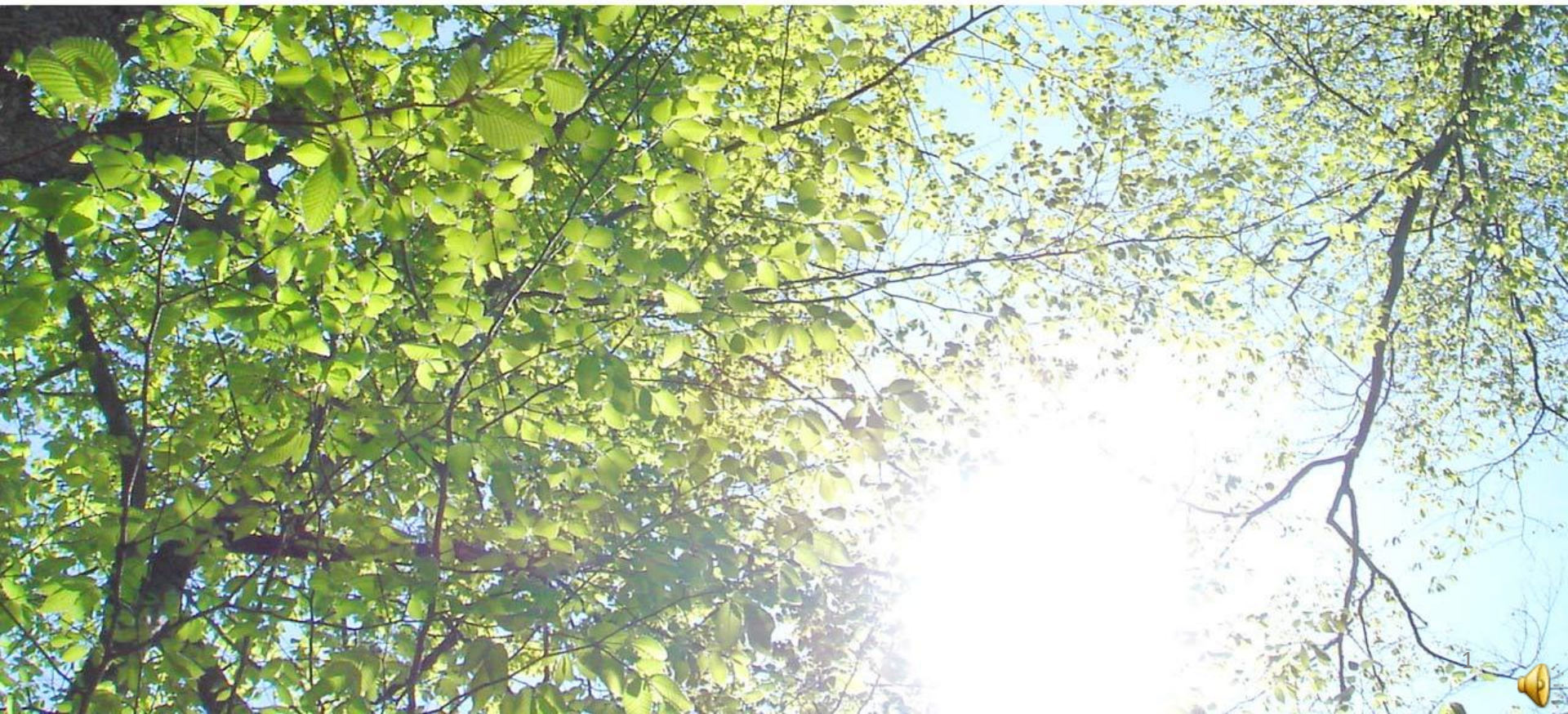




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ЦЕНТР КОРРЕКЦИИ ЗРЕНИЯ

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



MD

Igor A Remesnikov,

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.

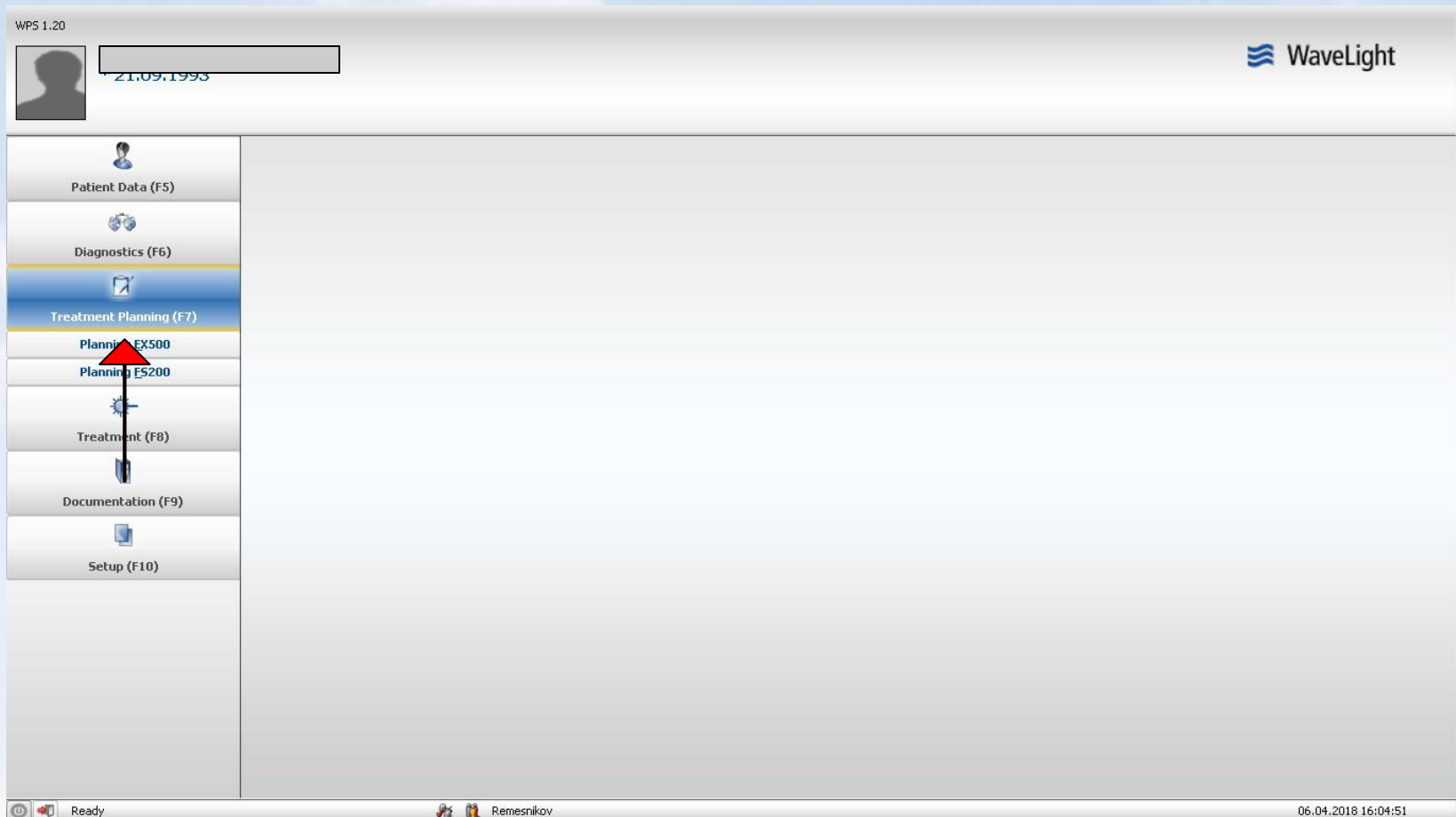
AR OS sph -2.75 SD * cyl -0.75 CD * ax 175°

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

Planning / Treatment Method

WaveLight

*21.09.1993

1 2 3 4 5 Select Method

Method

Wavefront Optimized (WFO)

OD OS

Wavefront-Guided (WFG)

OD OS

Topography-Guided (Topolyzer / TOPO-G)

OD OS

Topography-Guided (Oculyzer / OCU-G)

OD OS

Custom Q

OD OS

PTK

OD OS

Info & Warnings

Select treatment method and eye for treatment planning.

Ready

Remesnikov

06.04.2018 16:05:09

6

Step-by-Step Topo-Guided LASIK with TMR

□ **GOOD** quality topograms are required!

