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ЦЕНТР КОРРЕКЦИИ ЗРЕНИЯ

Optimization of TMR calculation for Topo-Guided LASIK Contoura Vision™ in astigmatic situations

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MD

Abbreviations

AR – refraction measured with Auto-Ref-Keratometer
SEQ – spheroequivalent of refraction
TMR – topography-modified refraction
BCDVA – best corrected distance visual acuity
NCDVA – non corrected distance visual acuity

Financial Disclosure: Author has no financial or proprietary interest in any material or method mentioned

Step-by-Step Topo-Guided LASIK with TMR

Part I Conventional method of calculation (V.1)

(A John Kanellopoulos)

Kanellopoulos AJ **Topography-modified refraction (TMR): adjustment of treated cylinder amount and axis to the topography versus standard clinical refraction in myopic topography-guided LASIK //** Clinical Ophthalmology, November 2016

Case 1.

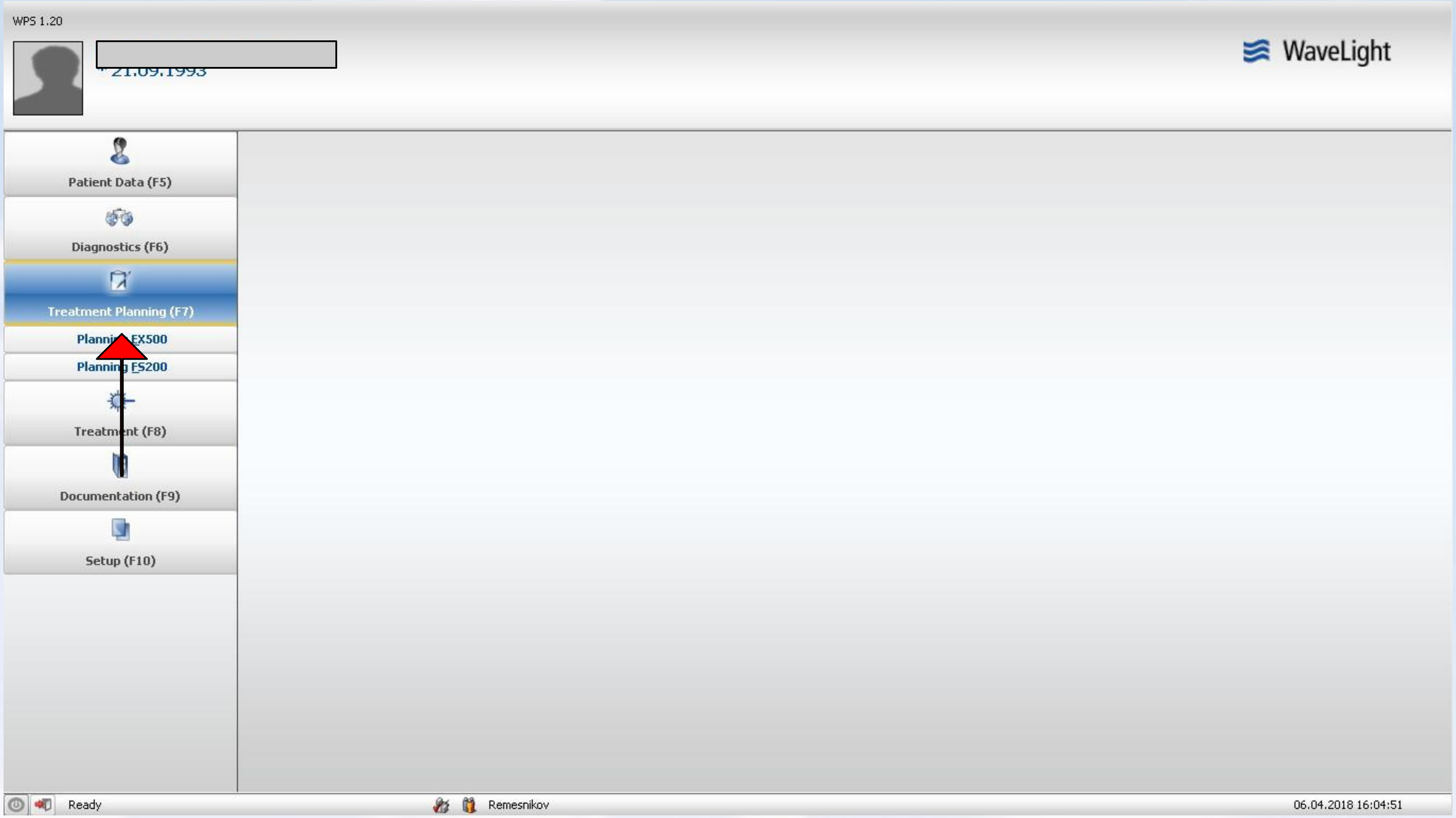
AR OS sph -2.75 SD * cyl -0.75 CD * ax 175°

BCDVA = 1.00 (0.00 LogMAR)

SEQ = -3.125 D

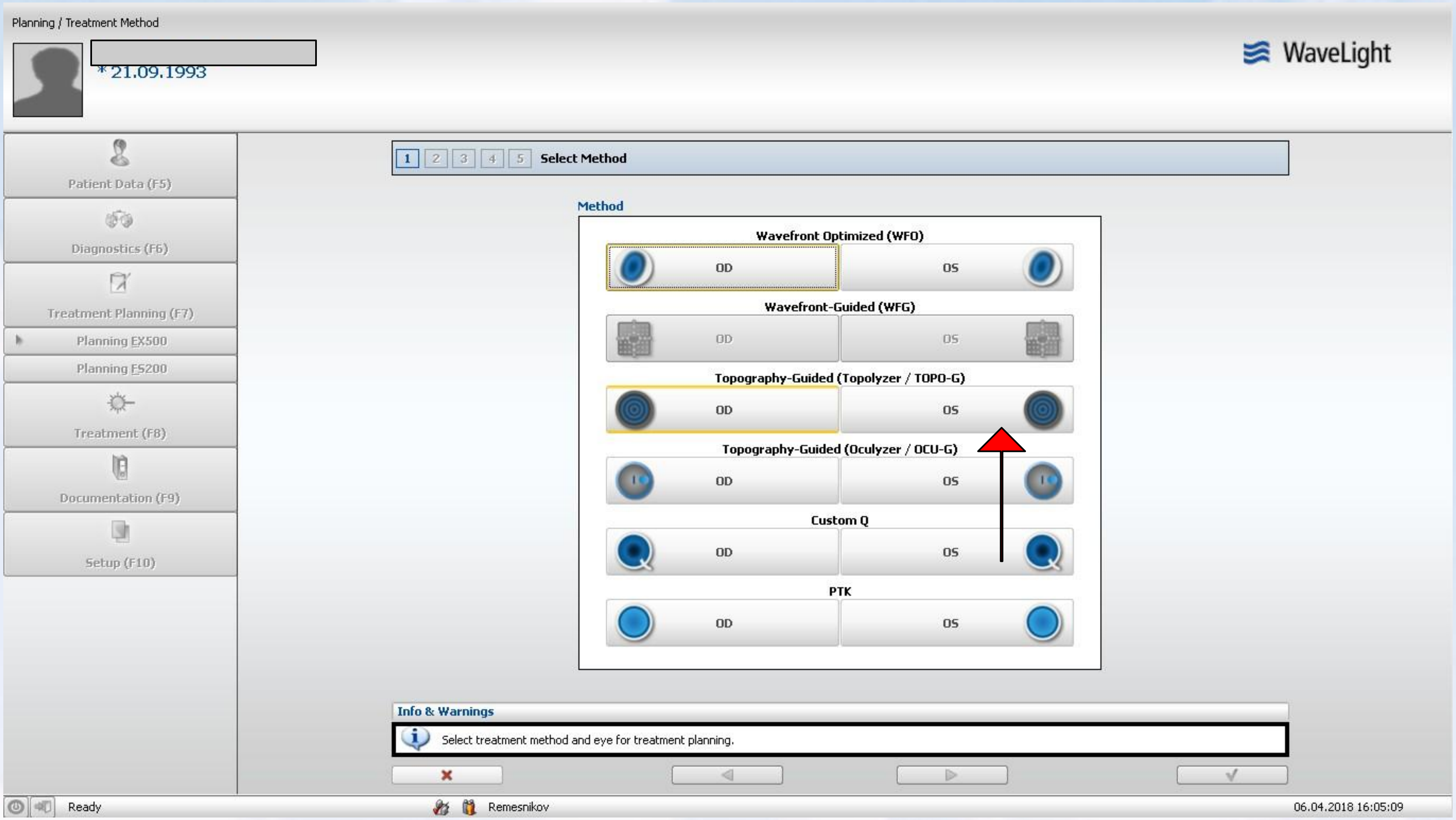
Step-by-Step Topo-Guided LASIK with TMR

- Open Treatment Planning (F7)



Step-by-Step Topo-Guided LASIK with TMR

- Choose Topo-Guided (Topolyzer / TOPO-G) method

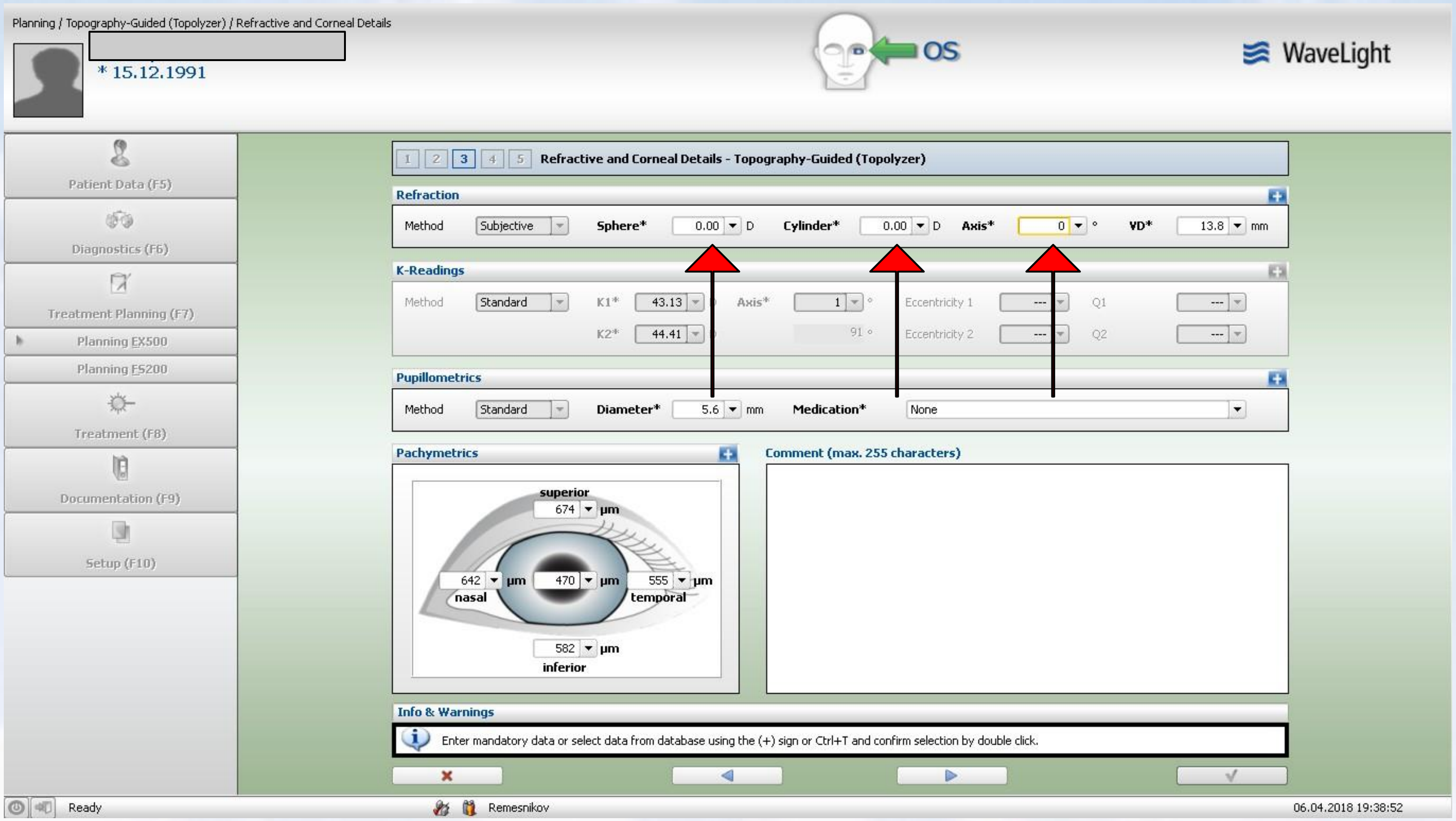


Step-by-Step Topo-Guided LASIK with TMR

- **GOOD** quality topograms are required!

