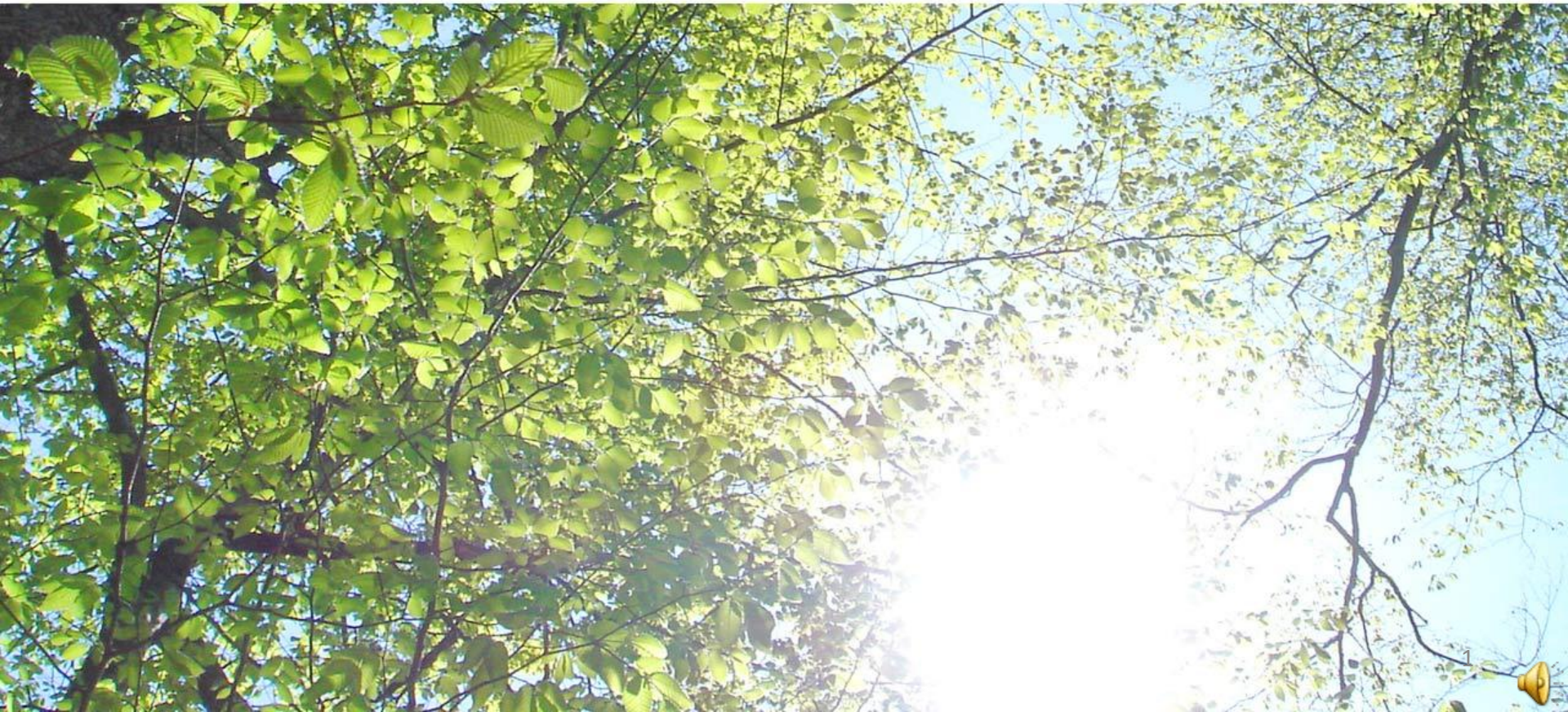




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A S T A N A
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ЦЕНТР КОРРЕКЦИИ ЗРЕНИЯ

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.

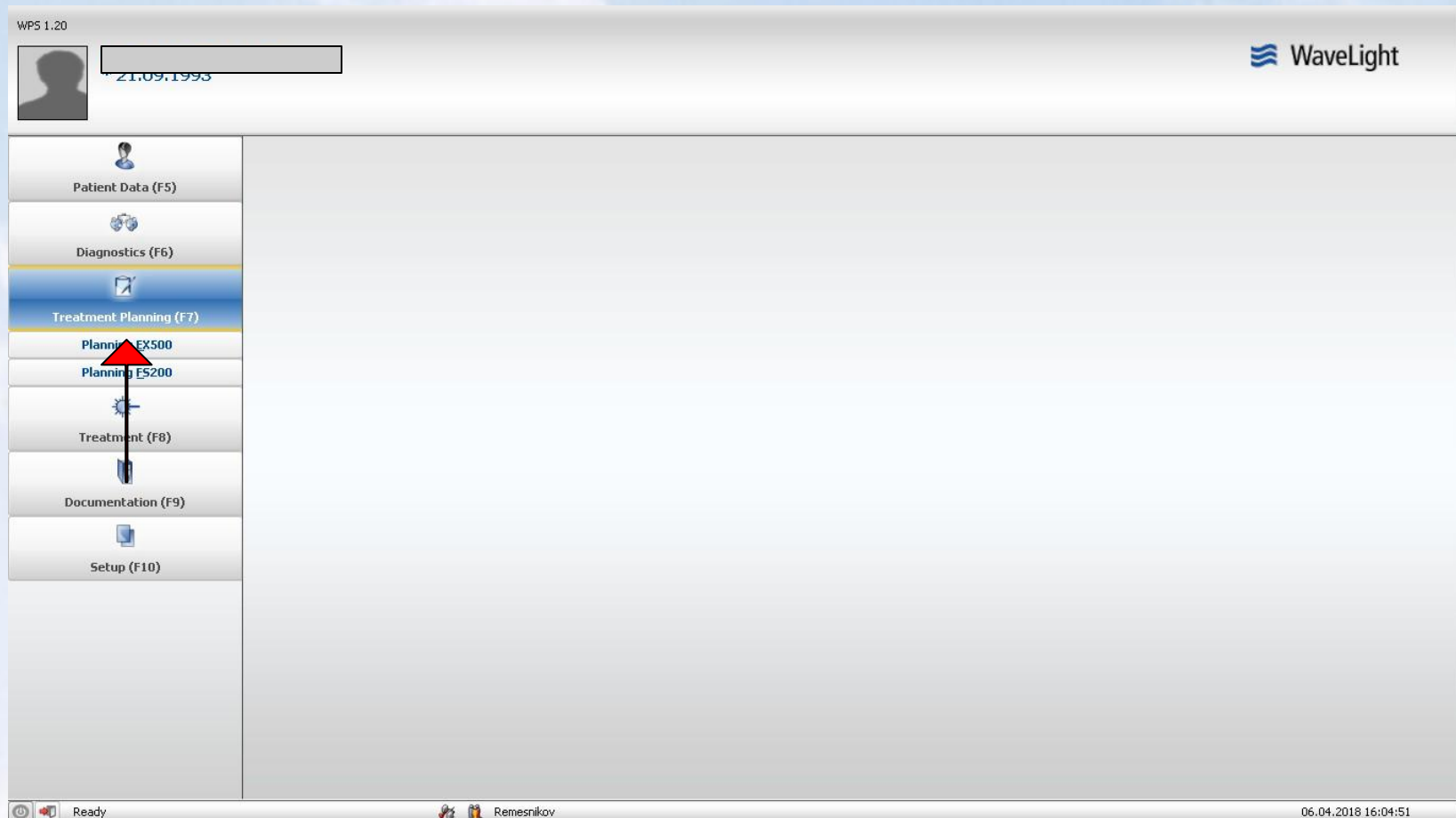
AR OS sph -2.75 SD * cyl -0.75 CD * ax 175°

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

Step-by-Step Topo-Guided LASIK with TMR

□ **GOOD** quality topograms are required!