Planning / Topography-Guided (Topolyzer) / Assign Examinations

WaveLight

OS

Patient Data (F5)

Diagnostics (F6)

Treatment Planning (F7)

Planning EX500

Planning E5200

Treatment (F8)

Documentation (F9)

Setup (F10)

Assign Examinations - Topography-Guided (Topolyzer)

Overview Examinations

Resulting Examination Profile

Examinations 19.03.2018

Status	Quality	ID	K-Readings	Q-Value	Pupil
✓	✓*	001	43.10 D @ 0° 44.35 D	-0.37	2.98 mm
✓	✓	002	43.16 D @ 2° 44.47 D	-0.40	2.86 mm

Optical Zone* 6.50 mm Target Q* -0.38

Median 43.13 D @ 1° 44.41 D

MAD 0.03 D @ 1.0° 0.06 D

Reset

Profile

Options Zernike-Fit dyn.

☐ 3D ☐ Animation ☒ Grid

Option

☐ Higher Orders Only

☐ Tilt Off

Info & Warnings

Ready Remesnikov 06.04.2018 17:34:14

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°)

Planning / Topography-Guided (Topolyzer) / Refractive and Corneal Details

* 15.12.1991

OS

WaveLight

1 2 3 4 5 Refractive and Corneal Details - Topography-Guided (Topolyzer)

Refraction

Method: Subjective Sphere*: 0.00 D Cylinder*: 0.00 D Axis*: 0° VD*: 13.8 mm

K-Readings

Method: Standard K1*: 43.13 Axis*: 1° Eccentricity 1: --- Q1: ---
K2*: 44.41 91° Eccentricity 2: --- Q2: ---

Pupillometrics

Method: Standard Diameter*: 5.6 mm Medication*: None

Pachymetrics

superior: 674 μm
nasal: 642 μm 470 μm 555 μm temporal
inferior: 582 μm

Comment (max. 255 characters)

Info & Warnings

Enter mandatory data or select data from database using the (+) sign or Ctrl+T and confirm selection by double click.

Ready Remesnikov 06.04.2018 19:38:52

Step-by-Step Topo-Guided LASIK with TMR

- Two steps later check Max. Ablation depth: it must be never $> 15 \mu\text{m}$
- Save this preliminary plan

Planning / Overview

15.12.1991

OS

WaveLight

1 2 3 4 5 Overview

Refractive and Corneal Details

Refraction: +0.00 D +0.00 D @ 0° / 13.8 mm

Pupillometry: 5.6 mm

Pachymetry: s 674 t 555 c 470 n 642 i 582 μm

K1 / Q1: 43.13 D @ 1° / ---

K2 / Q2: 44.41 D @ 91° / ---

Treatment Details

Measured: -0.83 D -1.58 D @ 1° / 13.8 mm

Modified: +0.00 D +0.00 D @ 0° / 13.8 mm

Target Q: -0.38

Optical Zone: 6.50 mm Planned Flap: 90 μm

Ablation Zone: 9.00 mm Cornea: 470 μm

Max. Ablation: 8 μm Res. Stroma: 373 μm

Central Ablation

Ablation Profile

max: 7.54 μm cent: 3.48 μm

Treatments

Method	Planning Date	Status
Topography-Guided (Topolyzer)	06.04.2018 19:39:28	✓

Info & Warnings

Plan additional treatment or select/deselect planned treatments. Press checkmark to save planning.

Ready

Remesnikov

06.04.2018 19:39:40

Step-by-Step Topo-Guided LASIK with TMR

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

The screenshot displays the WaveLight EX500 software interface. The top bar shows 'Treatments / Overview' and a patient profile icon. The left sidebar contains navigation buttons: Patient Data (F5), Diagnostics (F6), Treatment Planning (F7), Treatment (F8), EX500 (highlighted with a red arrow), Documentation (F9), and Setup (F10). The main area is divided into three sections: Refractive and Corneal Details, Treatment Details, and Ablation Profile.

Refractive and Corneal Details

Refraction	+0.00 D +0.00 D @ 0° / 13.8 mm			
Pupillometry	5.6 mm			
Pachymetry	s 674	t 555	c 470	n 642 582 μm
K1 / Q1	43.13 D @ 1° / ---			
K2 / Q2	44.41 D @ 91° / ---			

Treatment Details

Measured	-0.83 D -1.58 D @ 1° / 13.8 mm		Edit
Modified	+0.00 D +0.00 D @ 0° / 13.8 mm		
Target Q	-0.38		
Optical Zone	6.50 mm	Planned Flap	90 μm
Ablation Zone	9.00 mm	Cornea	470 μm
Max. Ablation	8 μm	Res. Stroma	373 μm
Central Ablation	4 μm		

Ablation Profile

The ablation profile is a circular heatmap showing the distribution of ablation energy. The color scale ranges from 0.0 (blue) to 4.2 (red). The maximum ablation is 7.54 μm and the central ablation is 3.48 μm.

Information

Tilt is switched off!

Treatments

Planned ☒ Aborted ☐ Completed ☐ Patient Filter ☒

Patient	Eye	Method	Date	Planned by	Confirmed by
	OS	Topography...	06.04.2018 19:39:28	Remesnikov, Igor A.	not confirmed

Info & Warnings

Check and confirm the treatment.

Step-by-Step Topo-Guided LASIK with TMR

□ Start edit it

Treatments / Edit

* 15.12.1991

OS

WaveLight

Edit Treatment

Refractive Parameters

	Sphere	Cylinder	Axis	VD
Clinical	0.00 D	0.00 D	0 °	13.8 mm
Measured	-0.83 D	-1.58 D	1 °	
Modified*	0.00 D	0.00 D	0 °	

Reset

Nomogram

Corneal Parameters

Optical Zone*	6.50 mm	Planned Flap*	90 µm
Trans. Zone*	1.25 mm	Cornea	470 µm
		Res. Stroma	373 µm

Attention:

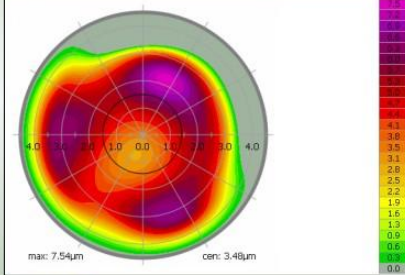
Tilt is switched off!

Option

☐ Higher Orders off ☒ Tilt off

Info & Warnings

Ablation Profile



max: 7.54µm

cen: 3.48µm

Display Profile

☐ 3D ☐ Animation ☒ Grid

Ready

Remesnikov

06.04.2018 19:40:55

Step-by-Step Topo-Guided LASIK with TMR

Open Zernike window and set C4 $\approx$ C12 by changing sphere to myopia about $-0.15 \div -0.25$ 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

Treatments / Edit

13.12.1991

OS

WaveLight

Edit Treatment

Refractive Parameters

	Sphere	Cylinder	Axis	VD
Clinical	0.00 D	0.00 D	0 °	13.8 mm
Measured	-0.83 D	-1.58 D	1 °	
Modified*	-2.35 D	-1.55 D	1 °	

Reset

Nomogram S 101

Corneal Parameters

Optical Zone*	6.50 mm	Planned Flap*	90 µm
Trans. Zone*	1.25 mm	Cornea	470 µm
		Res. Stroma	318 µm

Attention:

Tilt is switched off!

Option

☐ Higher Orders off ☒ Tilt off

Info & Warnings

max: 61.40µm cen: 61.30µm

Ablation Profile

Display Profile

☐ 3D ☐ Animation ☒ Grid

Ready Remesnikov 06.04.2018 19:45:01

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!

The screenshot shows the WaveLight software interface for LASIK treatment planning. The top bar includes a patient profile icon, a date field set to 15.12.1991, a 3D eye model with a green arrow pointing to the left eye labeled 'OS', and the WaveLight logo.

The left sidebar contains a vertical menu with the following options: Patient Data (F5), Diagnostics (F6), Treatment Planning (F7), Treatment (F8), EX500, FS200, Documentation (F9), and Setup (F10).