Step-by-Step Topo-Guided LASIK with TMR

- Set refraction in the upper windows to sph 0.00 and also cyl 0.00 with ax 0° (180°)

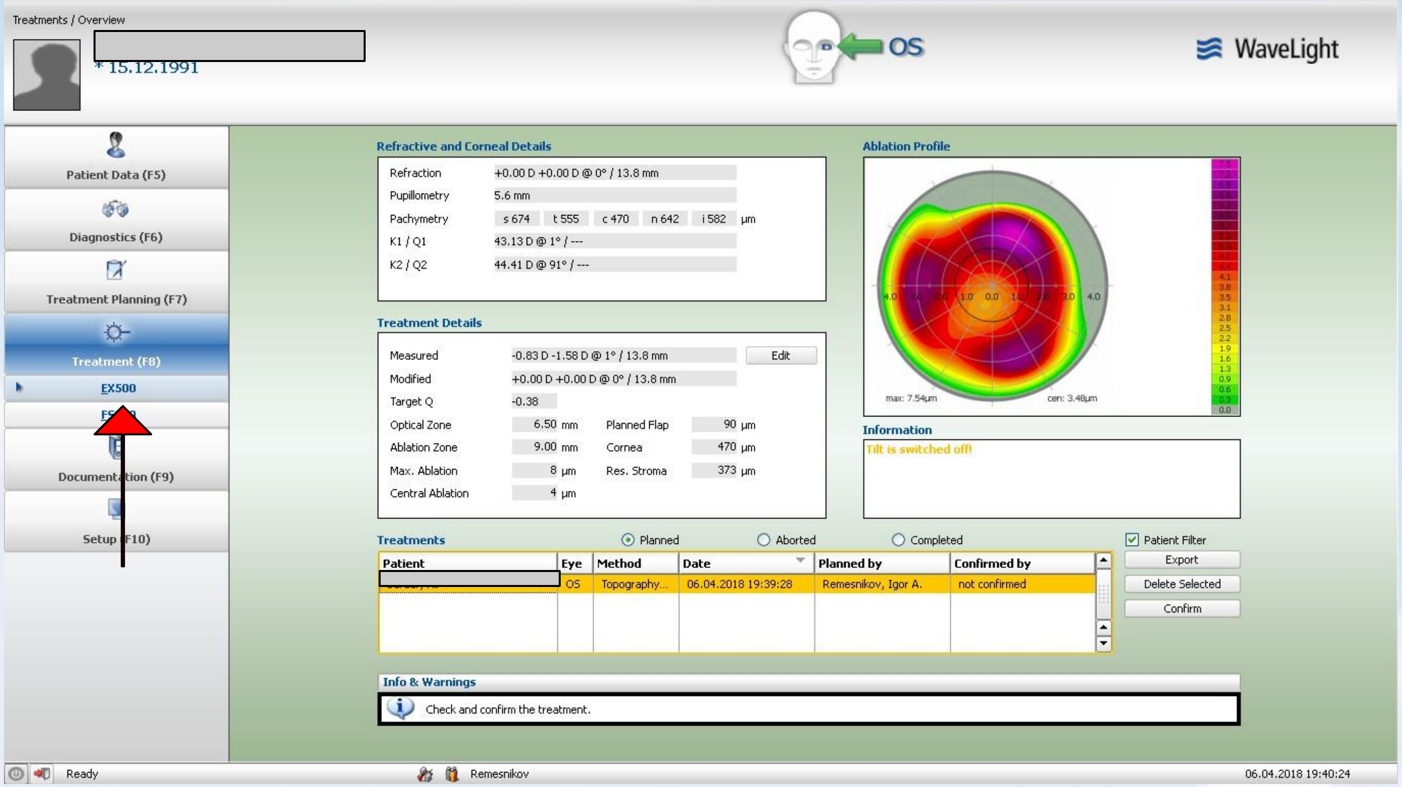


Step-by-Step Topo-Guided LASIK with TMR

- Two steps later check Max. Ablation depth: it must be never > 15 mkm
- Save this preliminary plan

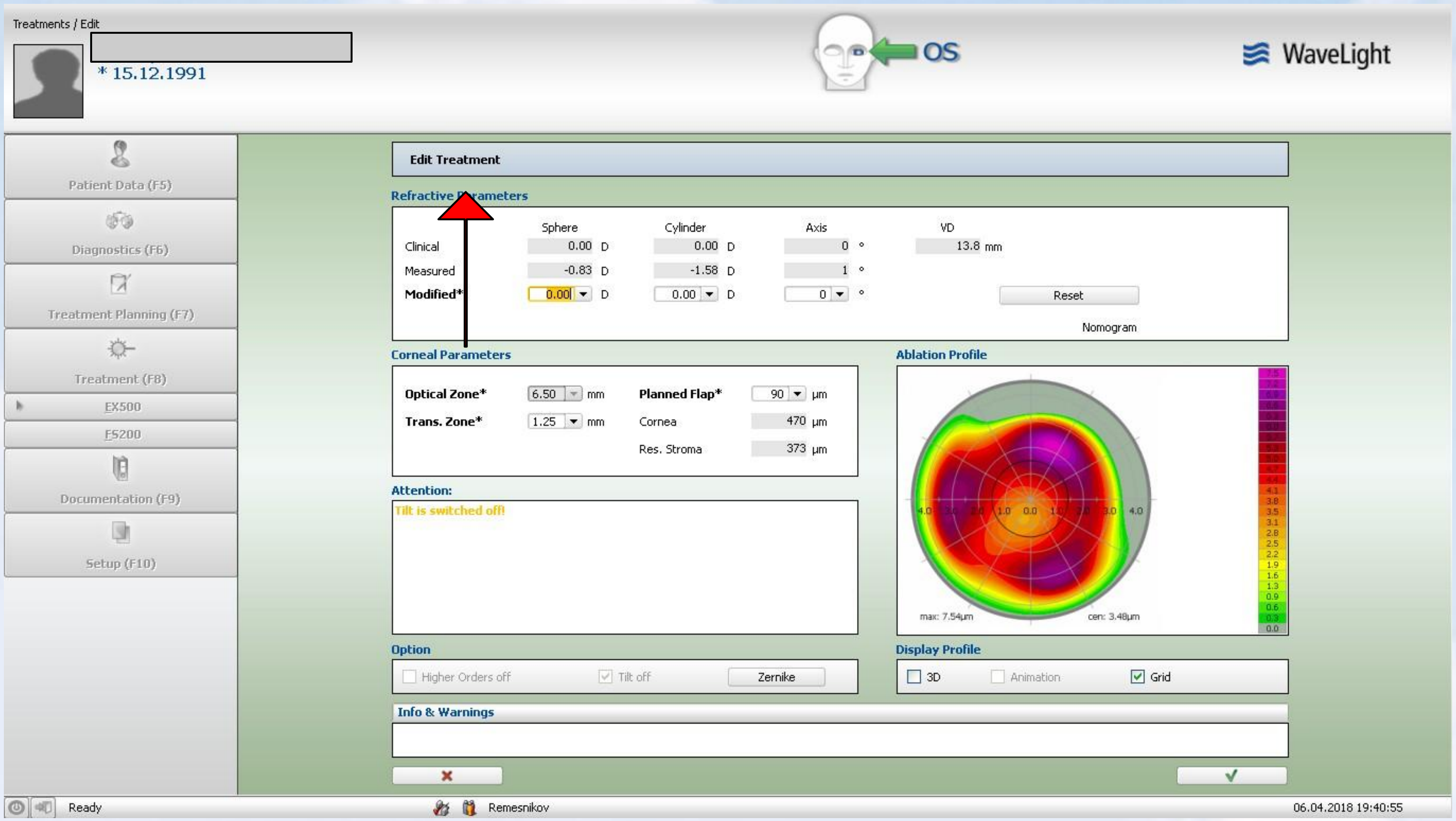
Step-by-Step Topo-Guided LASIK with TMR

- Open Treatment (F8) → EX500
- Open preliminary plan



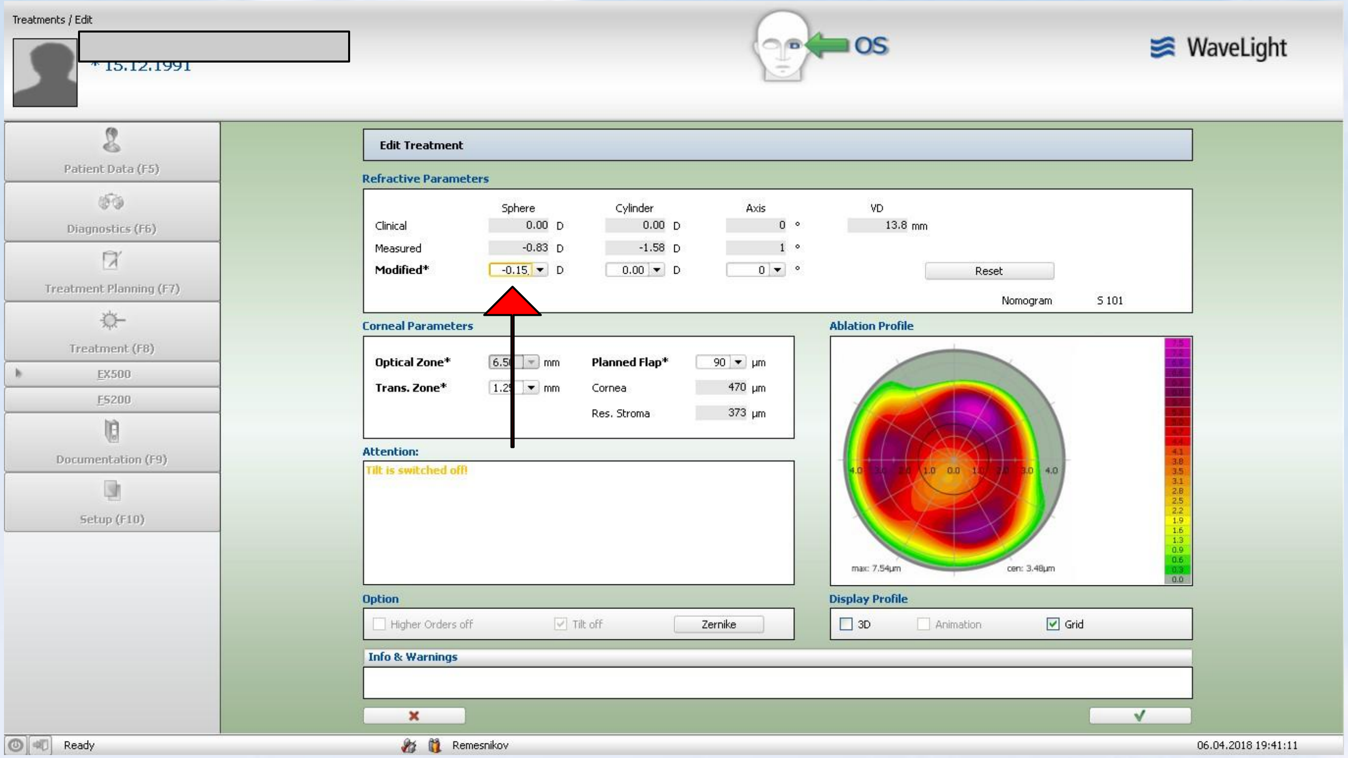
Step-by-Step Topo-Guided LASIK with TMR

- Start edit it



Step-by-Step Topo-Guided LASIK with TMR

- Open Zernike window and set C4 ≈ C12 by changing sphere to myopia about -0.15 ÷ -0.25 SD