Planning / Topography-Guided (Topolyzer) / Assign Examinations

WaveLight

OS

15.12.1991

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

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

WaveLight

OS

* 15.12.1991

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: ---

Pupilmetrics

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

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 software interface for a LASIK treatment. The interface is divided into several sections:

- Header:** Shows "Treatments / Overview", a patient profile picture, a date field with "15.12.1991", a patient icon with "OS" and a green arrow, and the "WaveLight" logo.
- Left Sidebar:** A vertical menu with buttons for "Patient Data (F5)", "Diagnostics (F6)", "Treatment Planning (F7)", "Treatment (F8)", "EX500", "Documentation (F9)", and "Setup (F10)". A red arrow points to the "EX500" button.
- 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 l 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 (with an "Edit" button)
 - 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:** A circular topographic map showing corneal curvature. A color scale on the right ranges from 0.0 (blue) to 4.2 (red). The map shows a central area of high curvature (red) transitioning to lower curvature (blue) at the periphery. Labels include "max: 7.54μm" and "cen: 3.48μm".
- Information:** A text box containing the message "Tilt is switched off!".
- Treatments Table:** A table with columns for Patient, Eye, Method, Date, Planned by, and Confirmed by. The "Planned" radio button is selected.

Patient	Eye	Method	Date	Planned by	Confirmed by
	OS	Topography...	06.04.2018 19:39:28	Remesnikov, Igor A.	not confirmed
- Info & Warnings:** A section with an information icon and the text "Check and confirm the treatment." followed by a text input field.

The Windows taskbar at the bottom shows the system is "Ready", the user is "Remesnikov", and the date/time is "06.04.2018 19:40:24".

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

Display Profile

3D Animation Grid

Info & Warnings

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

The screenshot shows the WaveLight software interface for LASIK treatment planning. The 'Refractive Parameters' section is highlighted, showing the 'Modified*' Sphere set to -0.15 D. A red arrow points to this field. The 'Corneal Parameters' section shows 'Optical Zone*' at 6.5 mm and 'Planned Flap*' at 90 micrometers. The 'Ablation Profile' section shows a topographic map with a color scale from 0.0 to 4.1 micrometers. The 'Display Profile' section has 'Grid' checked.

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

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*	-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

3D Animation Grid

max: 61.40µm cen: 61.30µm

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 displays the WaveLight software interface for LASIK treatment planning. The interface is divided into several sections:

- Header:** Shows "Treatments / Edit" and a patient profile with a date of birth of 15.12.1991. A green arrow points to the "OS" (Oculus Sinister) eye.
- Left Sidebar:** Contains navigation buttons for Patient Data (F5), Diagnostics (F6), Treatment-Planning (F7), Treatment (F8), EX500, ES200, Documentation (F9), and Setup (F10).
- Refractive Parameters:** A table showing clinical, measured, and modified values for Sphere, Cylinder, Axis, and VD.

	Sphere	Cylinder	Axis	VD
Clinical	0.00 D	0.00 D	0 °	13.8 mm
Measured	-0.83 D	-1.58 D	1 °	
Modified*	-2.50 D	-1.55 D	1 °	
- Corneal Parameters:** Shows planned flap thickness (90 µm) and corneal thickness (470 µm). Red arrows point to the "Modified*" sphere value and the "Axis" value.
- Ablation Profile:** A circular topographic map showing the ablation profile with a color scale from 0.0 to 34.4 µm. The maximum ablation is 61.40 µm and the center is 61.30 µm.
- Options:** Includes checkboxes for "Higher Orders off", "Tilt off", and "Zernike".
- Display Profile:** Includes checkboxes for "3D", "Animation", and "Grid".

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°**

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		<input type="button" value="Edit"/>
Modified	-2.50 D -1.55 D @ 1° / 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	64 μm	Res. Stroma	316 μm
Central Ablation	64 μm		

Ablation Profile

max: 63.51μm cen: 63.42μm

Information
Tilt is switched off!

Treatments Planned Aborted Completed Patient Filter

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

Info & Warnings

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

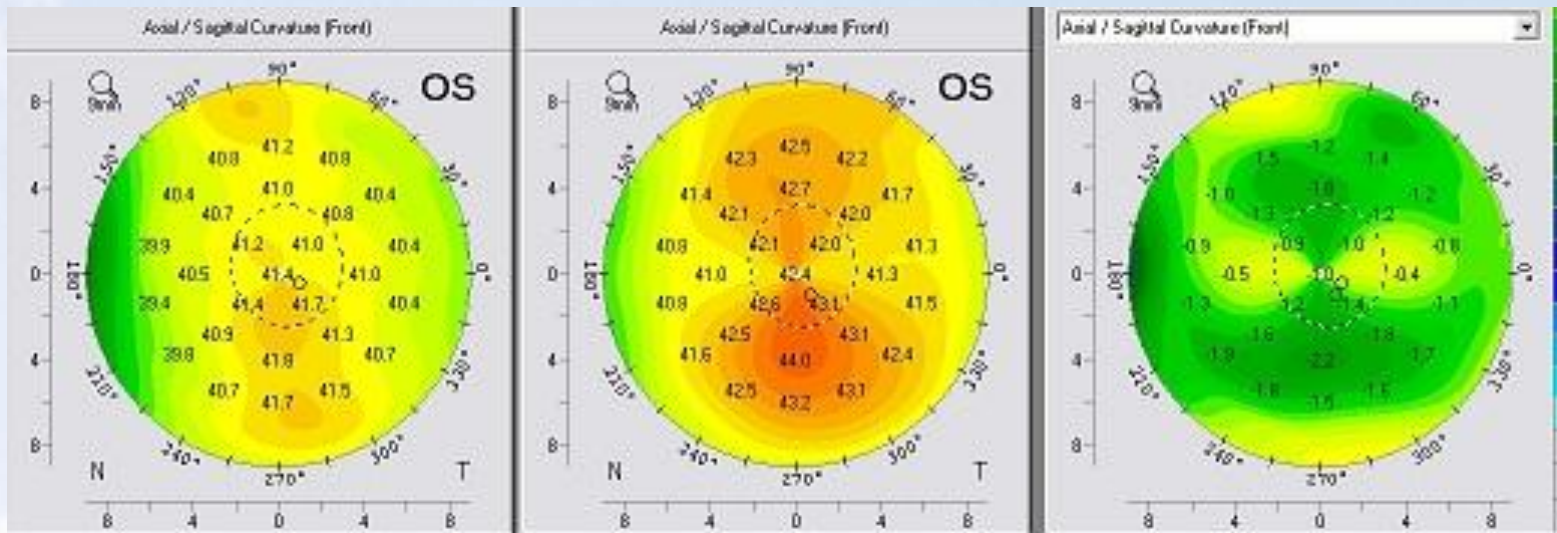
Step-by-Step Topo-Guided LASIK with TMR

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

The screenshot shows the WaveLight software interface for editing a treatment plan. The interface is divided into several sections:

- Header:** "Treatments / Edit" with a patient profile icon and name "21.09.1993". A "WaveLight" logo is in the top right. A "OD" label with a red arrow points to a patient head icon.
- Left Sidebar:** A vertical menu with buttons for "Patient Data (F5)", "Diagnostics (F6)", "Treatment Planning (F7)", "Treatment (F8)", "EX500", "F5200", "Documentation (F9)", and "Setup (F10)".
- Main Content Area:**
 - Edit Treatment:** A section with a blue header.
 - Refractive Parameters:** A table with columns for Sphere, Cylinder, Axis, and VD. The "Modified*" row shows Sphere: -2.15 D, Cylinder: 0.00 D, Axis: 178°. A red arrow points to the -2.15 value. A "Reset" button is present.
 - Corneal Parameters:** A table with columns for Optical Zone*, Trans. Zone*, Planned Flap*, Cornea, and Res. Stroma. Values include 6.50 mm, 1.25 mm, 90 µm, 476 µm, and 377 µm.
 - Attention:** A yellow box with the text "Tilt is switched off!".
 - Option:** Checkboxes for "Higher Orders off", "Tilt off", and a "Zernike" button.
 - Info & Warnings:** A section with a red 'X' icon and a green checkmark icon.
 - Ablation Profile:** A circular color-coded map showing the ablation profile. A color scale on the right ranges from 0.0 to 4.8. Text below the map indicates "max: 8.94µm" and "cen: 6.09µm".
 - Display Profile:** Checkboxes for "3D", "Animation", and "Grid" (checked).

The Windows taskbar at the bottom shows "Ready", "Remesnikov", and the date/time "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

The screenshot displays the WaveLight software interface for LASIK treatment planning. The top bar includes 'Treatments / Edit', a patient profile icon, a date field showing '* 21.09.1993', an 'OD' eye icon, and the WaveLight logo.

The main interface is divided into several sections:

- Edit Treatment**: A header bar.
- Refractive Parameters**: A table with columns for Sphere, Cylinder, Axis, and VD. The 'Modified*' row shows a cylinder value of -3.25 D, highlighted with a red arrow pointing to it from the 'Attention' section below.
- Corneal Parameters**: Fields for Optical Zone* (6.50 mm), Trans. Zone* (1.25 mm), Planned Flap* (90 µm), Cornea (476 µm), and Res. Strima (349 µm).
- Attention:** A yellow warning box stating 'Tilt is switched off'.
- Ablation Profile**: A circular topographic map showing ablation depth with a color scale from 0.0 to 20.0 µm. The map includes 'max: 36.95µm' and 'cen: 36.55µm' labels.
- Option**: Checkboxes for 'Higher Orders off', 'Tilt: off', and a 'Zernike' button.
- Display Profile**: Checkboxes for '3D', 'Animation', and 'Grid' (checked).
- Info & Warnings**: A section for displaying messages.

The bottom status bar shows 'Ready', the user 'Remesnikov', and the date/time '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

WaveLight

OD →

*21.09.1993

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 [Edit]
Modified: -2.15 D -3.25 D @ 178° / 13.8 mm
Target Q: -0.32
Optical Zone: 6.50 mm Planned Flap: 90 μm
Ablation Zone: 9.00 mm Cornea: 476 μm
Max. Ablation: 81 μm Res. Stroma: 305 μm
Central Ablation: 81 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

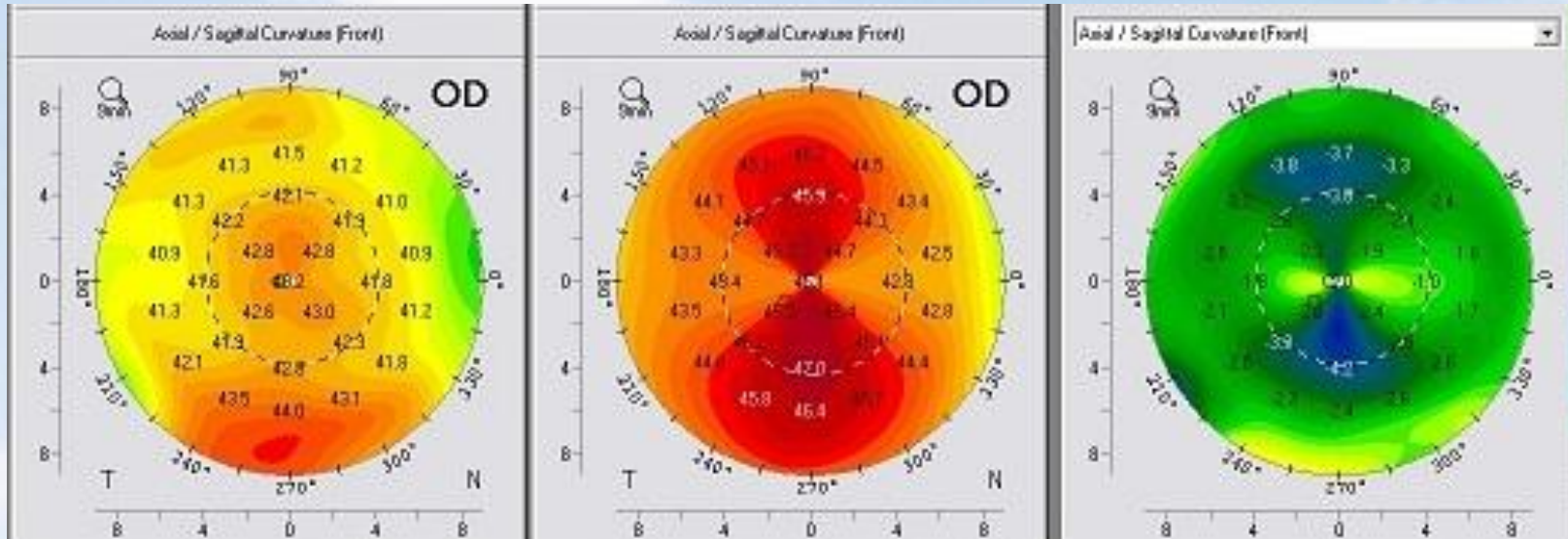
Case 2

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)