The main workspace is titled 'Edit Treatment' and is divided into several sections:

- Refractive Parameters:** This section contains input fields for Sphere, Cylinder, Axis, and VD. The 'Modified*' row shows Sphere set to -2.5 D, Cylinder to -1.55 D, and Axis to 1°. A red arrow points to the -2.5 D value. The 'Reset' button is located to the right of these fields. Below the input fields, the text 'Nomogram S 101' is displayed.
- Corneal Parameters:** This section includes fields for Optical Zone* (6.50 mm), Trans. Zone* (1.25 mm), Planned Flap* (90 µm), Cornea (470 µm), and Res. Stroma (318 µm). A red arrow points to the 1.25 mm value in the Trans. Zone* field.
- Attention:** A yellow warning box states 'Tilt is switched off!'.
- Option:** This section has checkboxes for 'Higher Orders off' and 'Tilt off' (which is checked), and a 'Zernike' button.
- Info & Warnings:** A section for displaying information and warnings.
- Ablation Profile:** A circular color-coded map showing the ablation profile. The map has a color scale on the right ranging from 0.0 to 34.4. The text 'max: 61.40µm' and 'cen: 61.30µm' is visible at the bottom of the map.
- Display Profile:** This section has checkboxes for '3D', 'Animation', and 'Grid' (which is checked).

The bottom status bar shows the system is 'Ready', the user is 'Remesnikov', and the date/time is '06.04.2018 19:45:22'.

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°**

The screenshot displays the WaveLight treatment planning software interface. The patient's name is Saruar, Ali, and the date of birth is 15.12.1991. The interface is divided into several sections:

- Refractive and Corneal Details:**
 - Refraction: +0.00 D +0.00 D @ 0° / 13.8 mm
 - Pupillometry: 5.6 mm
 - Pachymetry: s 674 t 555 c 470 n 642 i 582 μm
 - K1 / Q1: 43.13 D @ 1° / ---
 - K2 / Q2: 44.41 D @ 91° / ---
- Treatment Details:**
 - Measured: -0.83 D -1.58 D @ 1° / 13.8 mm
 - Modified: -2.50 D -1.55 D @ 1° / 13.8 mm
 - Target Q: -0.38
 - Optical Zone: 6.50 mm
 - Ablation Zone: 9.00 mm
 - Max. Ablation: 64 μm
 - Central Ablation: 64 μm
 - Planned Flap: 90 μm
 - Cornea: 470 μm
 - Res. Stroma: 316 μm
- Ablation Profile:** A circular diagram showing the ablation profile with a color scale from 0.0 to 20.0 μm. The maximum value is 63.51 μm and the center value is 63.42 μm.
- Information:** Tilt is switched off!
- Treatments Table:**

Patient	Eye	Method	Date	Planned by	Confirmed by
Saruar, Ali	OS	Topography...	06.04.2018 19:45:32	Remesnikov, Igor A.	Remesnikov, Igor A.

A red arrow points to the 'OS' column in the Treatments table. The interface also includes a sidebar with navigation options like Patient Data, Diagnostics, Treatment Planning, and Setup.

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

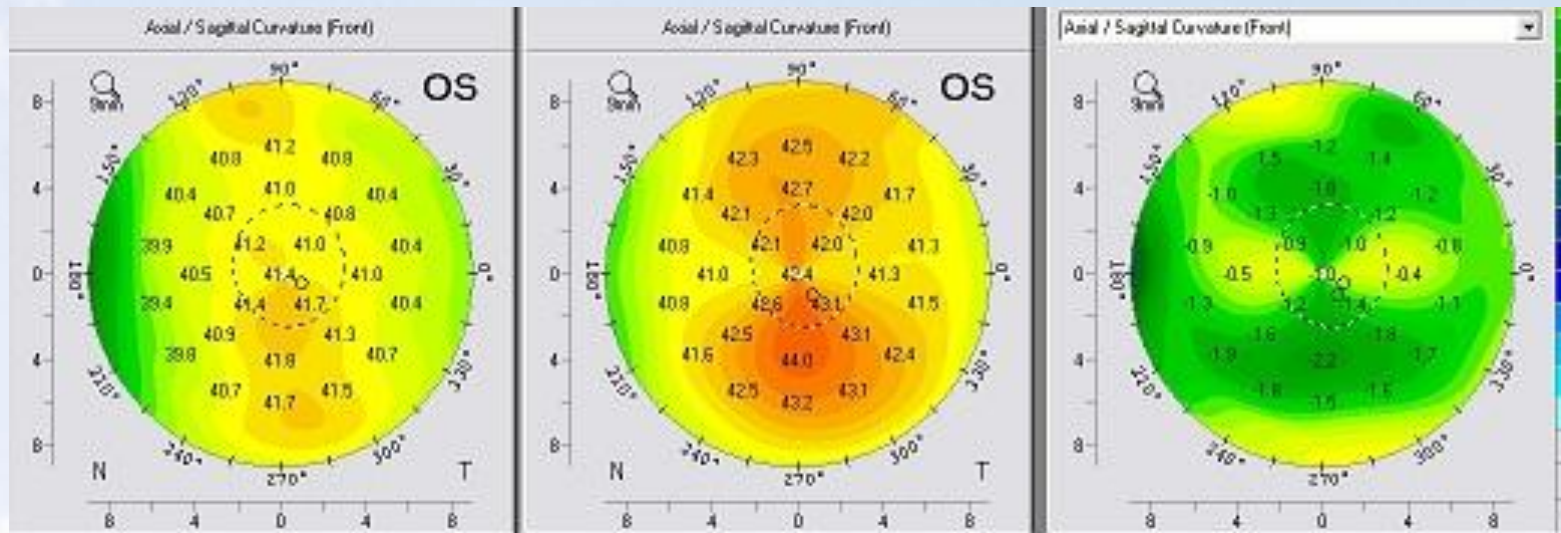
Step-by-Step Topo-Guided LASIK with TMR

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 Custom-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 $\approx 0.50 \div 0.75$ 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 $\approx 0.50 \div 0.75$ 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**

Treatments / Edit

21.09.1993

OD →

WaveLight

Edit Treatment

Refractive Parameters

	Sphere	Cylinder	Axis	VD
Clinical	0.00 D	0.00 D	0 °	13.8 mm
Measured	-1.05 D	-4.02 D	178 °	
Modified*	-2.15 D	0.00 D	178 °	

Reset

Nomogram S 101

Corneal Parameters

Optical Zone*	6.50 mm	Planned Flap*	90 μm
Trans. Zone*	1.25 mm	Cornea	476 μm
		Res. Stroma	377 μm

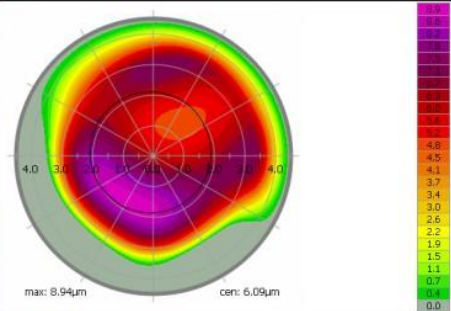
Attention:
Tilt is switched off!

Option

☐ Higher Orders off ☒ Tilt off

Info & Warnings

Ablation Profile



max: 8.94 μm cen: 6.09 μm

Display Profile

☐ 3D ☐ Animation ☒ Grid

Ready Remesnikov 06.04.2018 16:13:04

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

Treatments / Edit

* 21.09.1993

OD →

WaveLight

Edit Treatment

Refractive Parameters

	Sphere	Cylinder	Axis	VD
Clinical	0.00 D	0.00 D	0 °	13.8 mm
Measured	-1.05 D	-4.02 D	178 °	
Modified*	-2.15 D	-3.25 D	178 °	

Reset

Nomogram S 101

Corneal Parameters

Optical Zone*	6.50 mm	Planned Flap*	90 °
Trans. Zone*	1.25 mm	Cornea	476 µm
		Res. Strima	349 µm

Attention:

Tilt is switched off

Option

☐ Higher Orders off ☒ Tilt off

Info & Warnings

Ablation Profile

max: 36.95µm cent: 36.55µm

Display Profile

☐ 3D ☐ Animation ☒ Grid

Ready Remesnikov 06.04.2018 16:13:27

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

Treatments / Overview

21.09.1993

OD →

WaveLight

Patient Data (F5)

Diagnostics (F6)

Treatment Planning (F7)

Treatment (F8)

EX500

FS200

Documentation (F9)

Setup (F10)

Refractive and Corneal Details

Refraction: +0.00 D +0.00 D @ 0° / 13.8 mm

Pupillometry: 5.6 mm

Pachymetry: s 586 t 518 c 476 n 573 i 551 μm

K1 / Q1: 43.27 D @ 178° / ---

K2 / Q2: 46.62 D @ 88° / ---

Treatment Details

Measured: -1.05 D -4.02 D @ 178° / 13.8 mm

Modified: -2.15 D -3.25 D @ 178° / 13.8 mm

Target Q: -0.32

Optical Zone: 6.50 mm

Ablation Zone: 9.00 mm

Max. Ablation: 81 μm

Central Ablation: 81 μm

Planned Flap: 90 μm

Cornea: 476 μm

Res. Stroma: 305 μm

Ablation Profile

max: 80.21 μm

cen: 80.03 μm

Information

Tilt is switched off!