Initial Zernike C4 = 0.0000, C12 = 0.2150

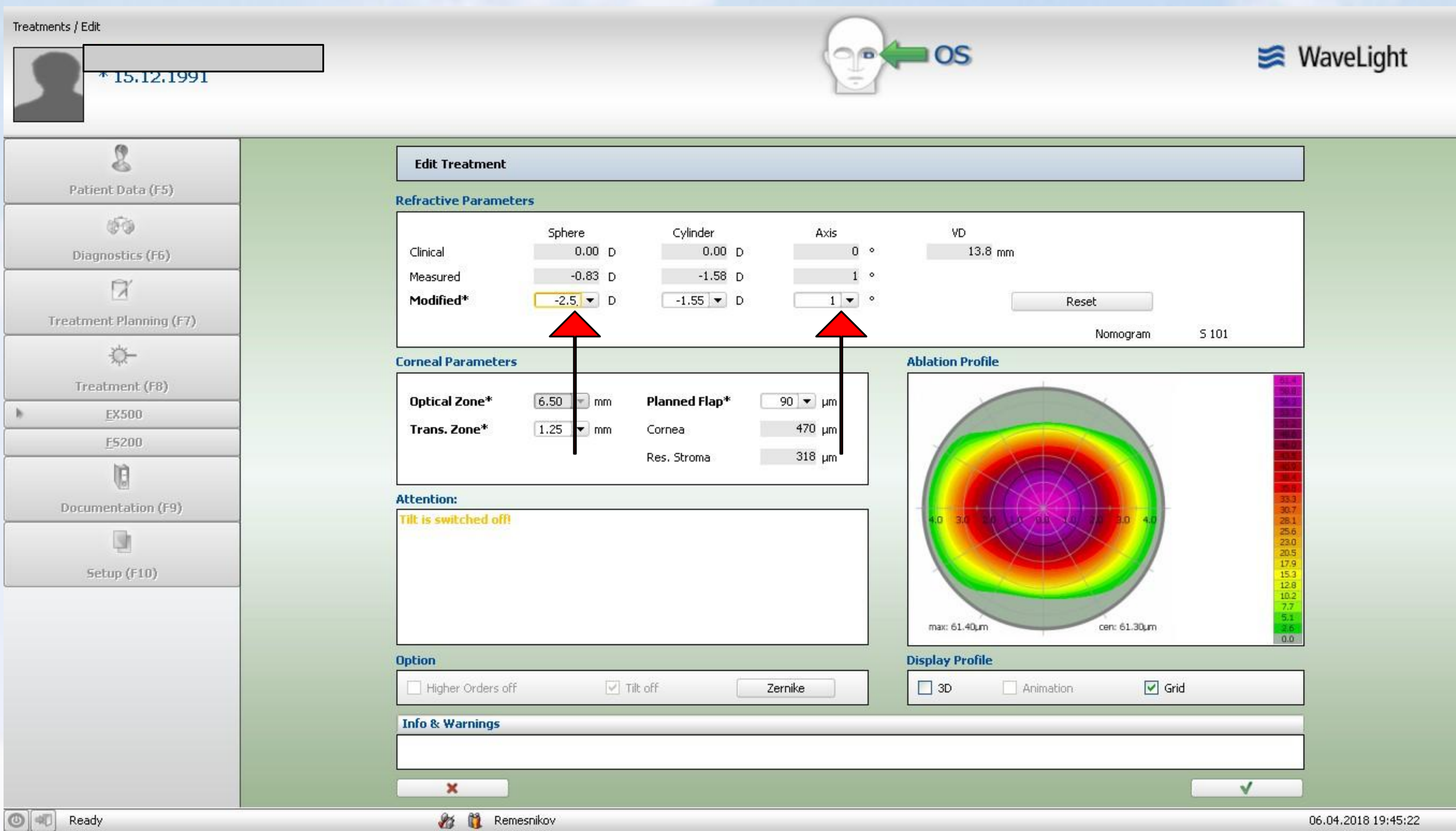
After adding -0.15 SD Zernike C4 = 0.2282

Step-by-Step Topo-Guided LASIK with TMR

- Measured cylinder is -1.58, so we plan sph -2.35 SD * cyl -1.55 CD, to keep initial SEQ = -3.125 D

Step-by-Step Topo-Guided LASIK with TMR

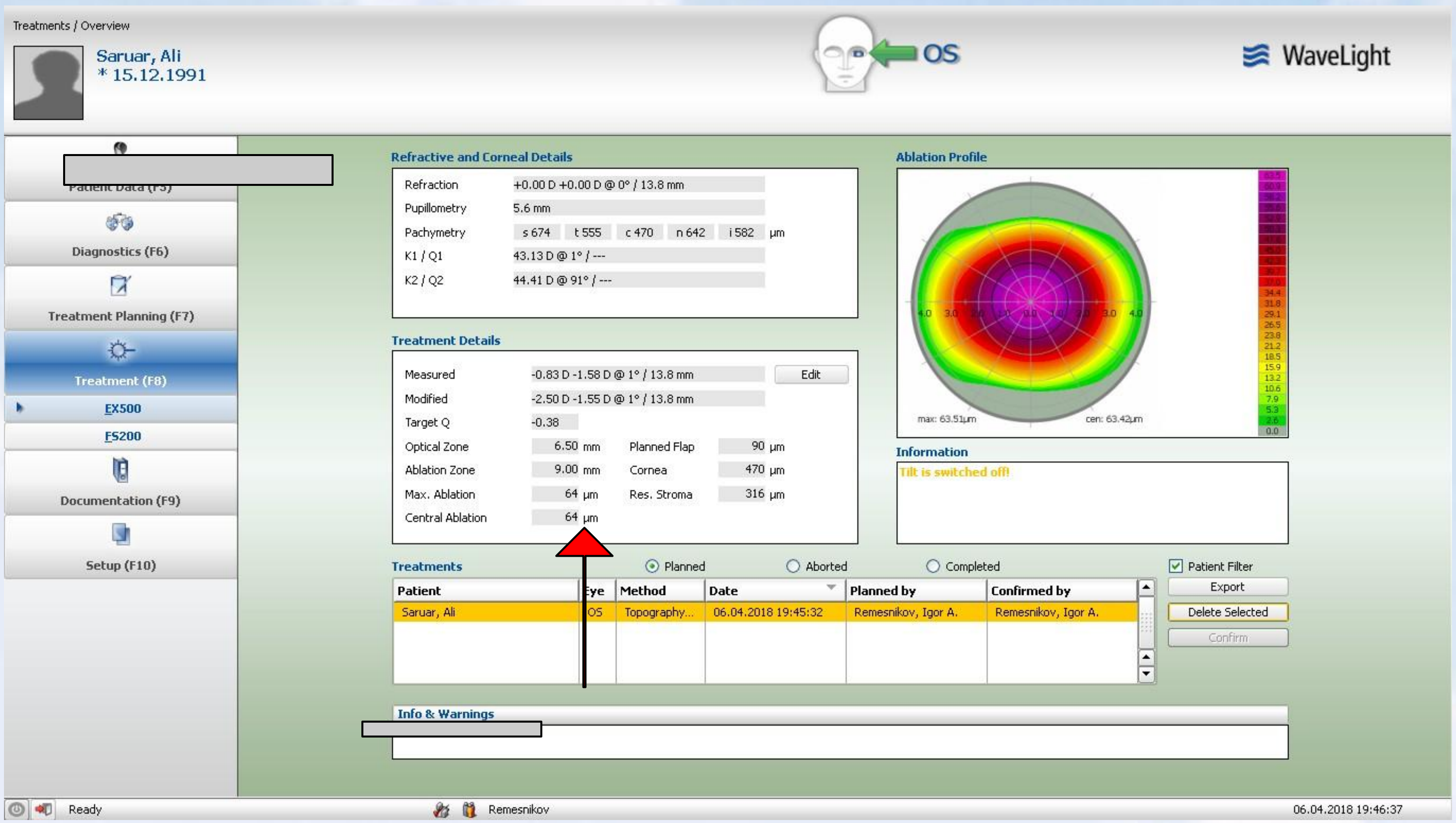
- Finally add -0.15 SD to sphere up to -2.50 SD, to compensate myopic shift
- Set cylinder axis to 1°as measured: TRUST TOPO!



Step-by-Step Topo-Guided LASIK with TMR

Finally, for this case: sph -2.75 SD * cyl -0.75 CD * ax 175°

TMR will be: sph -2.50 SD * cyl -1.55 CD * ax 1°



Steps from 11 to 14 slides you can also do in Treatment Planning EX500

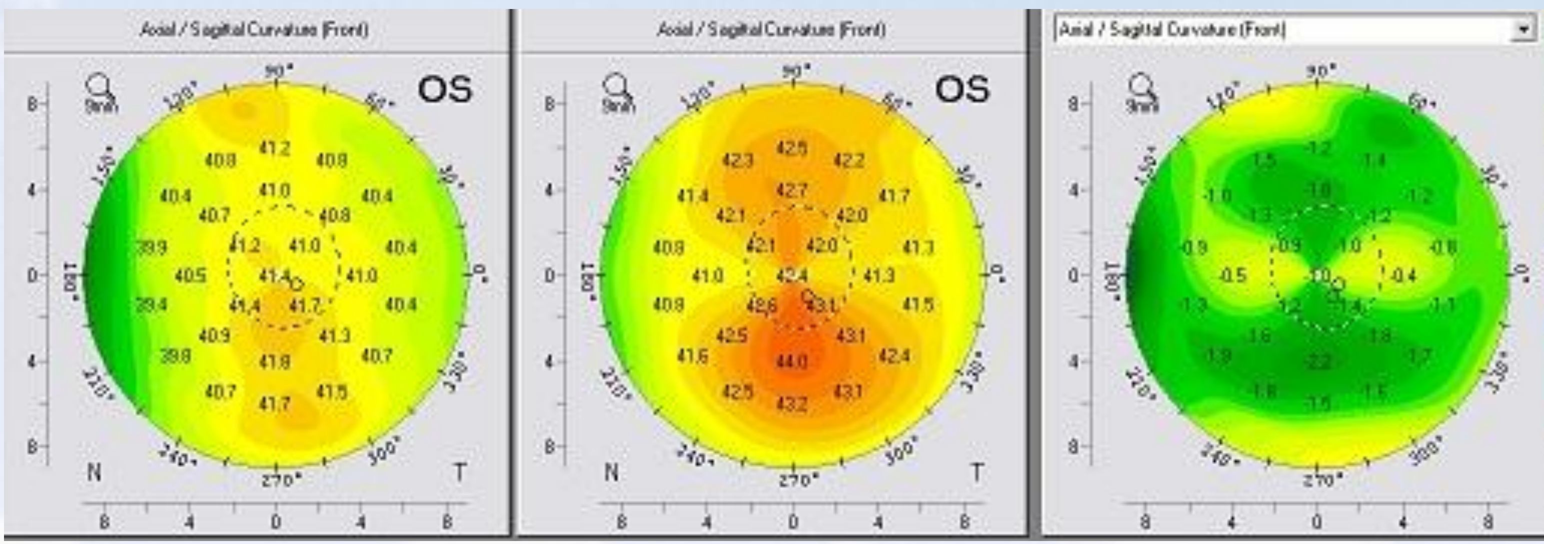
Step-by-Step Topo-Guided LASIK with TMR

But!!!

