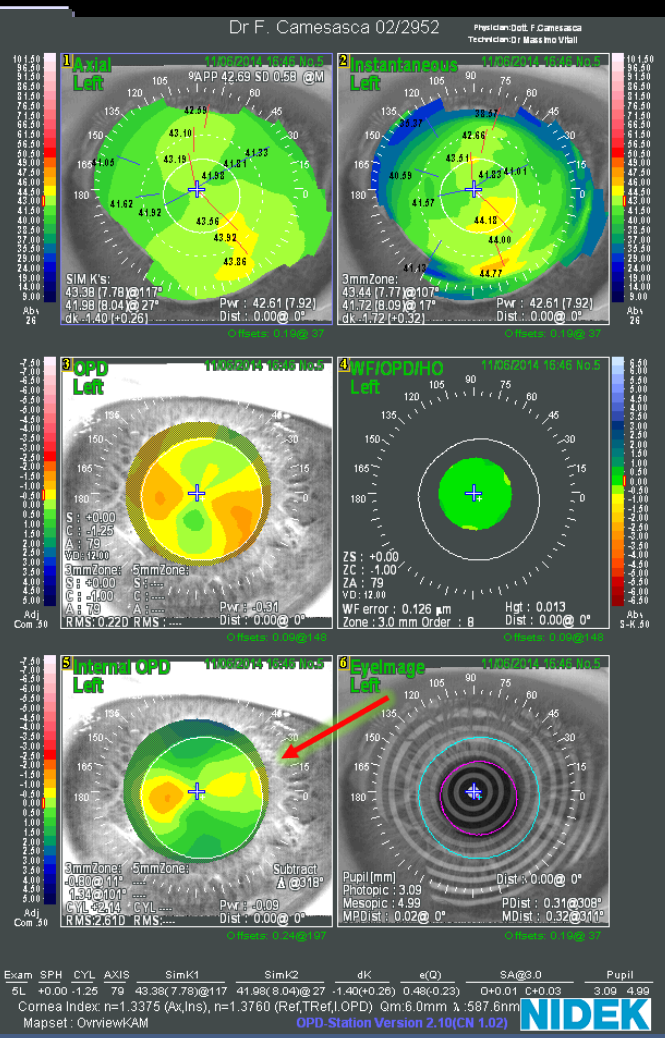
Alignment Error



+5.75 -1.75 (25)



+1.00 -2.75 (26)



+0.00 -0.75 (79)

Personal Results

- Precise intraoperative toric IOL axis orientation:
  - May be haphazardous
  - Complicated
  - Time-consuming
  - Every degree of misalignement leads to residual astigmatism and sphere
- Limbal vessels pattern may be a precise referral structure for proper axis alignement.

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Materials and Methods

1. IOL Aligment
    1. Preoperative identification of topographic axis of astigmatism
    2. Slit-lamp identification and photograph of limbal vessels in correspondence of the most curve axis of astigmatism
    3. Preoperative mark of 0° - 180° axis
    4. Intraoperative detection of involved limbal vessel and IOL alignement

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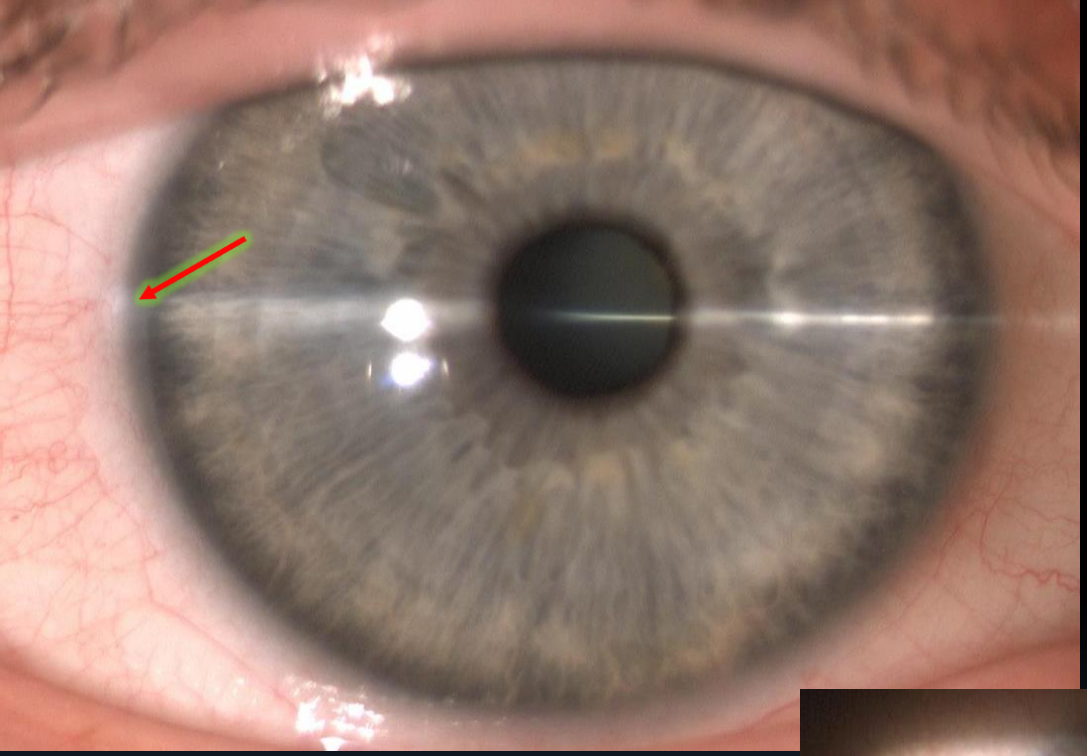