Treatments

☒ Planned ☐ Aborted ☐ Completed

Patient	Eye	Method	Date	Planned by	Confirmed by
	OD	Topography...	06.04.2018 16:13:58	Remesnikov, Igor A.	not confirmed

Info & Warnings

Check and confirm the treatment.

Ready

Remesnikov

06.04.2018 16:15:39

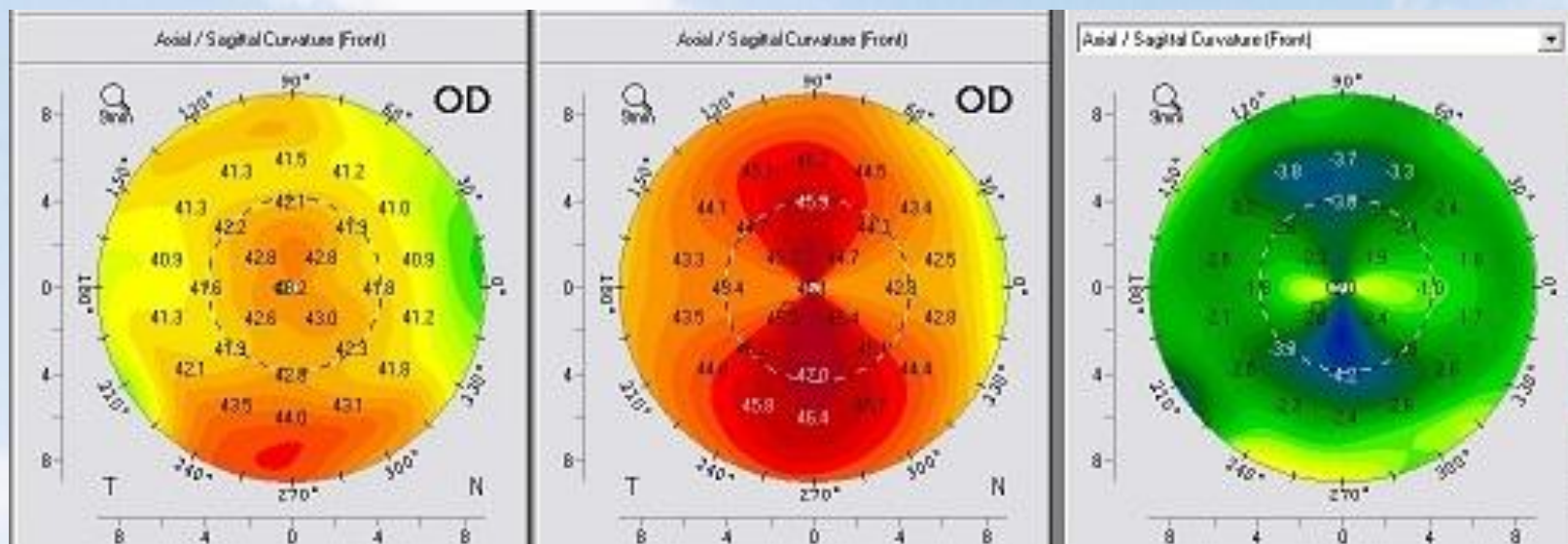
Case 2

PreOp

AR OD sph **-1.75** SD * cyl **-4.00** CD * ax **180°** $\Delta K = 3.25$ 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

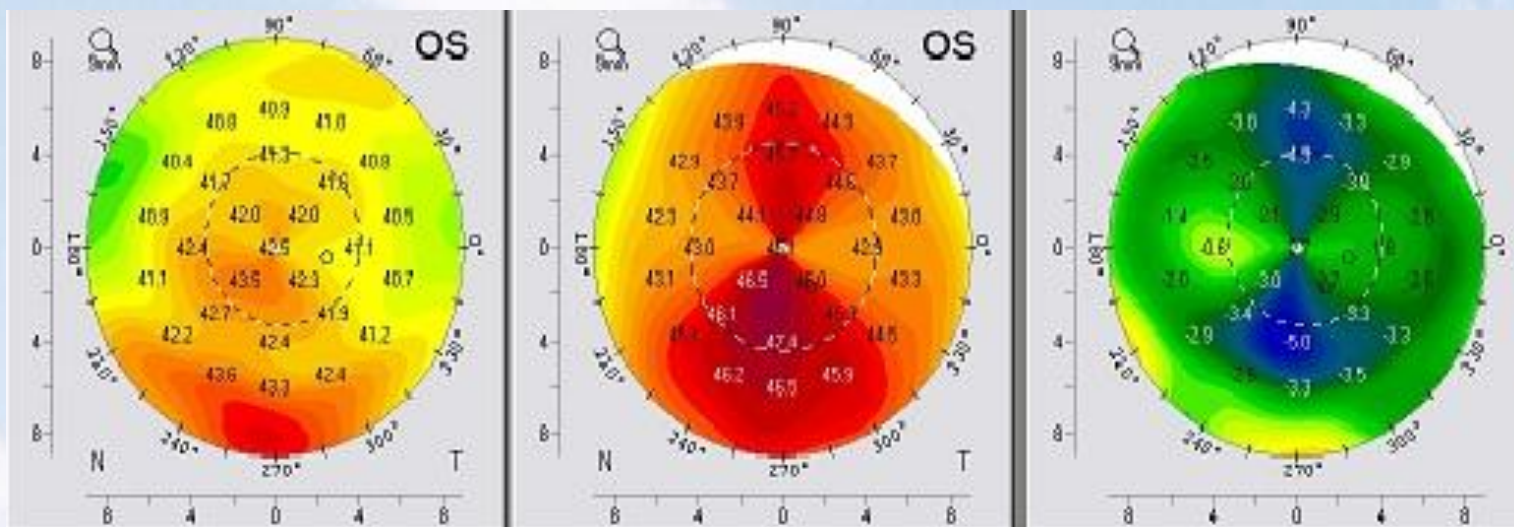
Case 3

PreOp

AR OS sph -1.50 SD * cyl -4.00 CD * ax 170° $\Delta K = 3.25$ 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

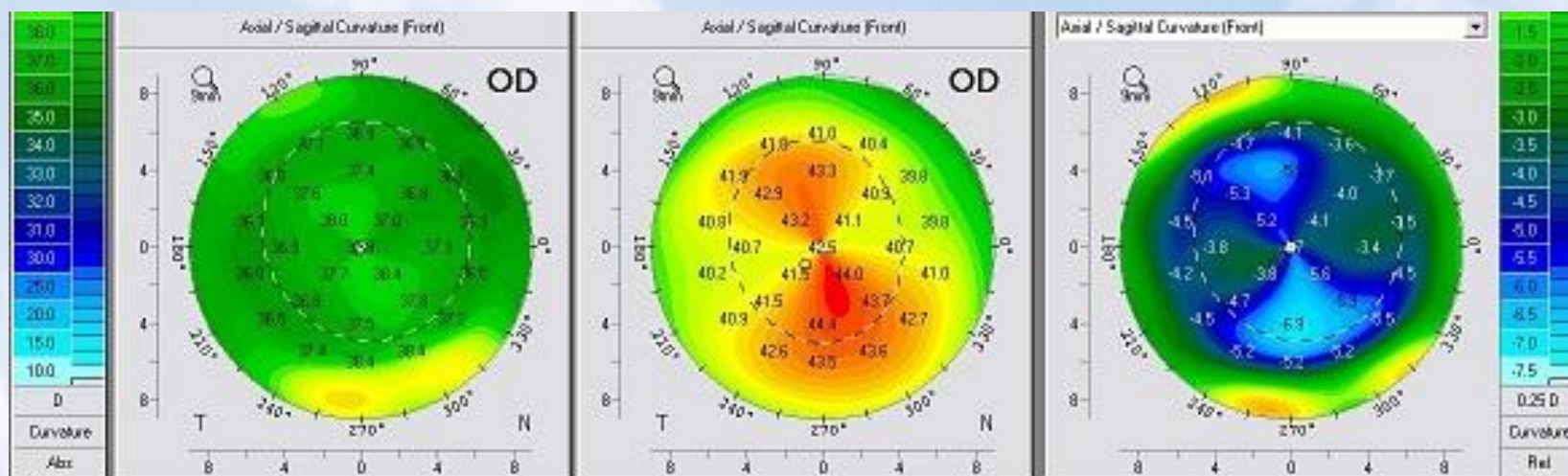
Case 4

PreOp

AR OD sph -4.25 SD * cyl -4.00 CD * ax 15° $\Delta K = 3.75$ 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