- If we have initially BCDVA = 1.00 (0.00 LogMAR) and we see regular symmetrical topograms, so, in my opinion according to my practice and my experience, we will get 1.00 or better NCDVA not only using Topo-Guided method, but also using standard Custon-Q method
- We have very simple planning in Custom-Q, requiring only entering sph -2.75 SD * cyl -0.75 CD * ax 175° and not this difficult steps described above, also with higher risk of committing accidental human errors during planning
- Furthermore, after treatment using this variant of Topo-Guided method we can expect undercorrected sphere with overcorrected cylinder and changed axis of astigmatism from WTR to the non-physiological ATR one

Step-by-Step Topo-Guided LASIK with TMR

- We can expect possible PostOp situation like this: AR sph -0.5 SD * cyl +1.00 CD * ax 180° and resulting SEQ = 0.00 with NCDVA = 1.00, but it will be “bad ten lines”
- “Uniformly-spherical” cornea without normal WTR astigmatism ≈ 0.50 ÷ 0.75 D in corneal plane will cause lens-induced ATR one, but now in the resulting general clinical refraction



Difference map

Step-by-Step Topo-Guided LASIK with TMR

Part II A novel method of calculation in myopic situations (V.2)

(Igor A Remesnikov)

Purpose:

- To get good functional results
- To get entirely corrected sphere
- To keep normal WTR astigmatism ≈ 0.50 ÷ 0.75 D in corneal plane

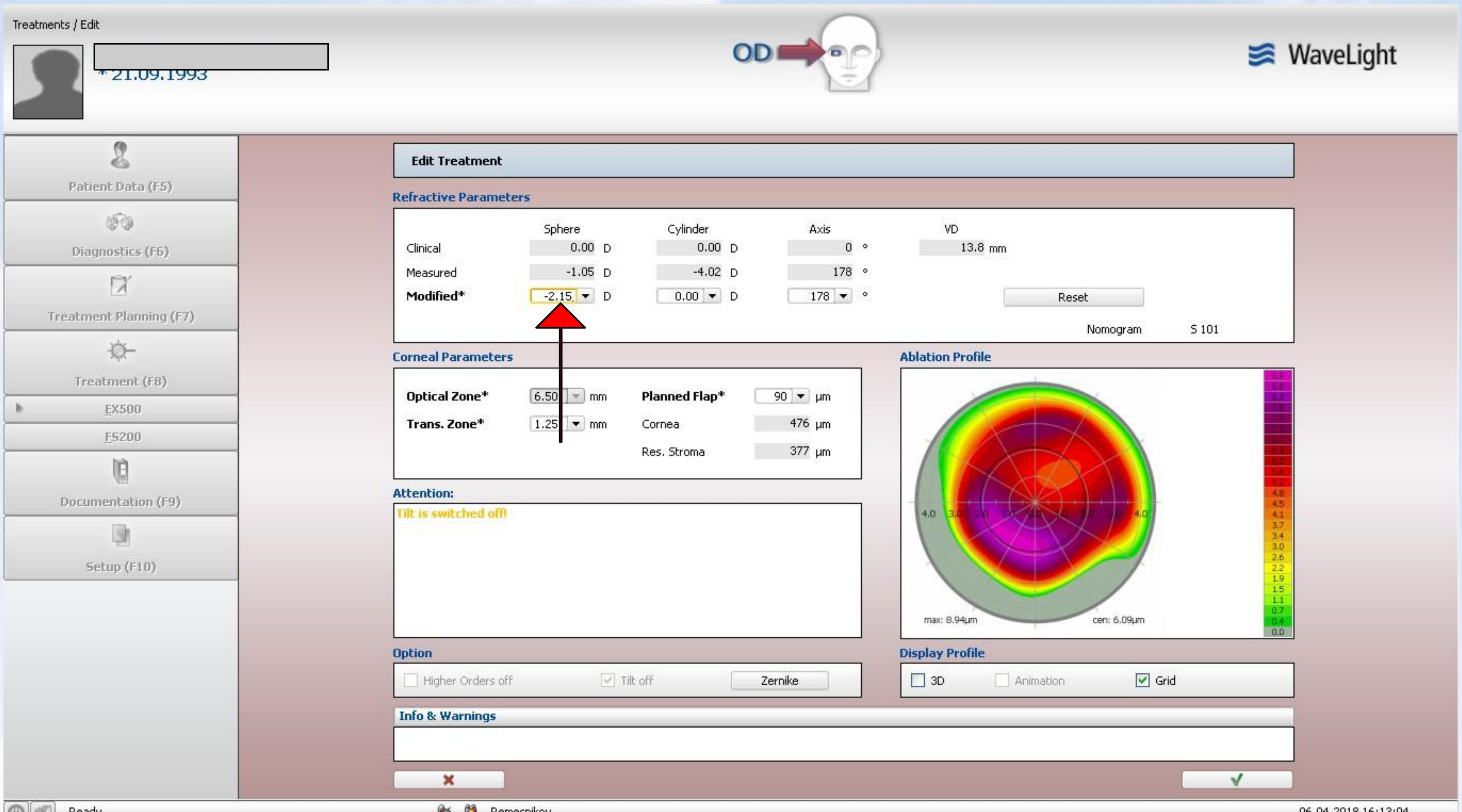
In our practice we use Topo-Guided method mainly in the cases with astigmatism ≥ 2.00 CD, excepting irregular corneas with any values of astigmatism, where we can also apply Topo-Guided method

Case 2.

AR OD sph -1.75 SD * cyl -4.00 CD * ax 180°

SEQ = -3.75 D   BCDVA = 1.00 (0.00 LogMAR)

- Steps from 5 to 12 slides are similar
- Calculate sphere: -1.75 – 0.25 (from the standard nomogram) – 0.15 (to prevent myopic shift) = -2.15 SD



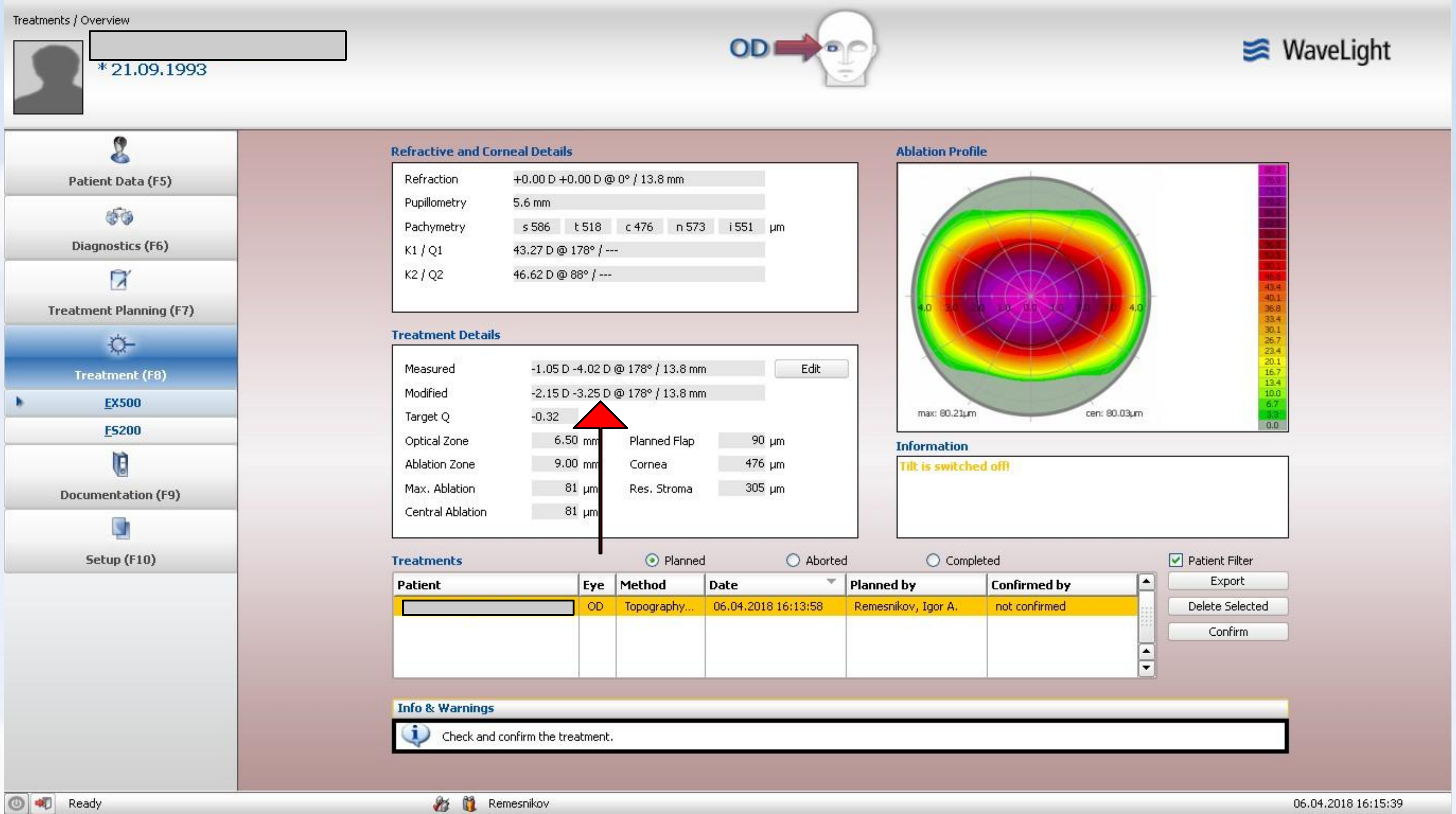
Step-by-Step Topo-Guided LASIK with TMR

- Subtract ≈ 0.80 CD from the amount of measured cylinder. For example: measured cylinder is -4.02 CD – (-0.80 CD) = -3.25 CD

Step-by-Step Topo-Guided LASIK with TMR

- Set axis of astigmatism as measured
- Finally, TMR for this case will be:

sph -2.15 SD * cyl -3.25 CD * ax 178° and it's no need to calculate SEQ to compare it with initial

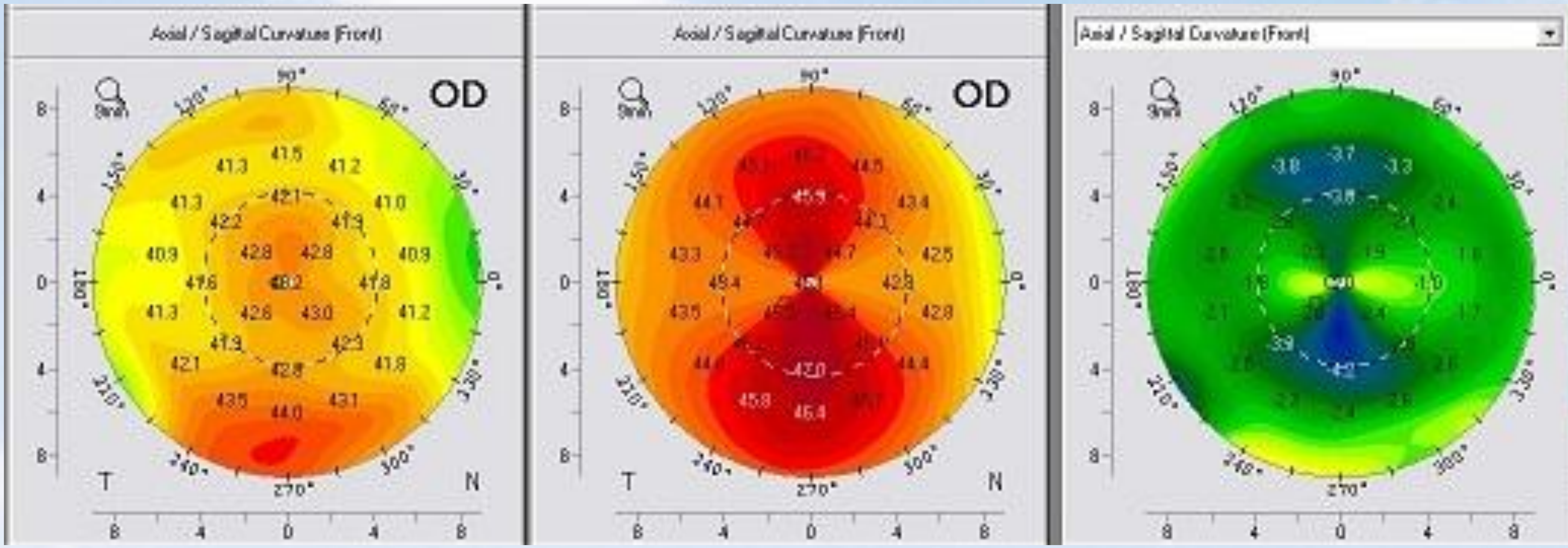


Case 2 **PreOp**

AR OD sph -1.75 SD * cyl -4.00 CD * ax180° ΔK = 3.25 D

BCDVA = 1.00 (0.00 LogMAR)