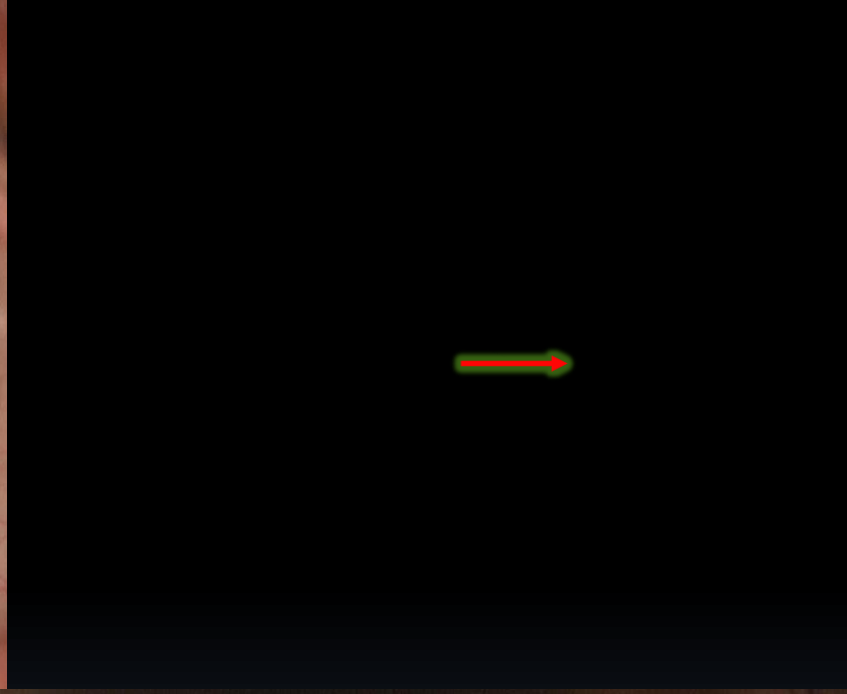

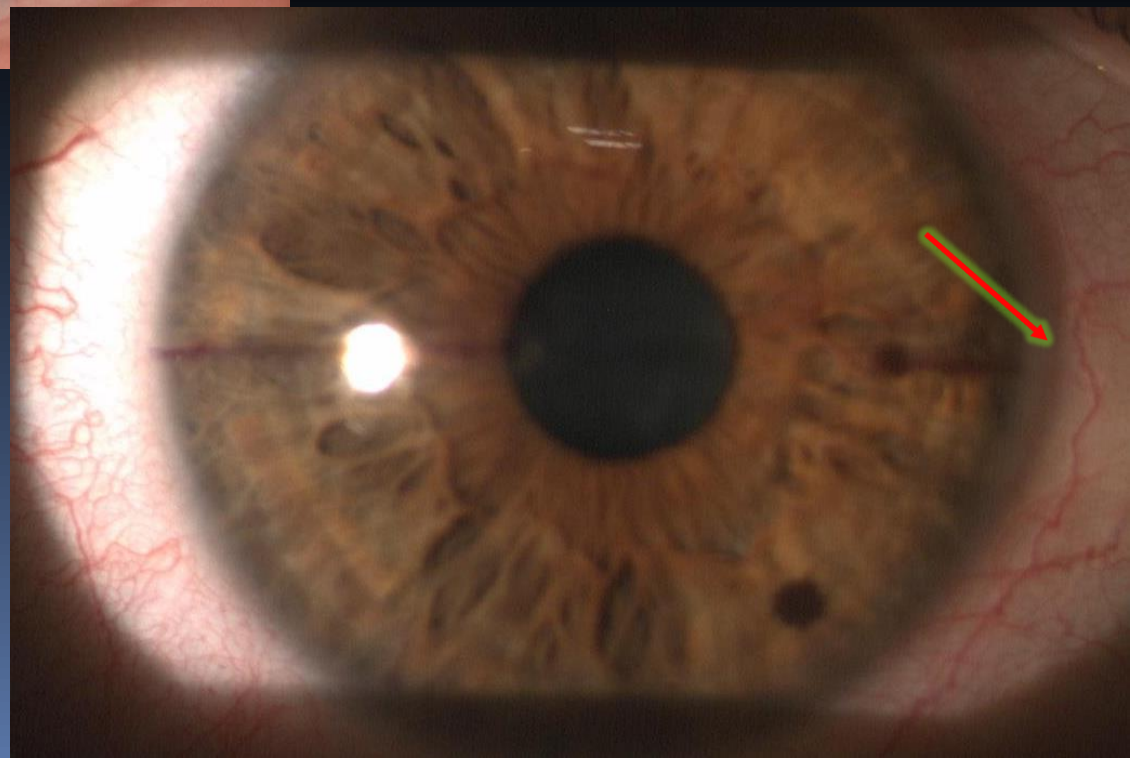

Materials and Methods

1. Thirty-six eyes (20 patients, mean age 64.35 ± 16.59)
2. 2.2 mm incision surgery
3. Toric aspheric monofocal IOL (Zeiss AT Torbi 409 MP)
4. Mean power: +16.33 D ± 7.57 D, -2.75 D ± 0.27 D cyl.
5. Preoperatively:
    1. Reference limbal vessels positioned in correspondance of the alignment axis recommended by the specific website software (Zeiss Z Calc) were photographed.
6. IOL axis orientation:
    1. Aligning the axis with reference limbal vessels
    2. Checking preoperative corneal topography astigmatism
7. Subjective refraction and TA were measured before and nine months after surgery.

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Results

1. Mean preoperative subjective refraction:-2.29 D ± 3.63 D sph with -2.19 D ± 0.55 D cyl at 64.44° ± 72.73°
2. Mean TA: -1.79 ± 0.39 at 118.88° ± 73.82° . Mean SIA was -0.20 D
3. Postop. (9 ± 4 months), mean subj. refraction was -0.41 D ± 0.79 D sph with -0.25 D ± 0.44 D cyl at 93.33° ± 45.09° .
4. Mean BSCVA and UCVA were -0.06 LogMar and -0.02 LogMar, respectively.
5. Mean TA was -1.87 D ± 0.40 D at 134.25° ± 63.90° .
6. Mean IOL axial orientation was at 90.83° ± 38.40° .