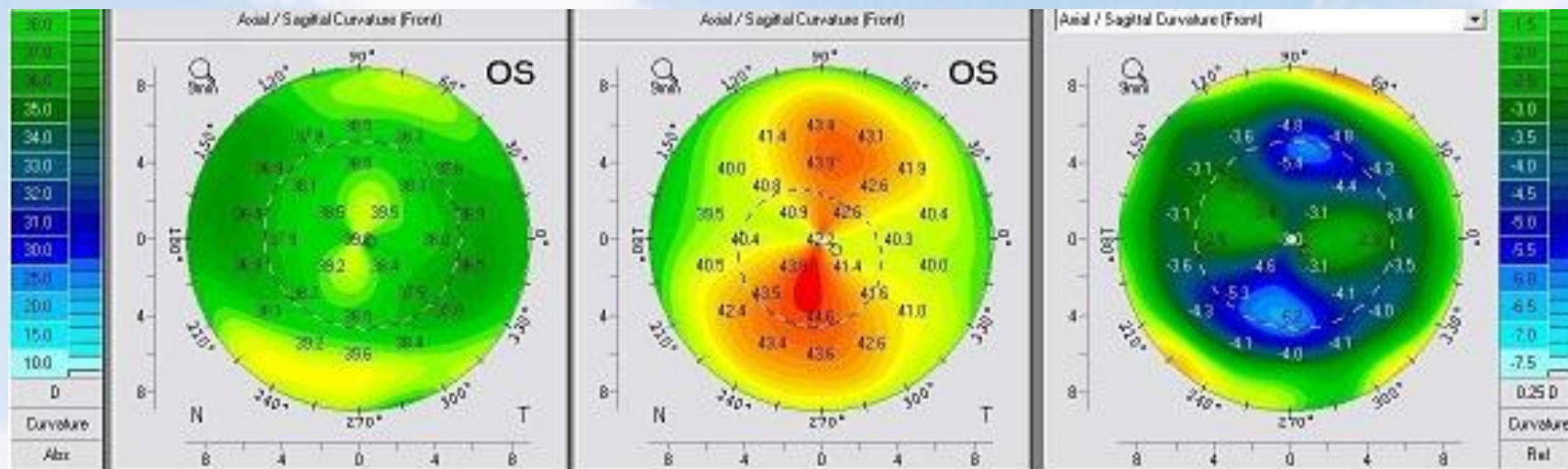
Case 5

PreOp

AR OS sph -1.50 SD * cyl -4.00 CD * ax 170° $\Delta K = 3.25$ D

BCDVA = 1.00 (0.00 LogMAR)

Difference Map



Measured cylinder was $-5.64 \text{ CD} - (-2.64 \text{ CD}) = -3.00 \text{ CD}$. 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

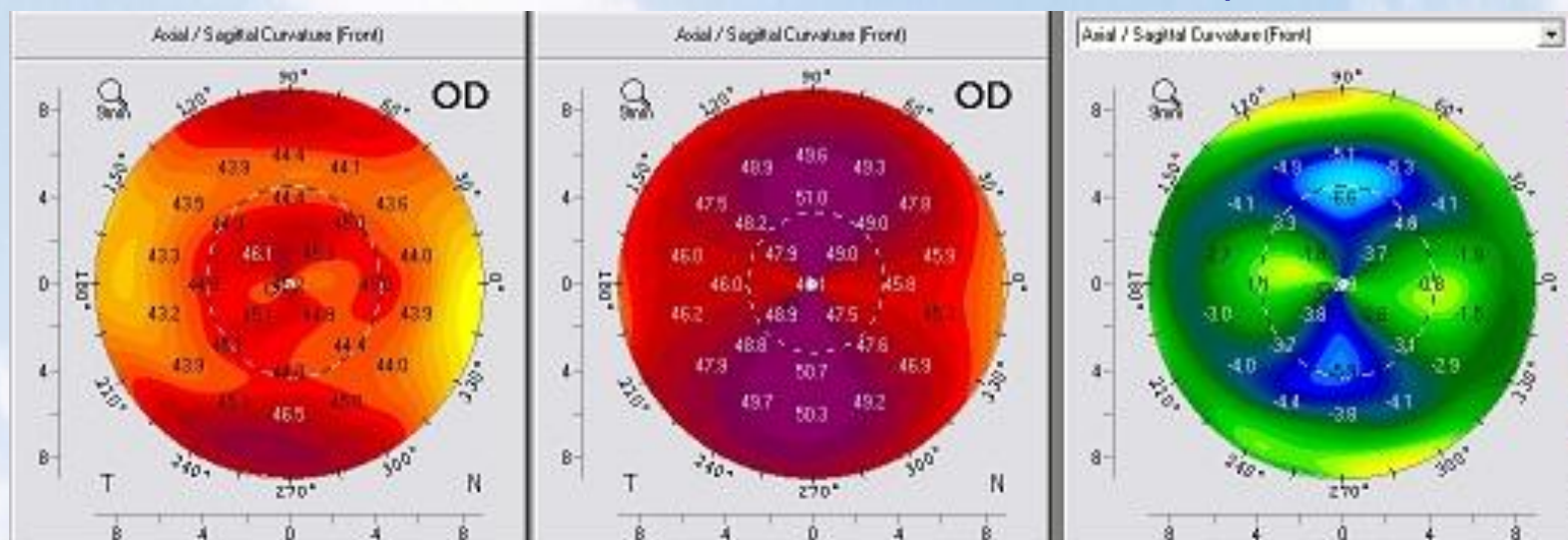
Case 6

PreOp

AR OD sph -1.75 SD * cyl -5.75 CD * ax160° $\Delta K = 4.75$ 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

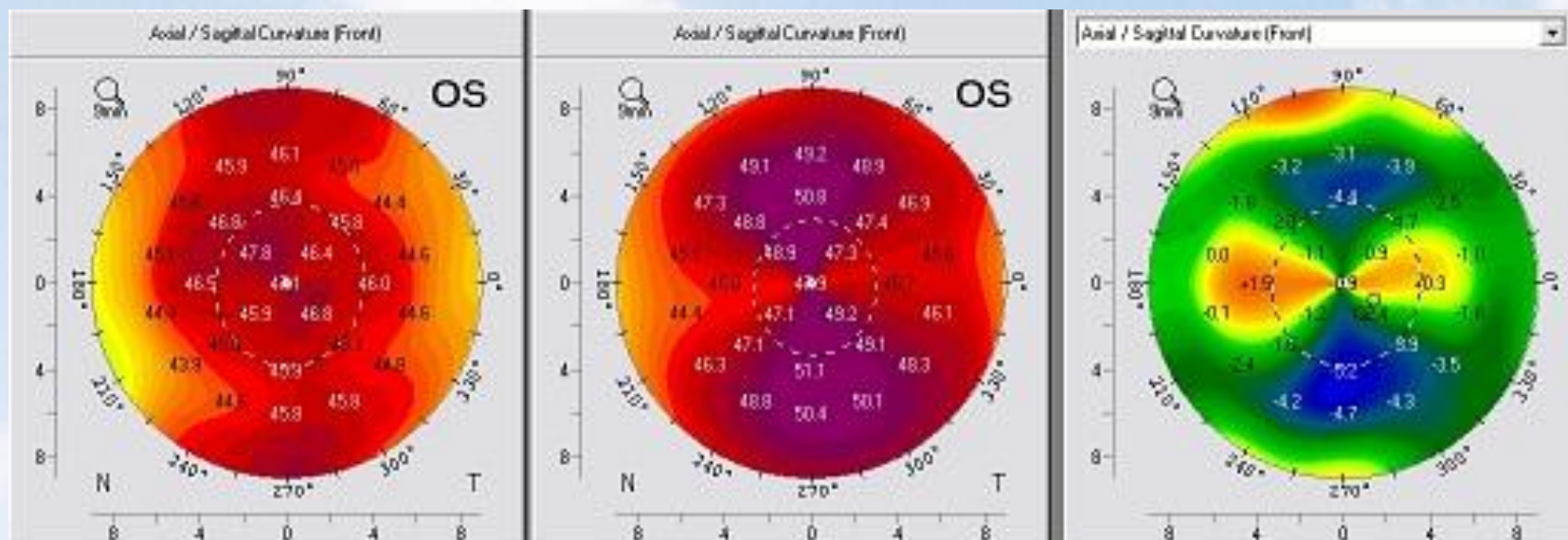
Case 7

PreOp

AR OS sph +0.25 SD * cyl -6.75 CD * ax 15° $\Delta K = 5.50$ 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