Difference Map



Measured cylinder was -4.02 CD – (-0.77 CD) = -3.25 CD

TMR = sph -2.15 SD * cyl -3.25 CD * ax 178° (V.2)

With conventional method of calculation:

TMR = sph -1.90 SD * cyl -4.00 CD * ax 178° (V.1)

1D PostOp

AR OD sph +0.25 SD * cyl -1.25 CD * ax 15°

NCDVA = 1.00 (0.00 LogMAR)

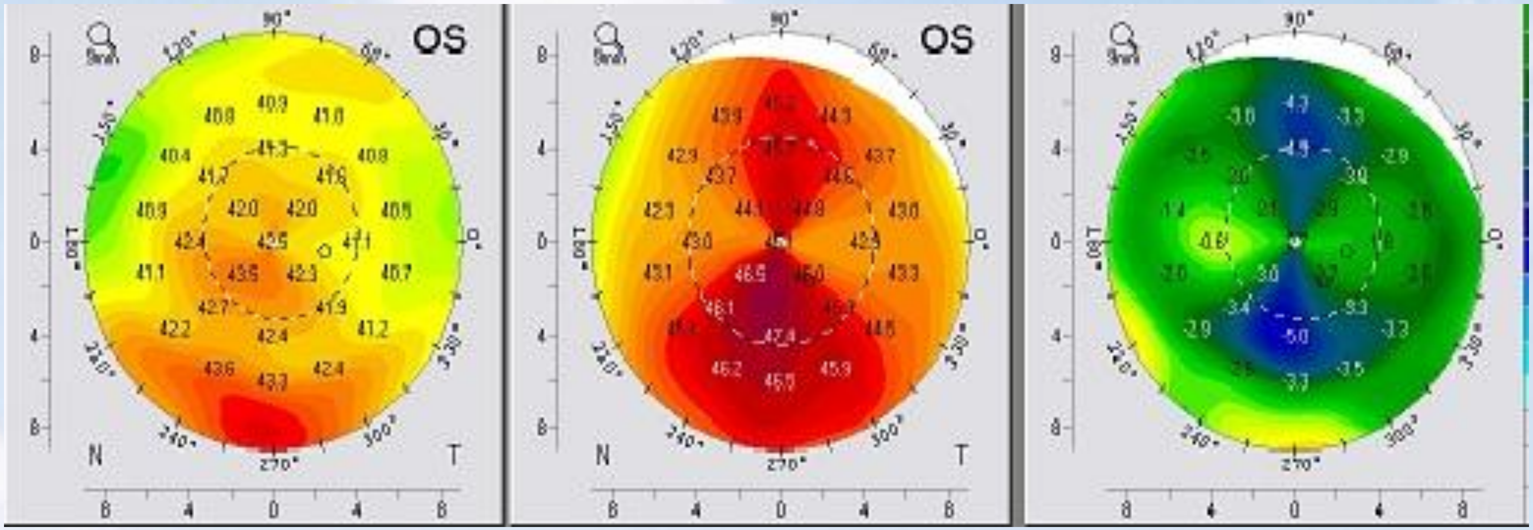
SEQ = -0.375 D

Case 3 **PreOp**

AR OS sph -1.50 SD * cyl -4.00 CD * ax 170° ΔK = 3.25 D

BCDVA = 1.00 (0.00 LogMAR)

Difference Map



Measured cylinder was -3.91 CD – (-0.76 CD) = -3.15 CD

TMR = sph -1.90 SD * cyl -3.15 CD * ax 179°

1D PostOp

AR OD sph +0.50 SD * cyl -1.00 CD * ax 120° (you can see slight torque-effect)

NCDVA = 1.00 (0.00 LogMAR)

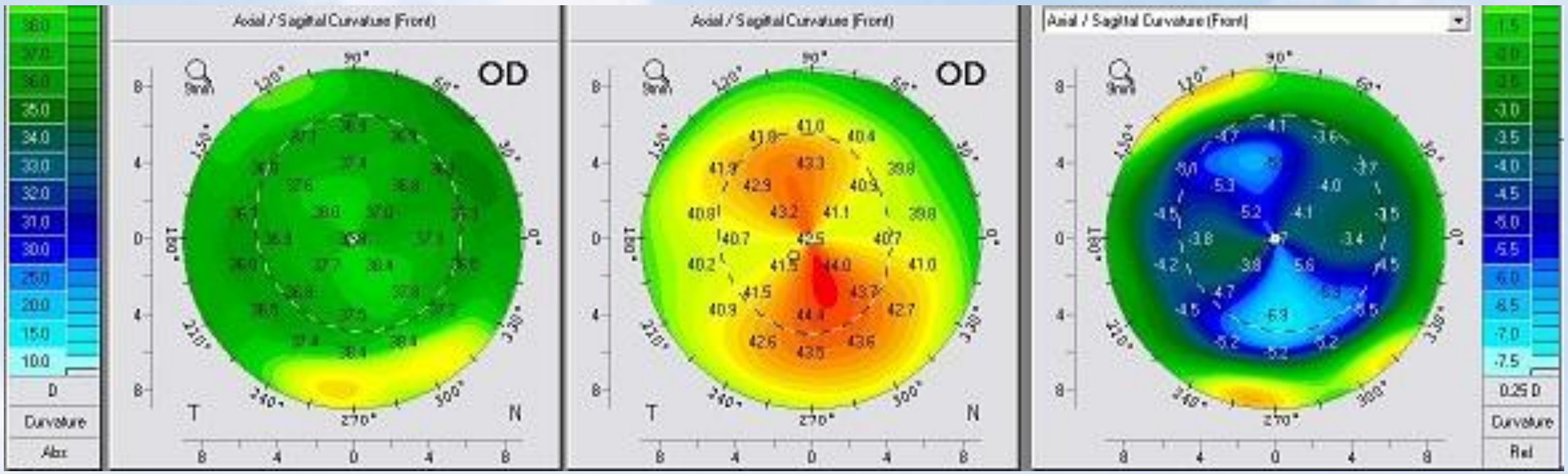
SEQ = 0.00 D

Case 4 **PreOp**

AR OD sph -4.25 SD * cyl -4.00 CD * ax 15° ΔK = 3.75 D

BCDVA = 0.80 (0.10 LogMAR)

Difference Map



Measured cylinder was -4.38 CD – (-0.83 CD) = -3.55 CD

TMR = sph -4.40 SD * cyl -3.55 CD * ax 12°

1D PostOp

AR OD sph +0.50 SD * cyl -1.25 CD * ax 40°

NCDVA = 1.00 (0.00 LogMAR)

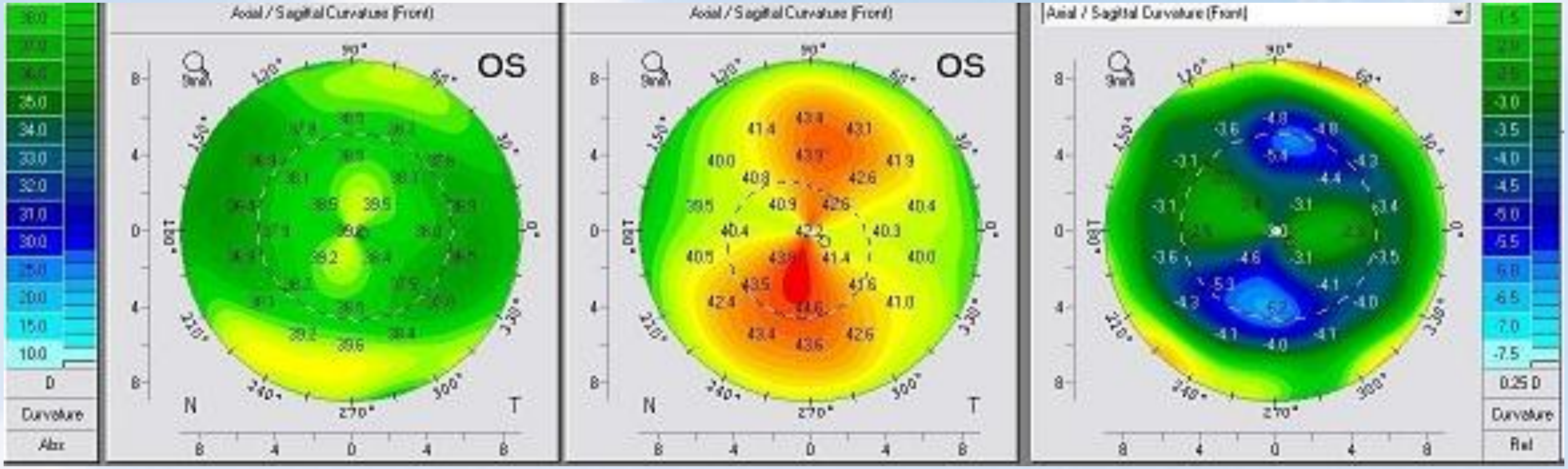
SEQ = -0.125 D

Case 5 **PreOp**

AR OS sph -1.50 SD * cyl -4.00 CD * ax 170° ΔK = **3.25** D

BCDVA = 1.00 (0.00 LogMAR)

Difference Map



Measured cylinder was -5.64 CD – (-2.64 CD) = -3.00 CD. The values of cylinders and ΔK measured by AR on the both eyes (see previous Case 4) are almost the same, so we significantly reduced amount of cylinder for entering in TMR.