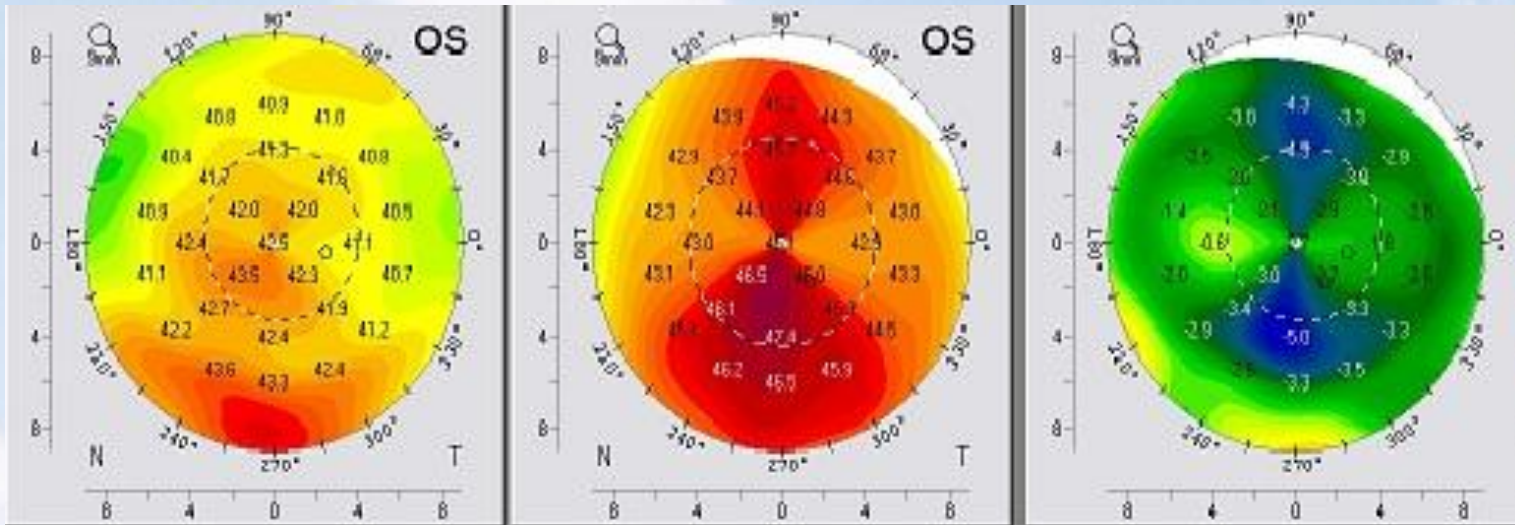
SEQ = **-0.375 D**

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)

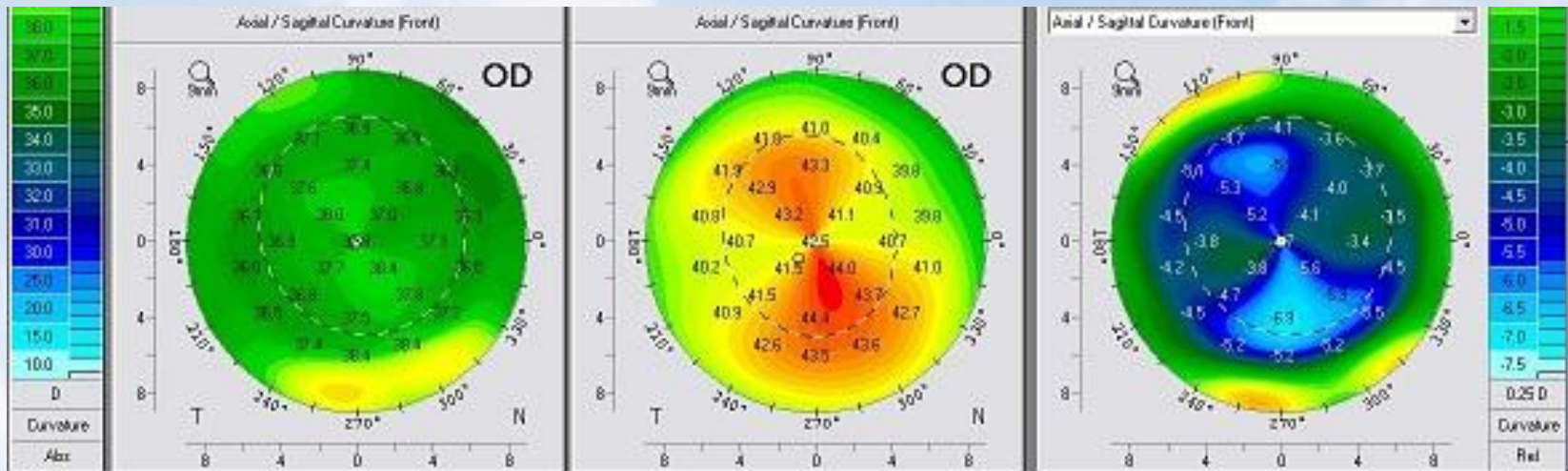
SEQ = **0.00** D

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**

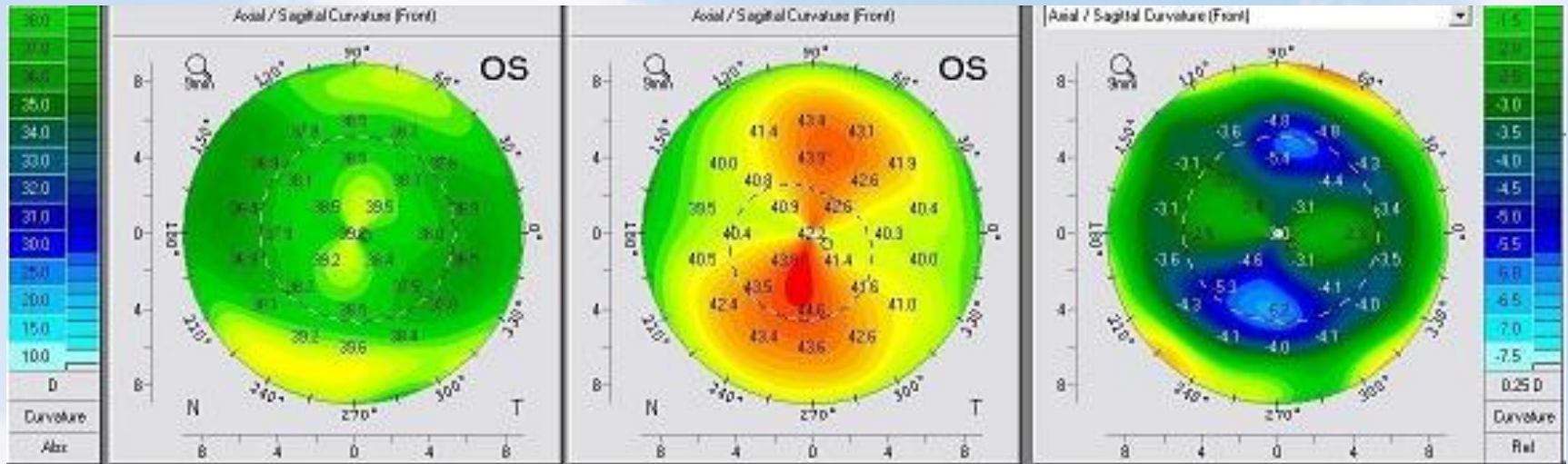
Case 5

PreOp

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

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)