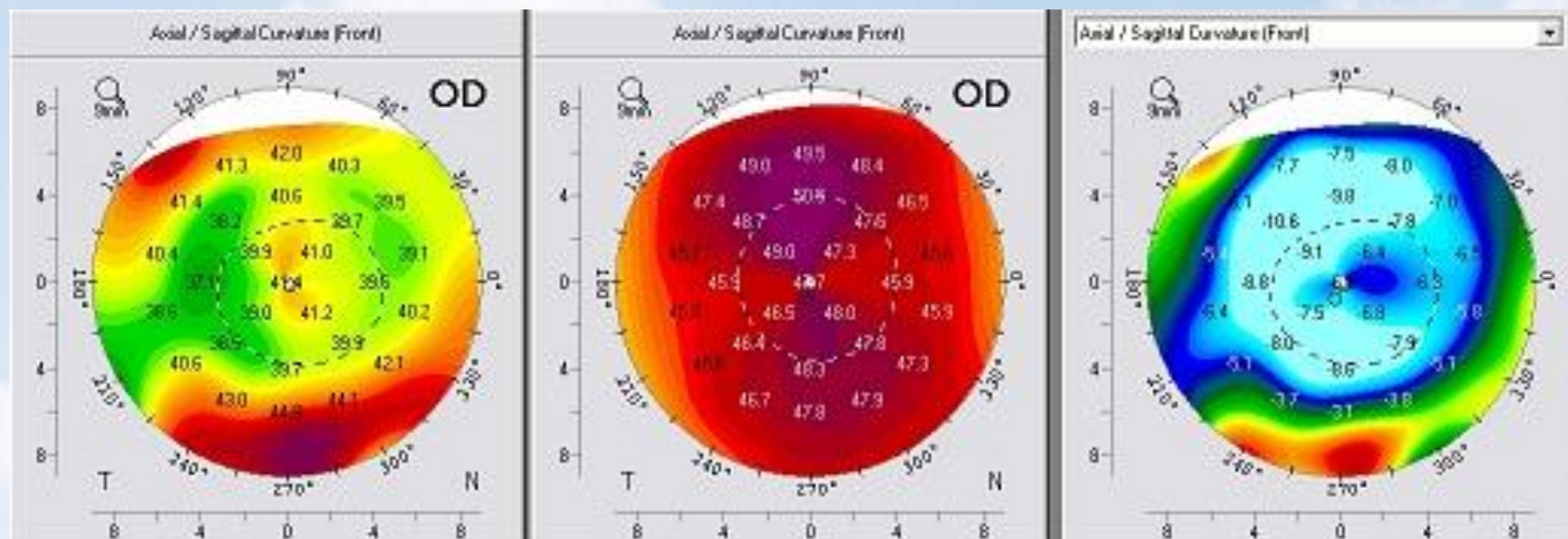
Case 8

PreOp

AR OD sph -8.75 SD * cyl -4.25 CD * ax 5° $\Delta K = 3.00$ 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

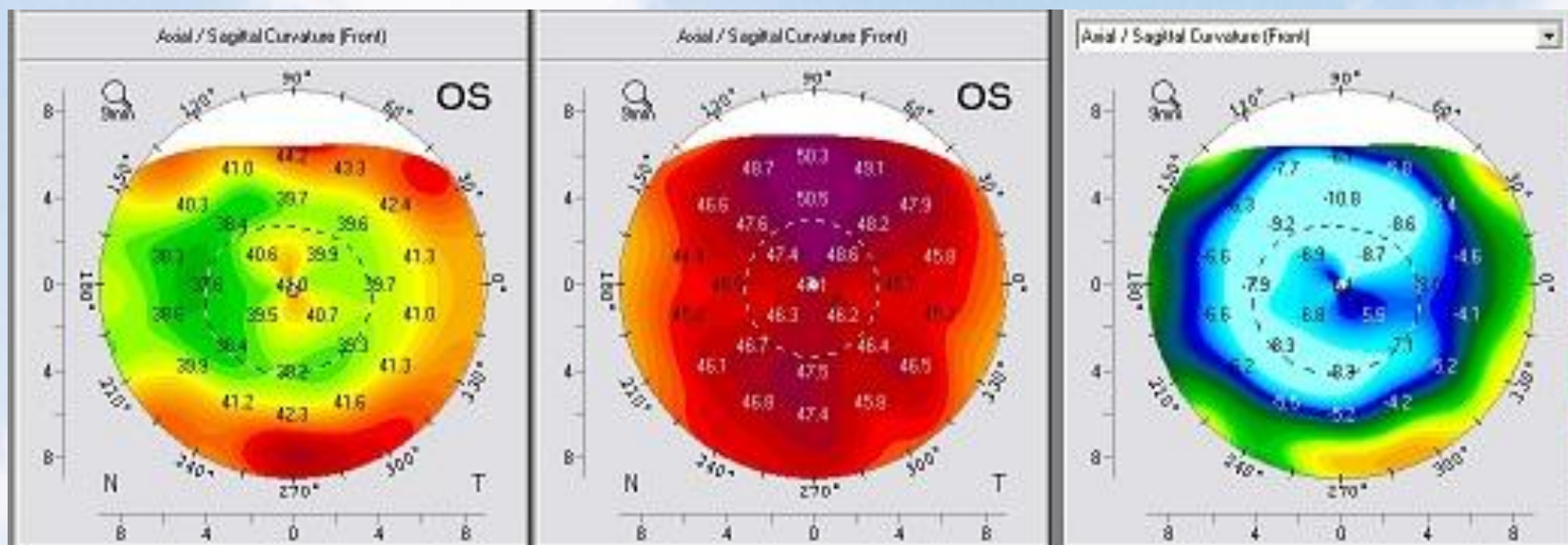
Case 9

PreOp

AR OS sph -8.50 SD * cyl -3.25 CD * ax 170° $\Delta K = 2.75 D$

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**

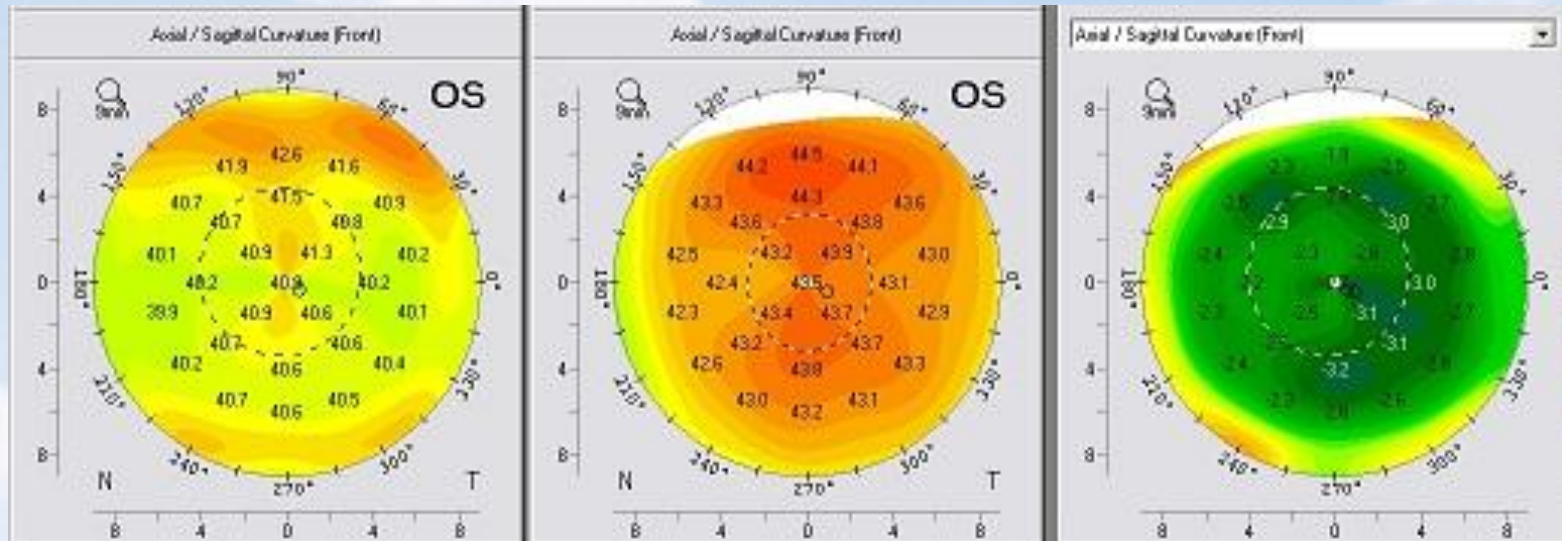
PreOp

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

$\Delta K = 1.00$ D

BCDVA = **1.00** (0.00 LogMAR)