TMR = sph -3.15 SD * cyl -3.00 CD * ax 170°

1D PostOp

AR OD sph +0.50 SD * cyl -1.00 CD * ax 120° (you can see slight torque-effect)

NCDVA = 1.00 (0.00 LogMAR)

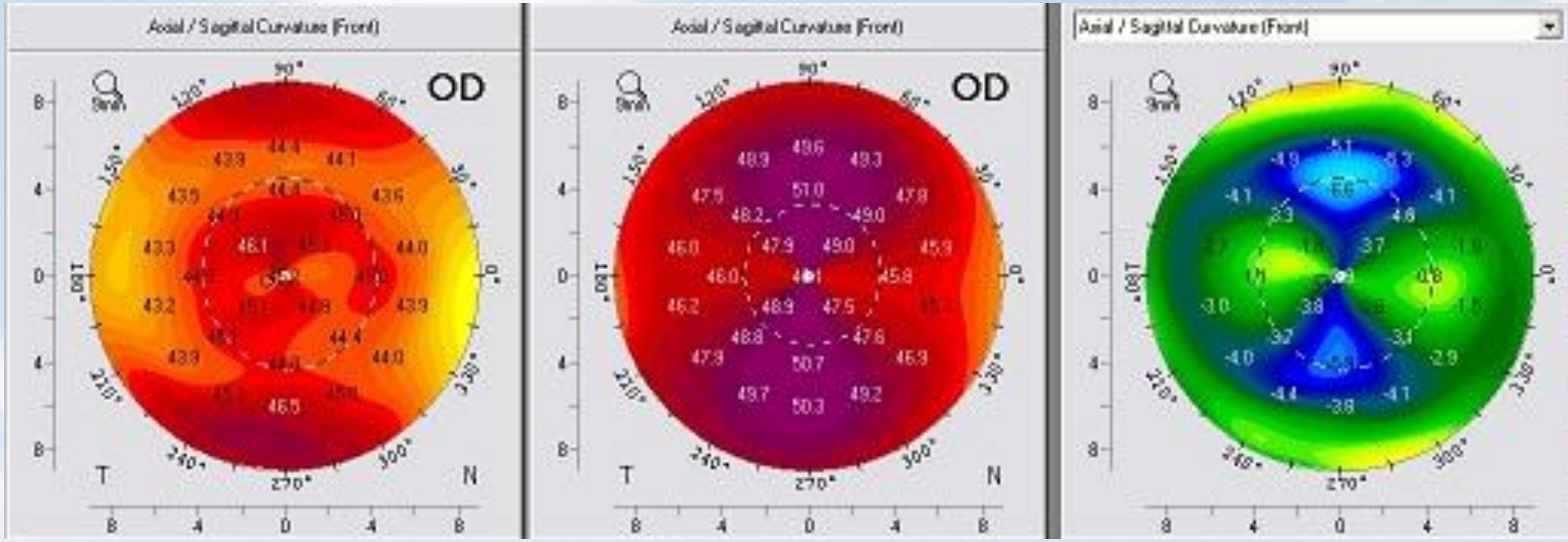
SEQ = 0.00 D

Case 6 **PreOp**

AR OD sph -1.75 SD * cyl -5.75 CD * ax160° ΔK = 4.75 D

BCDVA = 0.70 (0.15 LogMAR)

Difference Map



Measured cylinder was -6.16 CD – (-0.86 CD) = -5.30 CD

TMR = sph -2.10 SD * cyl -5.30 CD * ax 168°

PostOp

AR OD sph 0.00 SD * cyl 0.00 CD * ax 0°

NCDVA = 1.00 (0.00 LogMAR)

SEQ = 0.00 D

Case 7

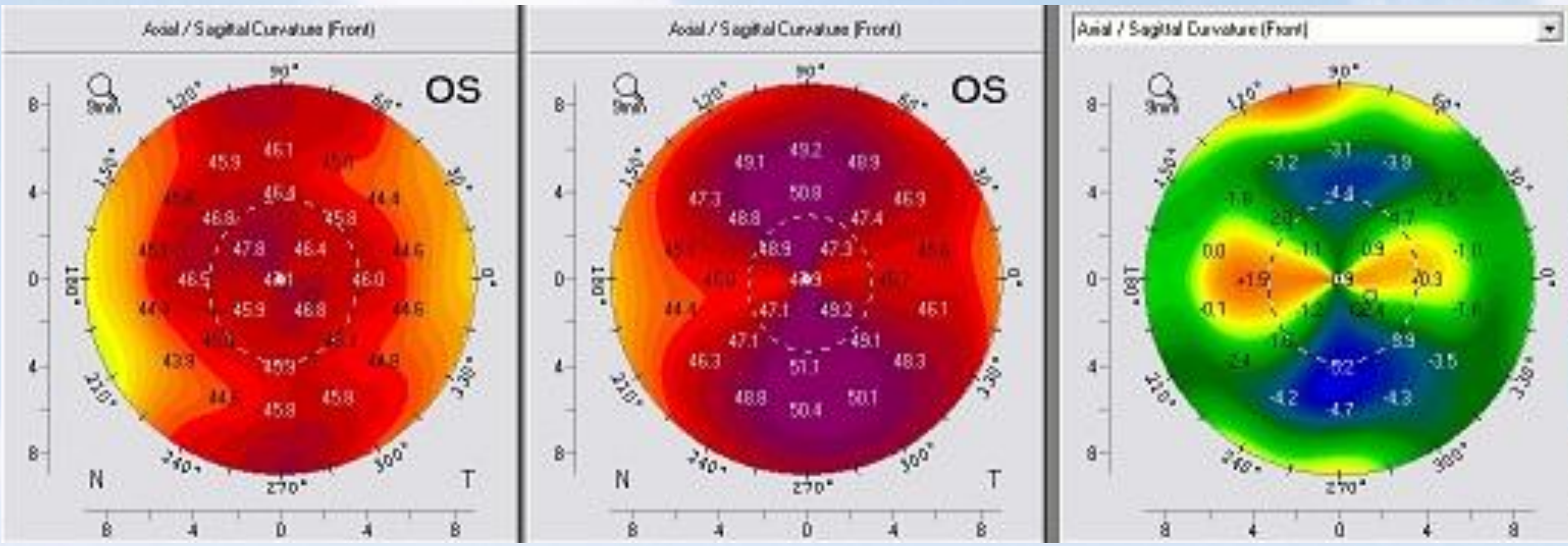
PreOp

AR OS sph +0.25 SD * cyl -6.75 CD * ax 15°

ΔK = 5.50 D

BCDVA = 0.8 (0.10 LogMAR)

Difference Map



Measured cylinder was -7.27 CD – (-1.27 CD) = -6.00 CD. We can't enter the value of cylinder more than +/- 6.00 CD, so we significantly reduced amount of measured cylinder for entering in TMR.

TMR = sph -0.35 SD * cyl -6.00 CD * ax 14°

1D PostOp

AR OD sph -0.50 SD * cyl -1.00 CD * ax 45° (you can see slight torque-effect)

NCDVA = 1.00 (0.00 LogMAR)

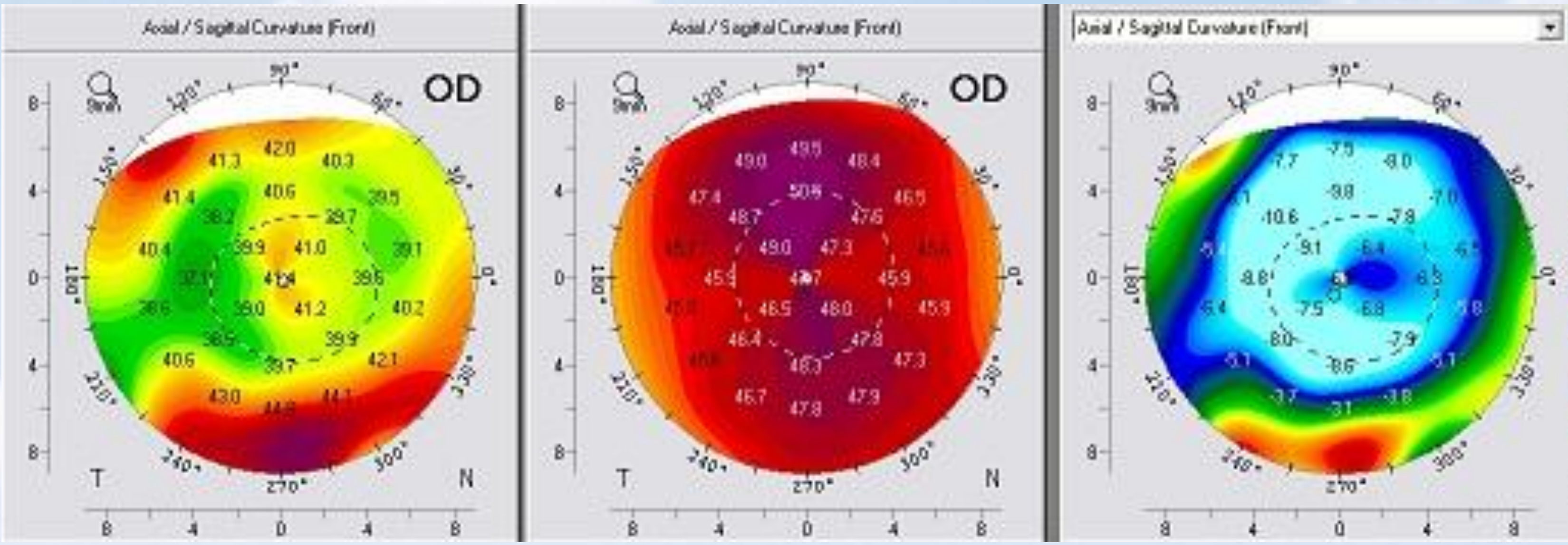
SEQ = -0.75 D

Case 8 **PreOp**

AR OD sph -8.75 SD * cyl -4.25 CD * ax 5° ΔK = 3.00 D

BCDVA = 0.10 (1.00 LogMAR)

Difference Map



Measured cylinder was -4.19 CD – (-0.74 CD) = -3.45 CD

TMR = sph -8.15 SD * cyl -3.45 CD * ax 9°

1D PostOp

AR OD sph +0.25 SD * cyl -0.75 CD * ax 0°

NCDVA = 0.30 (0.50 LogMAR)

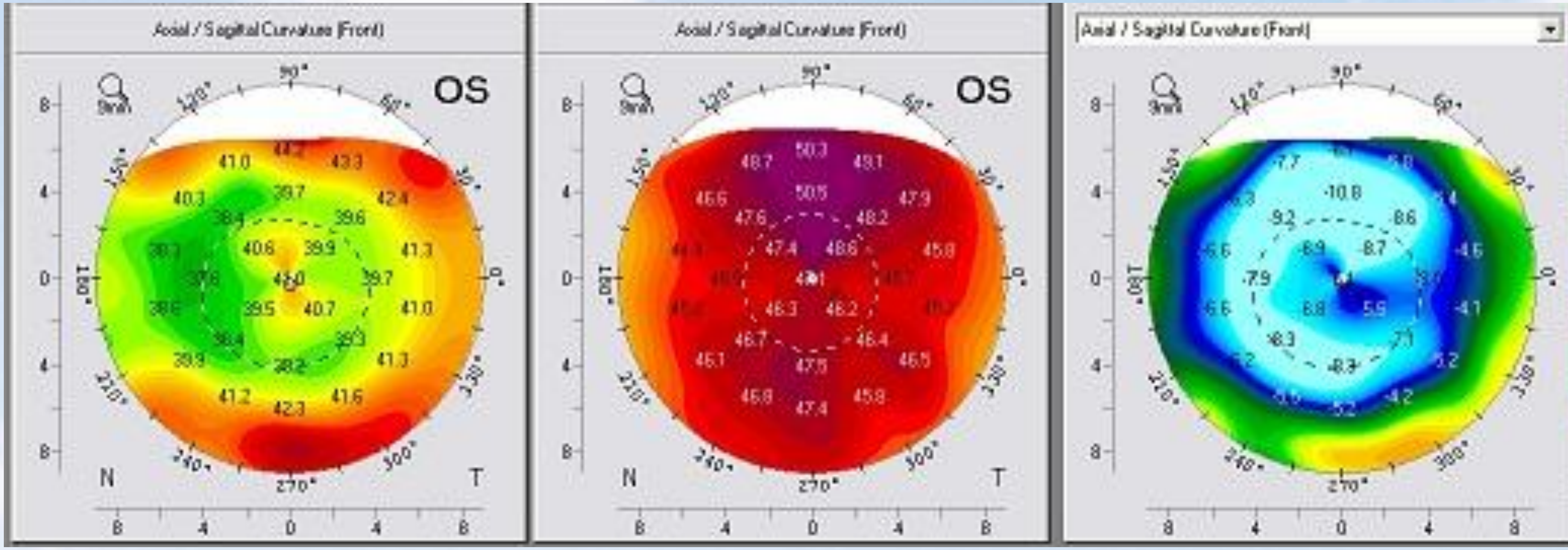
SEQ = -0.125 D

Case 9 **PreOp**

AR OS sph -8.50 SD * cyl -3.25 CD * ax 170° ΔK = 2.75 D

BCDVA = 0.50 (0.30 LogMAR)

Difference Map



Measured cylinder was -4.35 CD – (-1.45 CD) = -2.90 CD. The value of cylinder measured by AR and ΔK are significantly less, so we reduced amount of cylinder for entering in TMR.