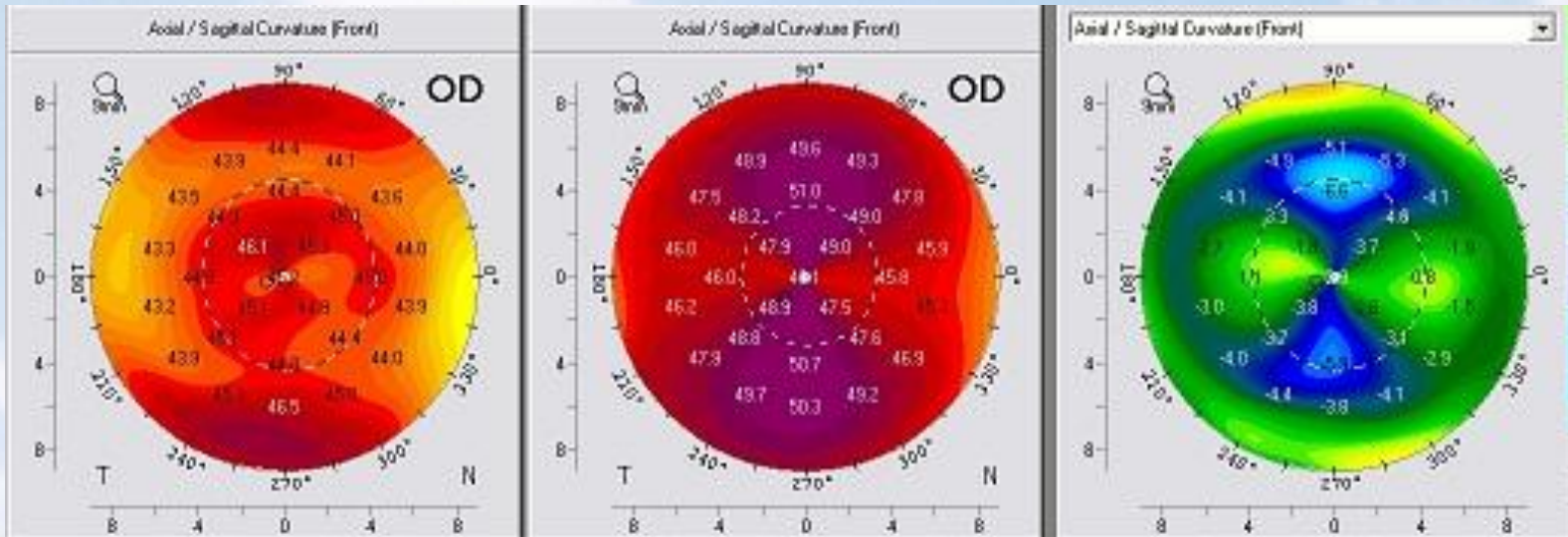
SEQ = **0.00 D**

Case 6

AR OD sph -1.75 SD * cyl -5.75 CD * ax160° $\Delta K = 4.75$ D
BCDVA = 0.70 (0.15 LogMAR)

PreOp

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

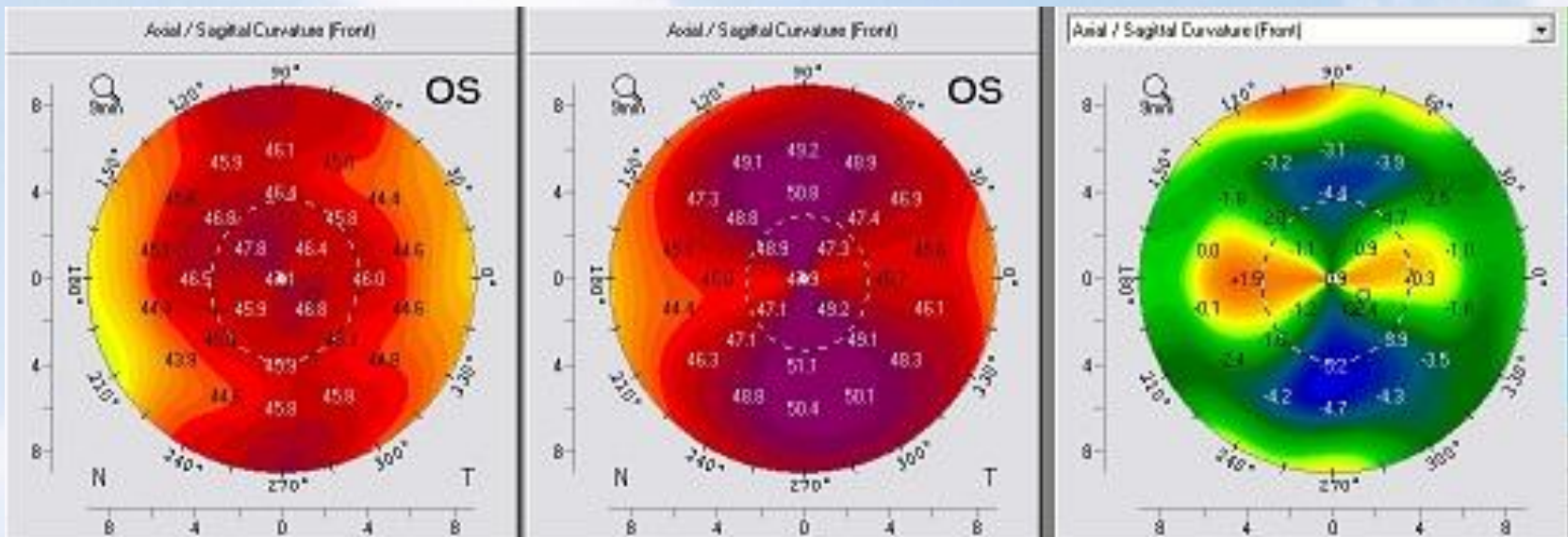
Case 7

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)