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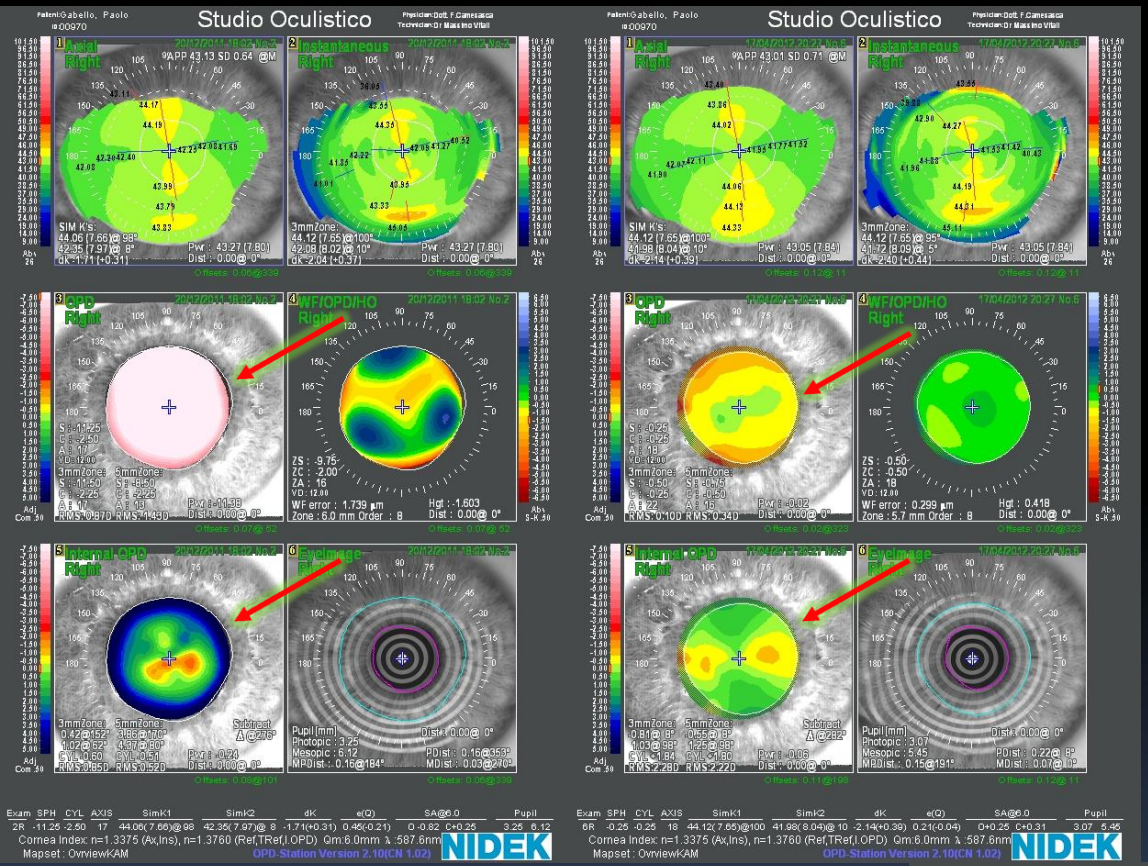
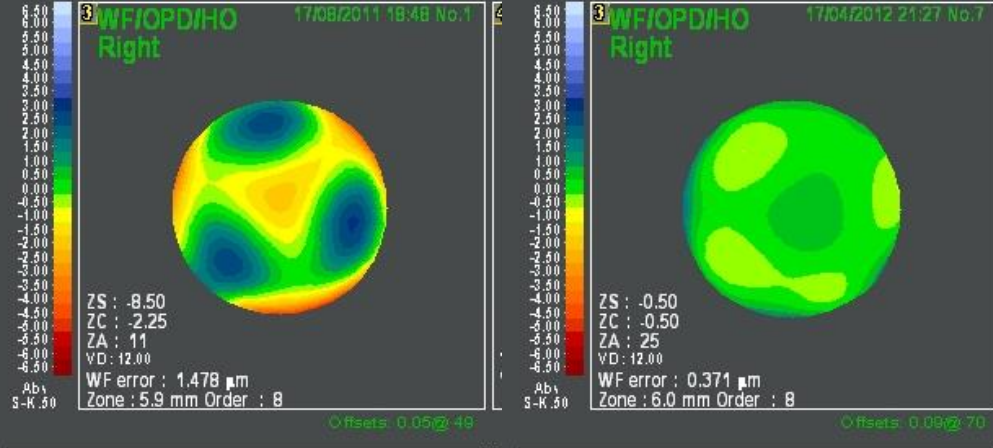
-11.25 -2.50 (170) -0.25 -0.25 (18)



6 mos FUP

VOD 0.1 LogMar

Wavefront



Study Conclusions

1. Patients receiving monofocal toric IOLs aligned through an empirical method reached optimal visual acuity.
2. Mean TA was not influenced by SIA
3. Final refraction showed highly satisfactory correction of spherical and astigmatic defect.

(van Gaalen KW, J Cataract Refract Surg 2010)

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Conclusions

- Toric IOLs are an effective way to correct astigmatism
- Precise alignement mandatory
- IOL calculation will improve
- Posterior corneal surface to be considered
- Several IOLs available, with different ease of positioning
- Excellent visual acuity
- Possible residual astigmatism
- Limited postoperative rotation

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In the Future

1. Toric IOL calculators will take into account posterior corneal astigmatism
2. Intraoperative aberrometry and dioptrical power after cristalline lens removal (ORA, Clarity)
3. Improved knowledge about ocular optical components and their interaction in time
4. Improved nomograms and calculation systems
5. Tailoring refraction for the single patient, his/hers lifestyle and life expectation
6. Cataract surgery = refractive surgery

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Thank You For Your Attention !!

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