TMR = sph -7.90 SD * cyl -2.90 CD * ax 172° (V.2)

With conventional method of calculation it will be:

TMR = sph -7.60 SD * cyl -4.35 CD * ax 172° (V.1)

1D PostOp

AR OD sph +0.50 SD * cyl 0.00 CD * ax 0°

NCDVA = 1.00 (0.00 LogMAR)

SEQ = +0.50 D

Finally, back to Case 1 , but in V.2

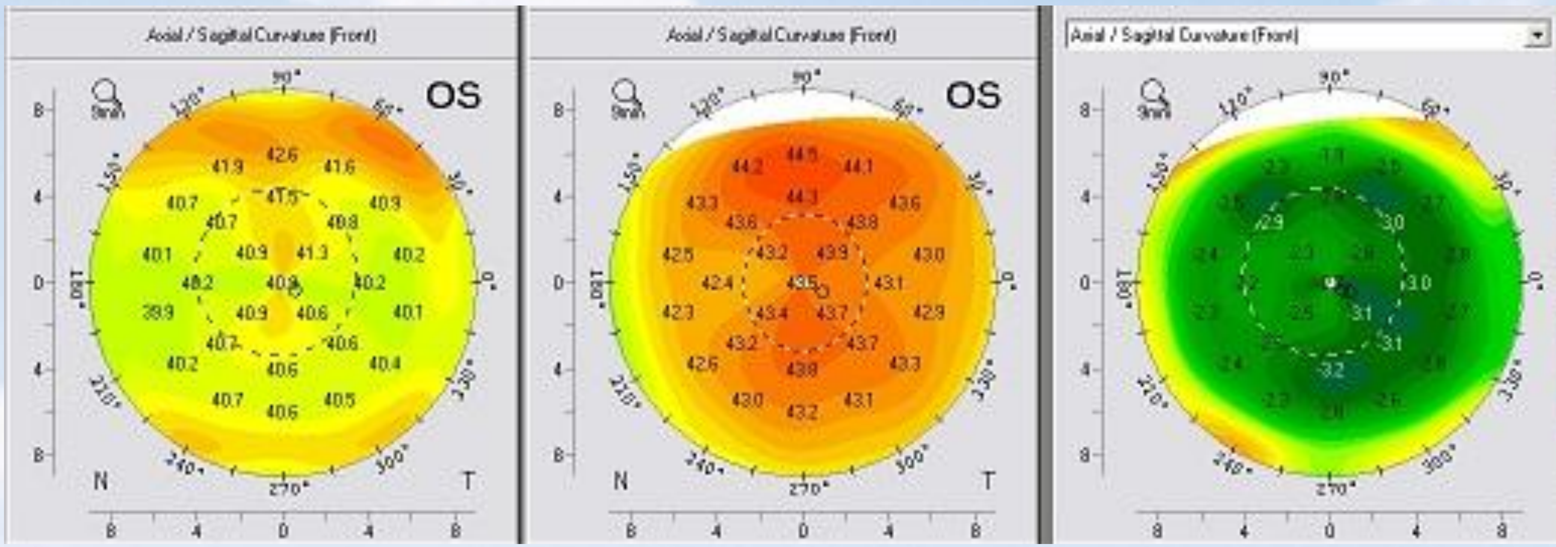
PreOp

AR OS sph -2.75 SD * cyl -0.75 CD * ax 175°

ΔK = 1.00 D

BCDVA = 1.00 (0.00 LogMAR)

Difference Map



Measured cylinder was -1.58 CD – (-0.88 CD) = -0.70 CD. The value of cylinder measured by AR and ΔK are slightly less, so we reduced amount of cylinder for entering in TMR.

TMR = sph -2.95 SD * cyl 0.70 CD * ax 1°

1D PostOp

AR OD sph +0.25 SD * cyl 0.00 CD * ax 0°

NCDVA = 1.25 (0.00 LogMAR)

SEQ = +0.25 D and we can see presence of WTR astigmatism ≈ 0.75 D on topogram

Step-by-Step Topo-Guided LASIK with TMR

Part III Calculation in mixed astigmatism situations

Previously we successfully used Arthur Cammings method for calculation in mixed astigmatism situations:

- Turn refraction into the plus-cylinder form
- Minus sphere planned with standard nomogram
- Reduction of the (+) cylinder

We tried to join it together with TMR method:

- In our practice we subtract ≈ 30% from the (+) cylinder
- We entering topo-measured axis of cylinder not from AR or manifest refraction

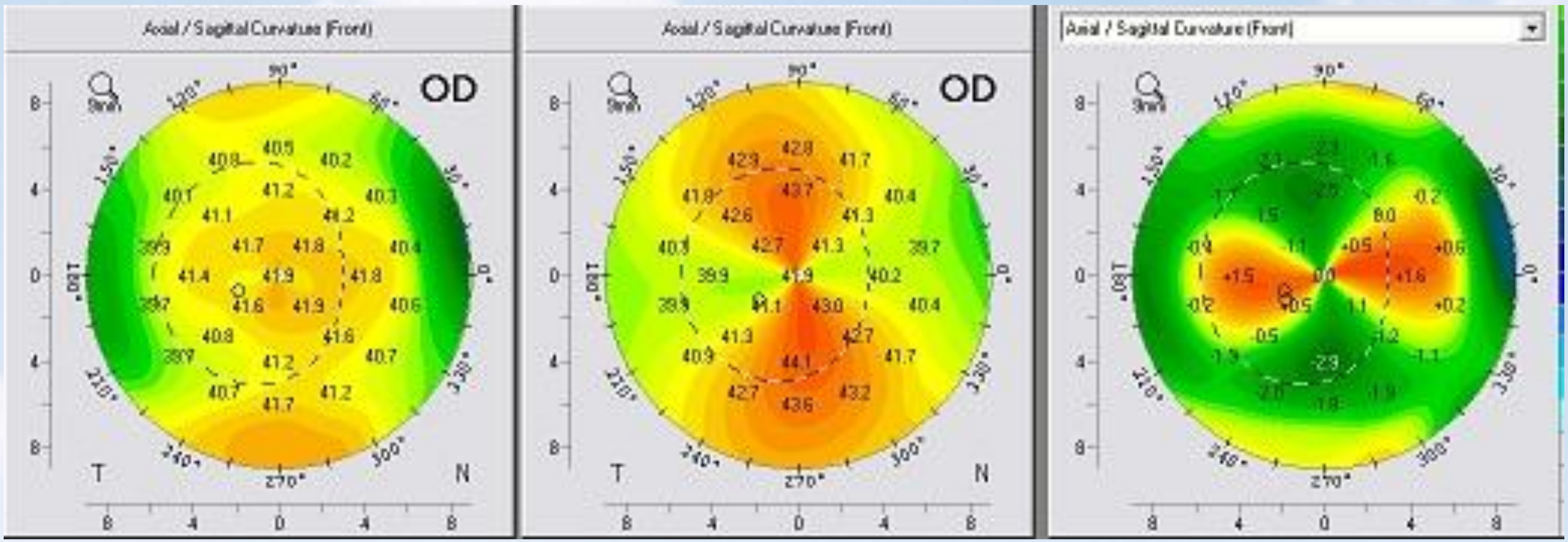
Case 10 **PreOp**

AR OD sph +2.00 SD * cyl -4.50 CD * ax 0° = sph -2.50 SD * cyl +4.50 CD * ax 90°

ΔK = 3.75 D

BCDVA = 0.60 (0.20 LogMAR)

Difference Map



Spere: -2.50 - 0.25 (from the nomogram) – 0.15 (to prevent myopic shift) = 2.85 SD

Cylinder: +4.50 - 30% = 3.15 CD Measured axis of (-) cylinder was 5°

TMR = sph -2.85 SD * cyl +3.15 CD * ax 95°

1D PostOp

AR OD sph +0.25 SD * cyl -0.50 CD * ax 165°

NCDVA = 0.80 (0.10 LogMAR)

SEQ = +0.50 D

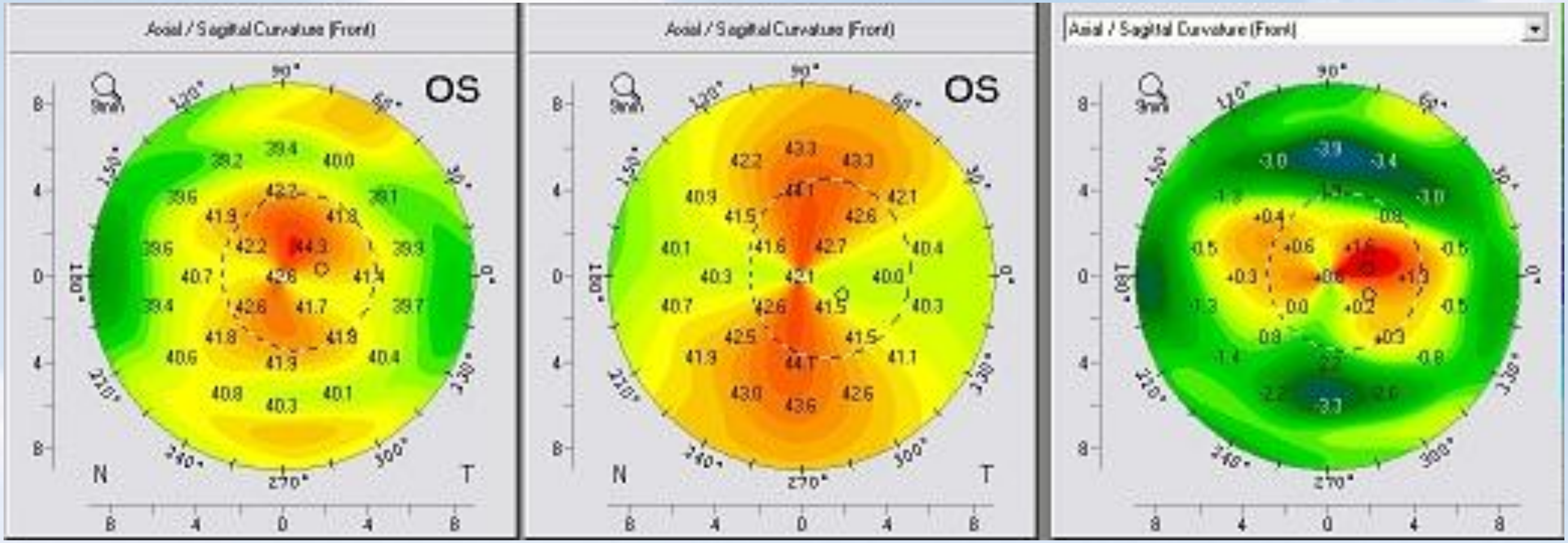
Case 11 **PreOp**

AR OS sph +1.50 SD * cyl -5.00 CD * ax 170° = sph -3.50 SD * cyl +5.00 CD * ax 80°

ΔK = 3.75 D

BCDVA = 0.60 (0.20 LogMAR)

Difference Map



Spere: -3.50 – 0.15 (to prevent myopic shift) = 3.65 SD

Cylinder: +4.50 - 30% = 3.15 CD Measured axis of **(-)** cylinder was 174°

TMR = sph -3.65 SD * cyl +3.50 CD * ax 84°

1D PostOp

AR OD sph +0.25 SD * cyl +0.50 CD * ax 60°

NCDVA = 0.70 (0.15 LogMAR)