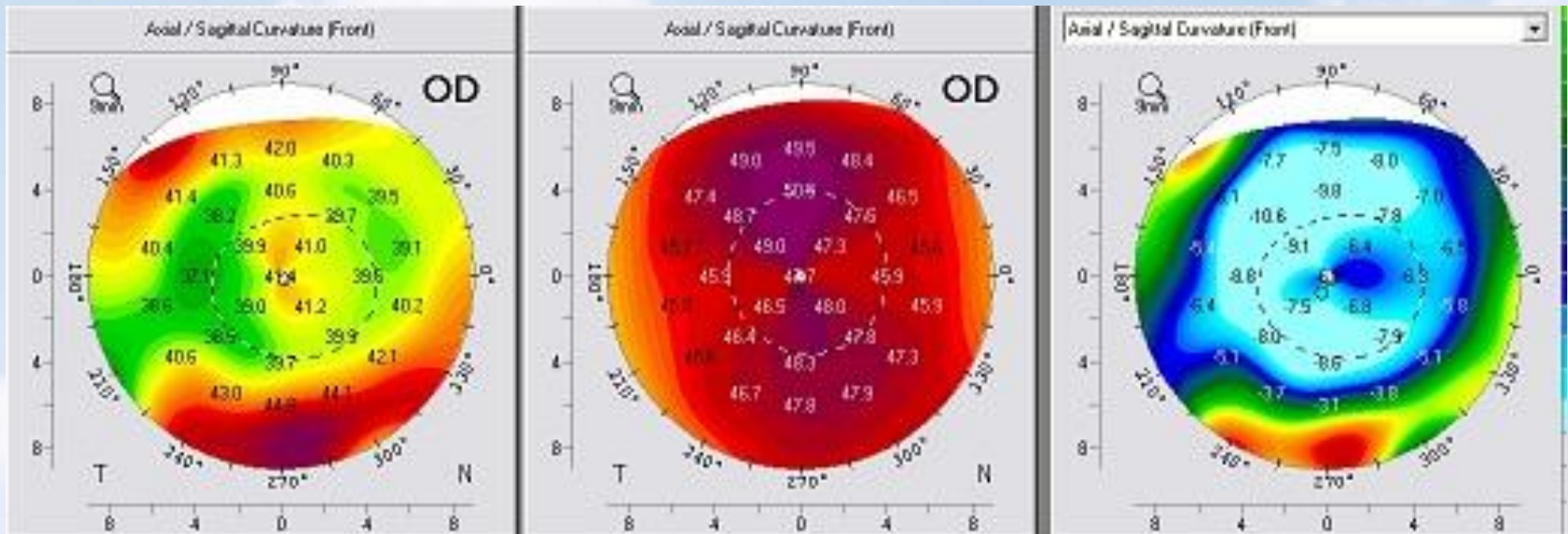
SEQ = **-0.75** D

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 $-4.19 \text{ CD} - (-0.74 \text{ CD}) = -3.45 \text{ CD}$

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

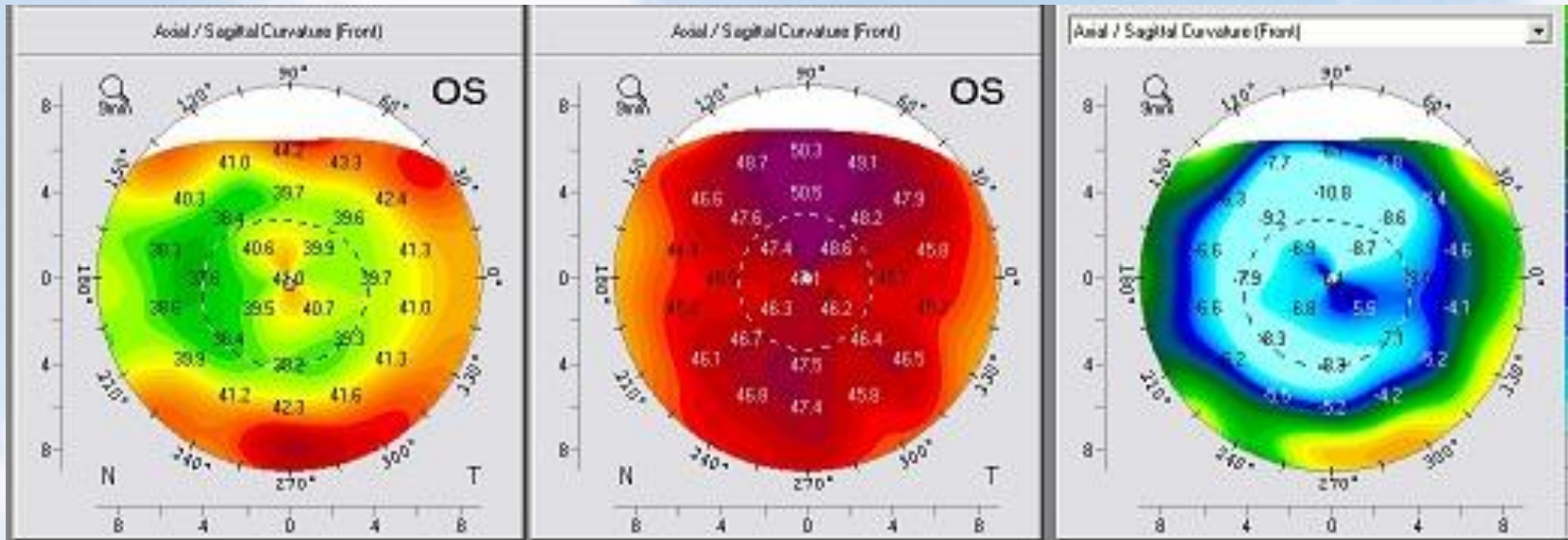
AR OS sph -8.50 SD * cyl -3.25 CD * ax 170°

BCDVA = 0.50 (0.30 LogMAR)

PreOp

$\Delta K = 2.75$ D

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**

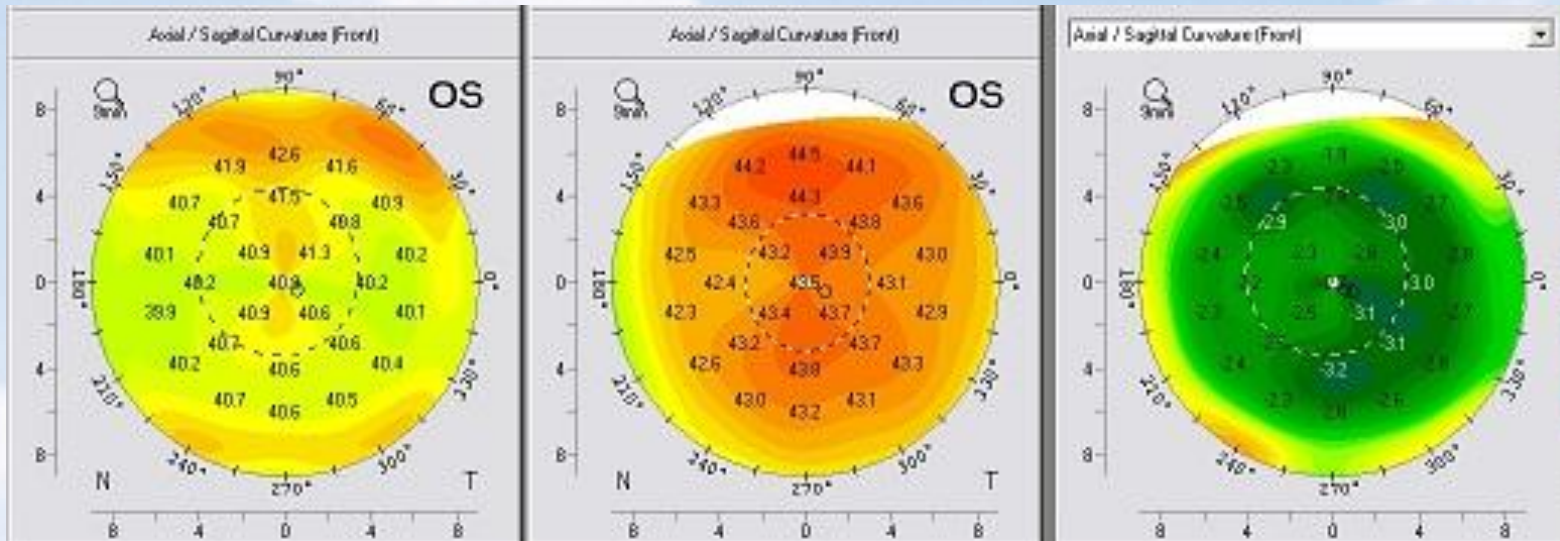
PreOp

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 $-1.58 CD - (-0.88 CD) = -0.70 CD$. 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 $\approx 0.75 D$ 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