Difference Map



Measured cylinder was $-1.58 \text{ CD} - (-0.88 \text{ CD}) = -0.70 \text{ CD}$. 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 $\approx 30\%$ from the (+) cylinder
- We entering topo-measured axis of cylinder not from AR or manifest refraction

Case 10

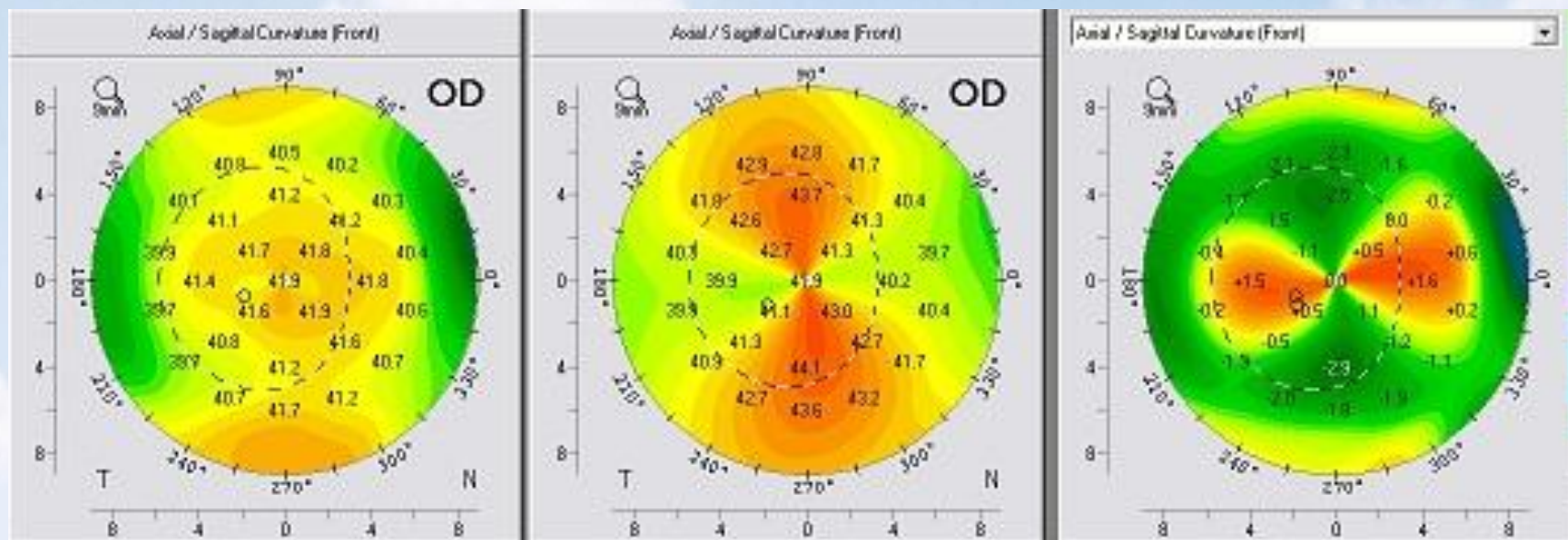
PreOp

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

$\Delta K = 3.75$ 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

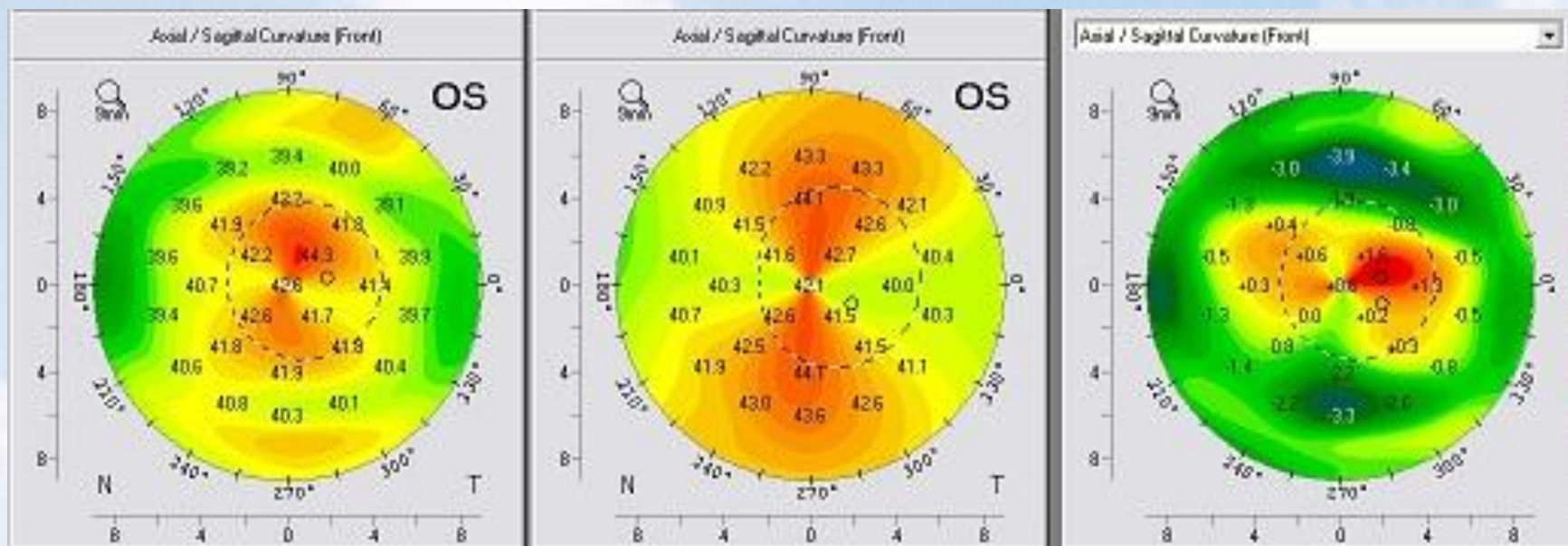
PreOp

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

$\Delta K = 3.75$ D

BCDVA = 0.60 (0.20 LogMAR)