SEQ = +0.50 D

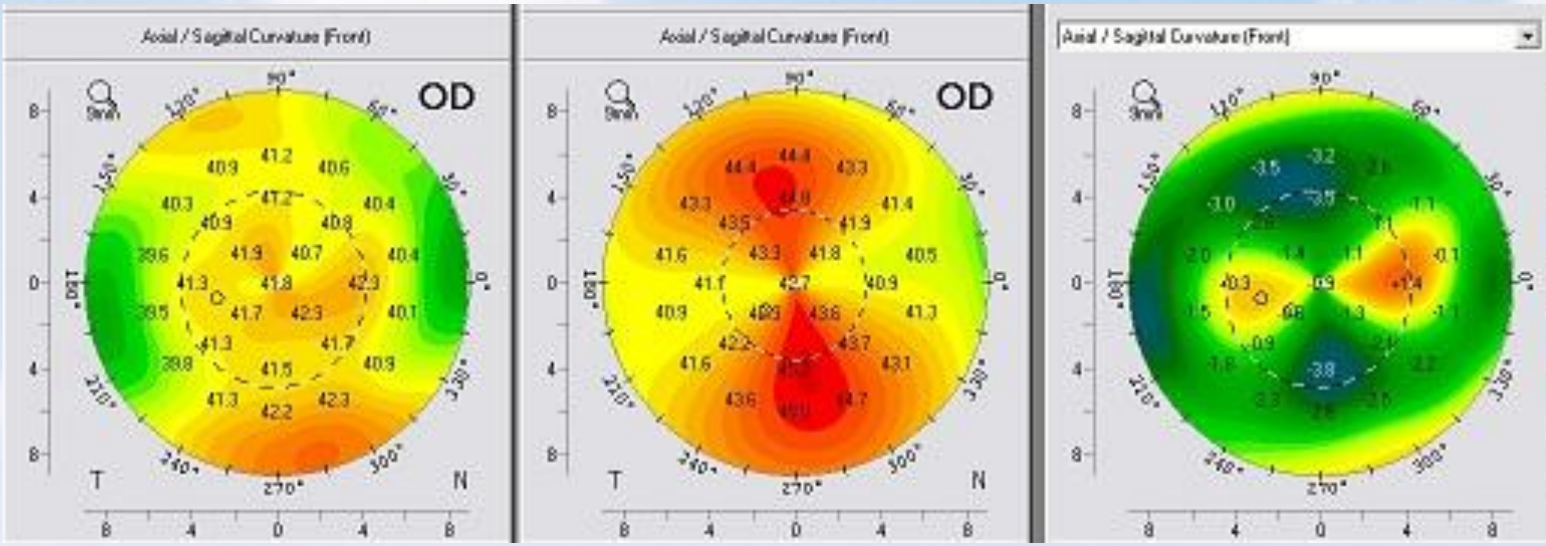
Case 12 **PreOp**

AR OD sph +1.50 SD * cyl -5.25 CD * ax 0° = sph -3.75 SD * cyl +5.25 CD * ax 90°

ΔK = 3.50 D

VA = 0.40 NC (0.40 LogMAR)

Difference Map



Spere: -3.75 – 0.15 (to prevent myopic shift) = 3.90 SD

Cylinder: +5.25 - 28% = 3.75 CD   Measured axis of (-) cylinder was 8°

TMR = sph -3.90 SD * cyl +3.75 CD * ax 98°

1D PostOp

AR OD sph +0.25 SD * cyl -0.50 CD * ax 25°

NCDVA = 1.00 (0.00 LogMAR)

SEQ = +0.50 D

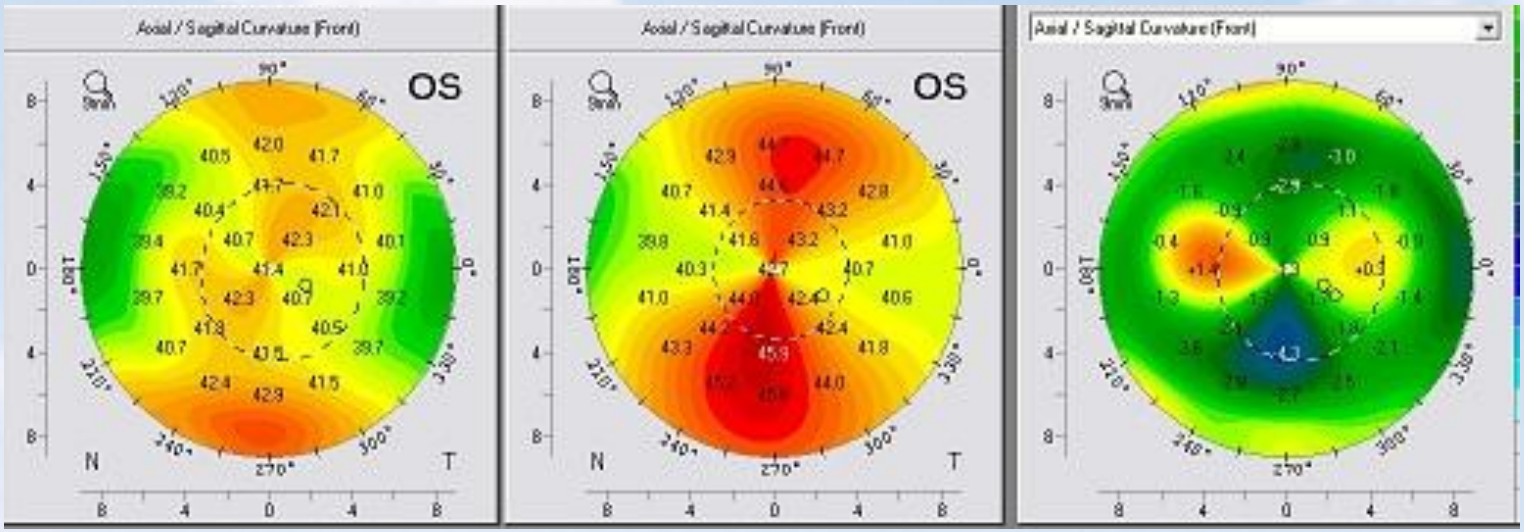
Case 13 **PreOp**

AR OS sph +1.75 SD * cyl -5.75 CD * ax 170° = sph -4.00 SD * cyl +5.75 CD * ax 80°

ΔK = 4.50 D

VA = 0.40 NC (0.40 LogMAR)

Difference Map



Spere: -4.00 – 0.15 (to prevent myopic shift) = 3.65 SD

Cylinder: +5.75 - 30% = 4.00 CD Measured axis of **(-)** cylinder was 177°

TMR = sph -4.15 SD * cyl +4.00 CD * ax 87°

1D PostOp

AR OD sph +1.50 SD * cyl -2.00 CD * ax 145° (you can see slight torque-effect)

NCDVA = 0.80 (0.10 LogMAR)

SEQ = +0.50 D

Case 14 **PreOp**

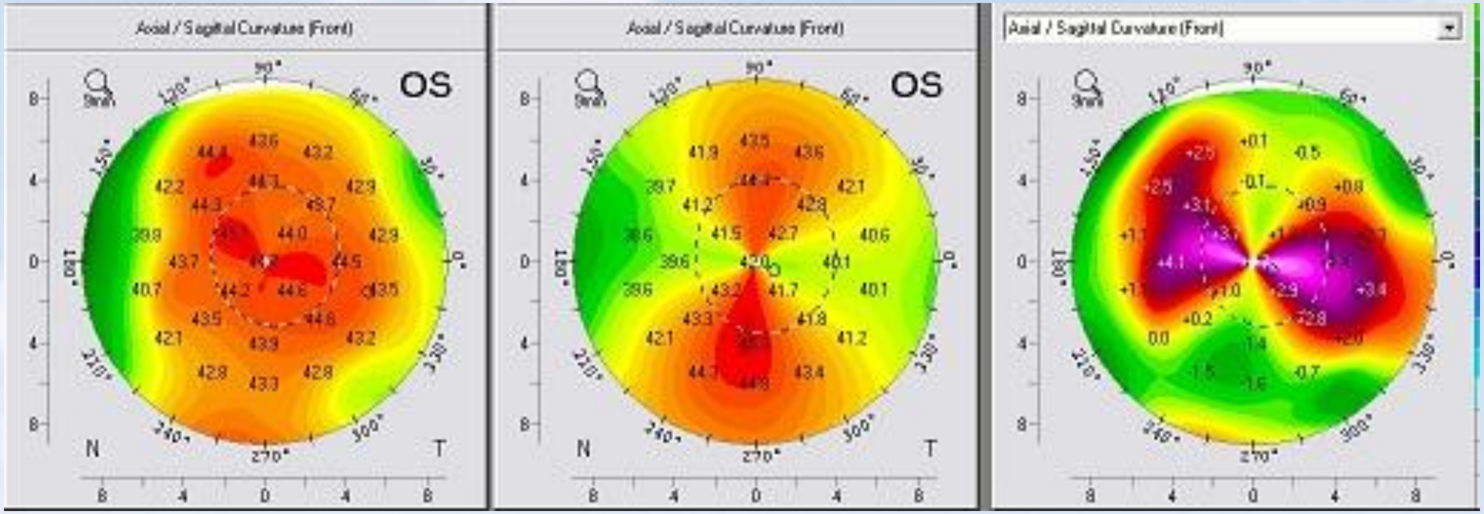
OD NCDVA = 1.00

AR **OS** sph +5.50 SD * cyl -6.00 CD * ax 170° **=** sph -0.50 SD * cyl +6.00 CD * ax 80°

ΔK = 4.75 D

BCDVA = 0.80 (0.10 LogMAR)

Difference Map



Spere: -4.00 – 0.25 (from the nomogram) – 0.15 (to prevent myopic shift) = 3.65 SD

Cylinder: +6.00 - 28% = 4.30 CD Measured axis of **(-)** cylinder was 177°

TMR = sph -1.00 SD * cyl +4.30 CD * ax 87°

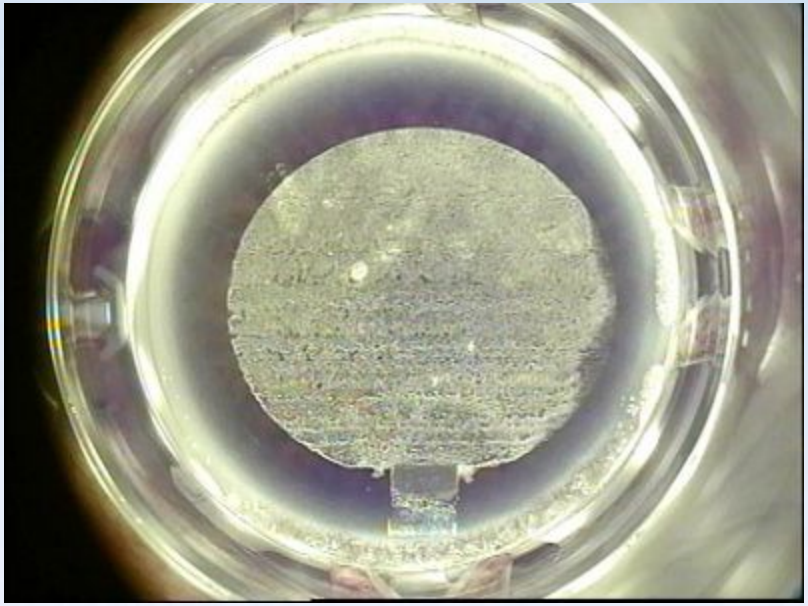
1D PostOp

AR OD sph +0.50 SD * cyl -0.75 CD * ax 25°

NCDVA = 1.00 (0.00 LogMAR)

SEQ = +0.125 D

NB! You can also put to use Custom Femto-flap in astigmatic cases. For example, for mixed astigmatism: 9.3 mm X 8.5 mm flap with hinge position according to the astigmatism axis



Discussion

1. We specially show you the 1D PostOp cases – you can already see good functional results in early PostOp period
2. We specially show you autorefractometry data despite the fact that the analysis of the refractive outcomes is based on the manifest refraction
3. You can more accurately evaluate the quality of surgery with Autorefractometry as well as Topography and not only manifest refraction
4. Amount of reduction in 0.80 CD of measured minus-cylinder is based on my individual surgical factor and also may vary due to the clinical situation: value of cylinder, ΔK from AR and IOL-Master (or equal device) and etc. and are only recommended!

Conclusions

1. This proposed method of calculation allows to save normal 0.50 ÷ 0.75 D WTR astigmatism in the corneal plane
2. It can be applied not only in presence of significant astigmatism
3. We suggest to use measured axis of astigmatism in situations with mixed and hyperopic astigmatism
4. It’s only my point of view
5. No other conclusions – **You Can Try It Yourself!**

Thank you for attention!

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