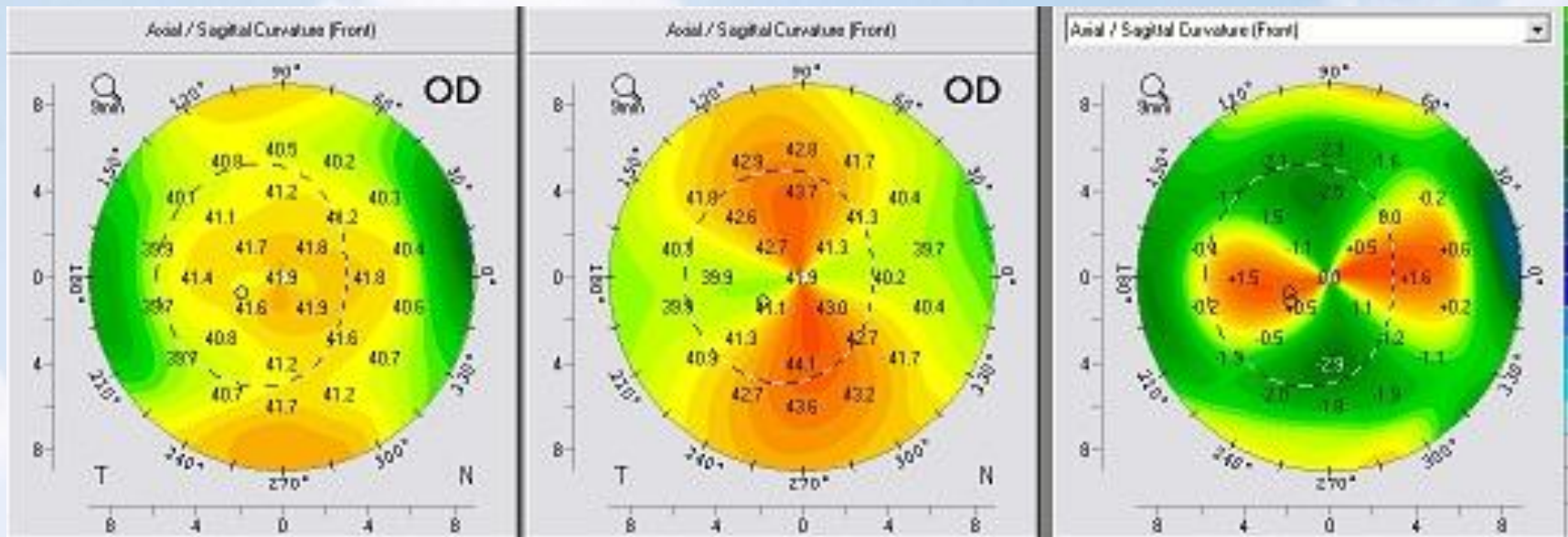
PreOp

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



Sphere: -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

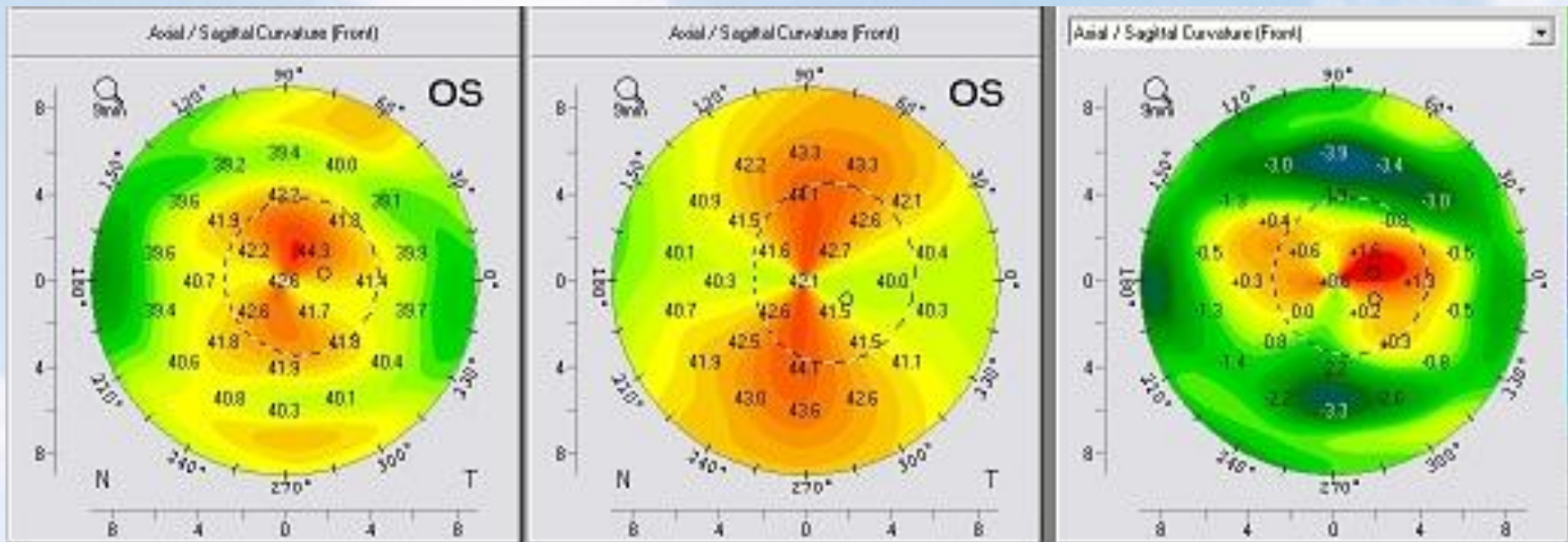
PreOp

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

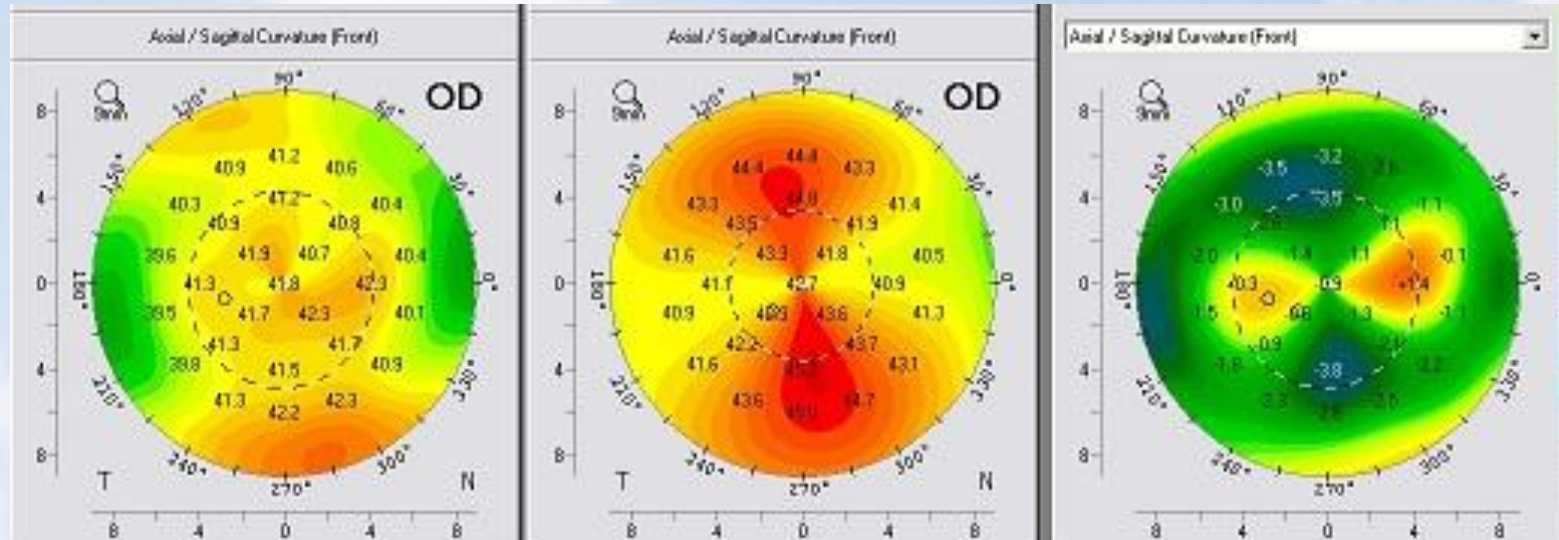
PreOp

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