Difference Map



Sphere: $-3.50 - 0.15$ (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

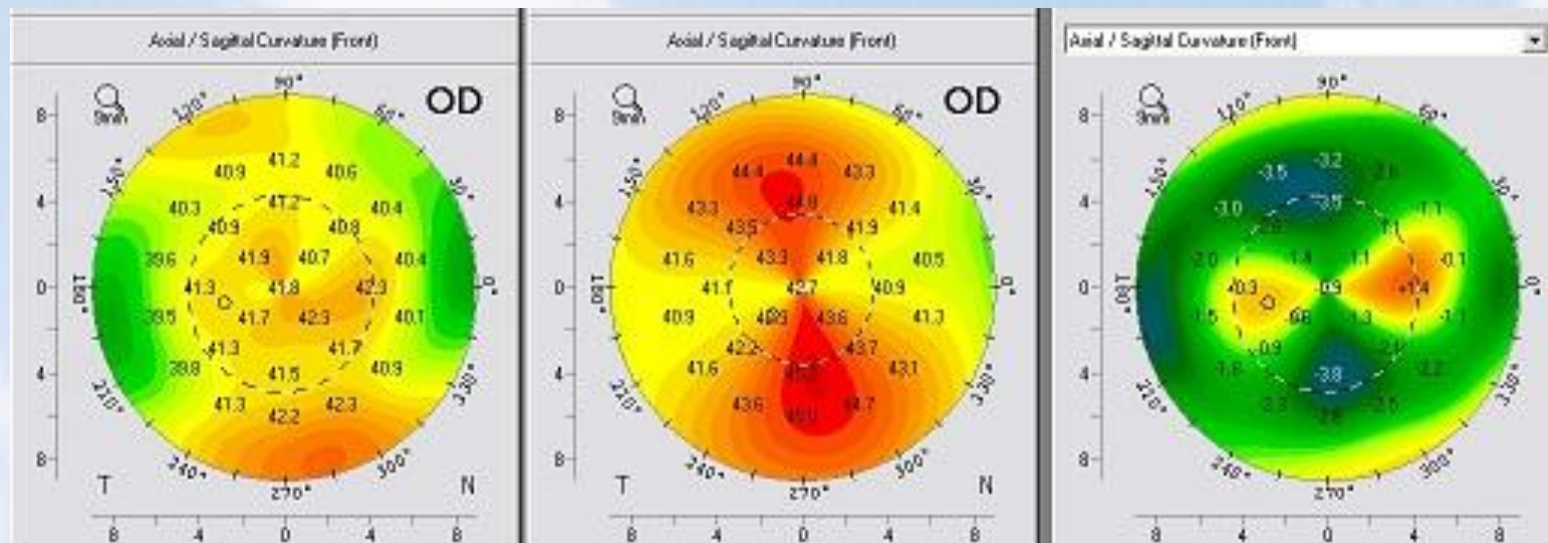
PreOp

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

$\Delta K = 3.50$ 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

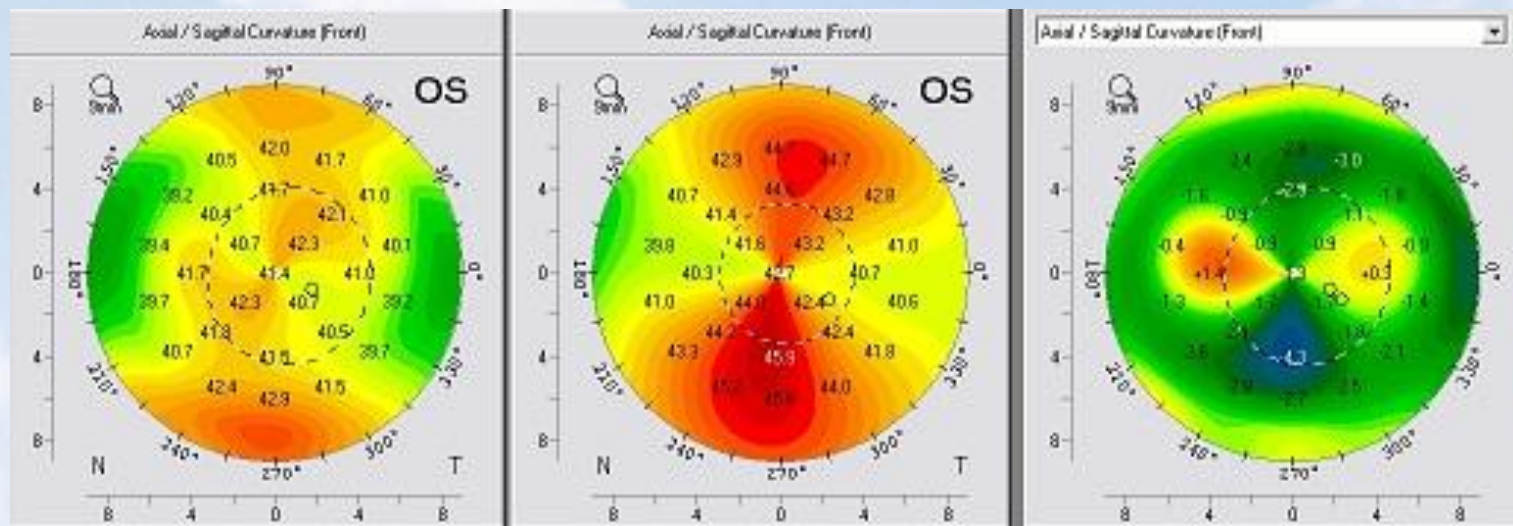
PreOp

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

$\Delta K = 4.50$ 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

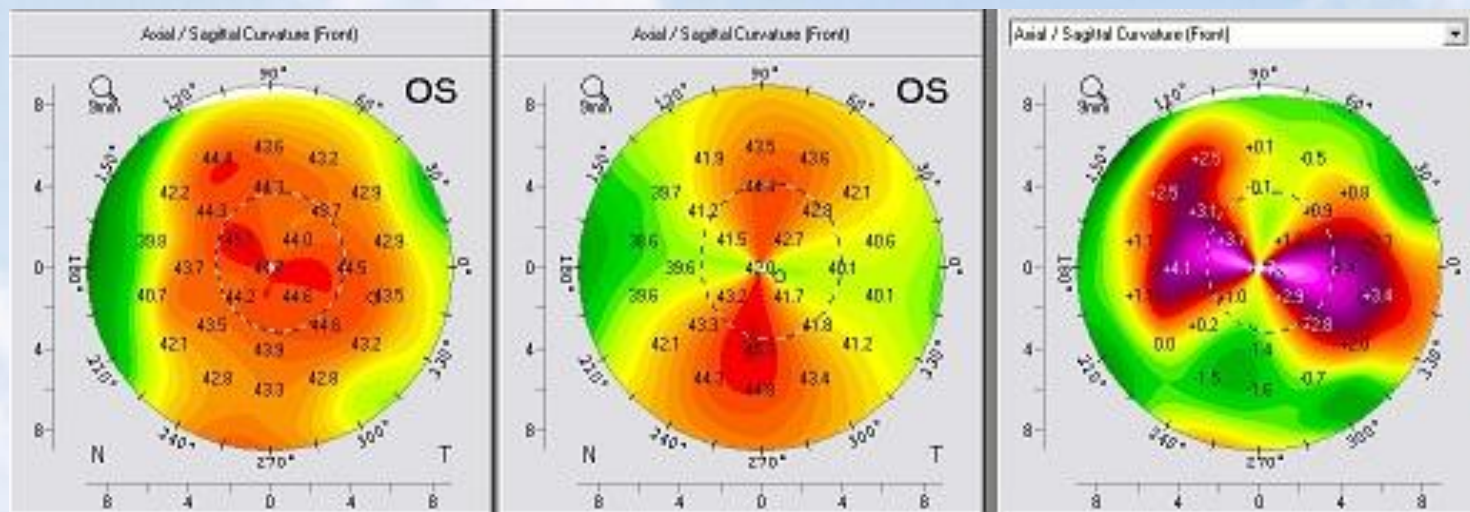
OD NCDVA = 1.00

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°

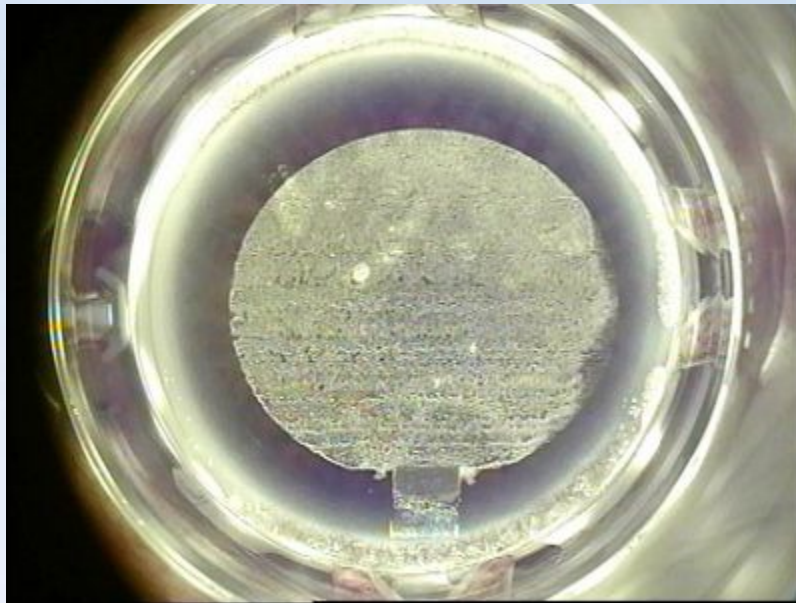
1D PostOp

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 $0.50 \div 0.75$ 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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