Sphere: $-3.75 - 0.15$ (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

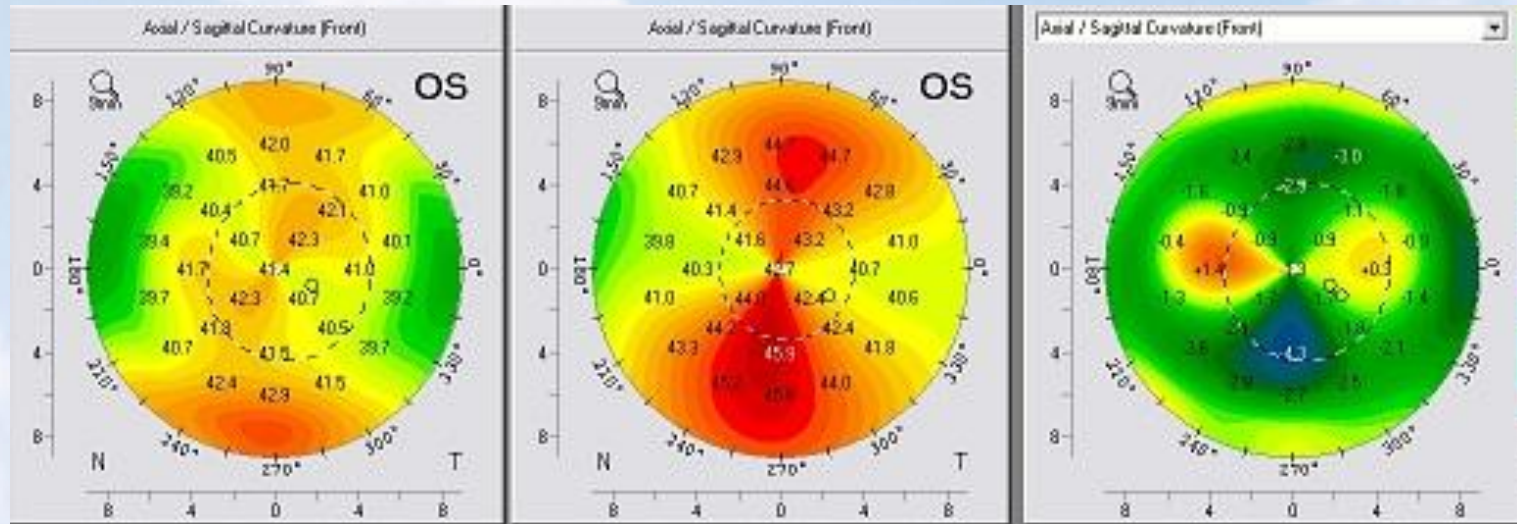
PreOp

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



Sphere: $-4.00 - 0.15$ (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

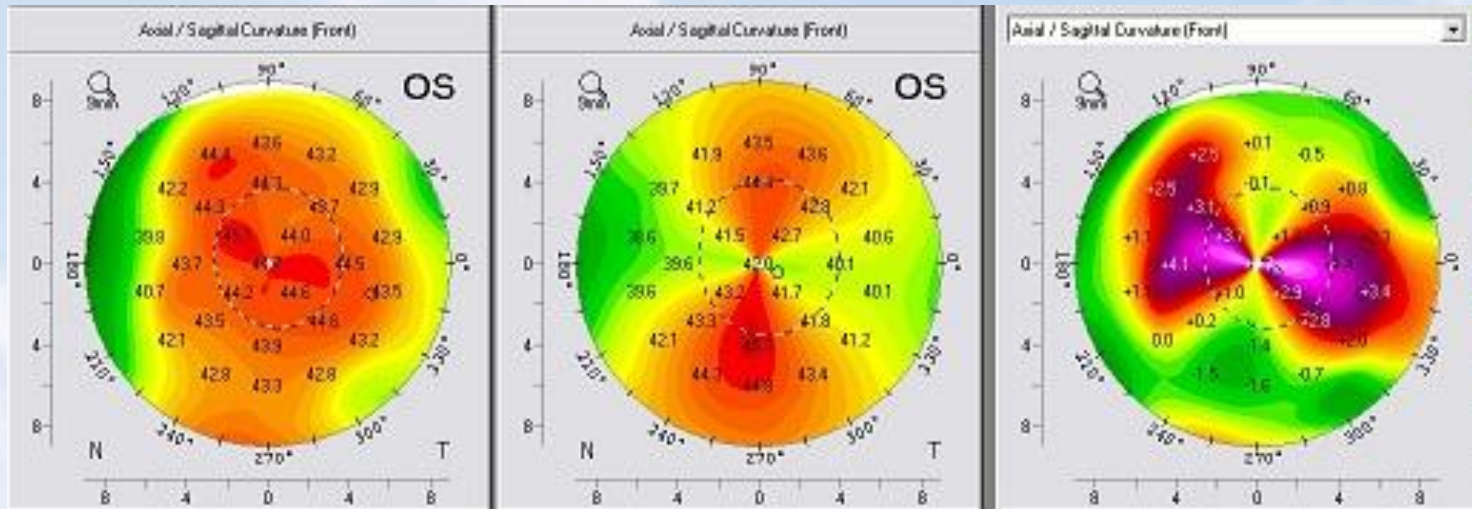
OD NCDVA = 1.00

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

$\Delta K = 4.75$ 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°

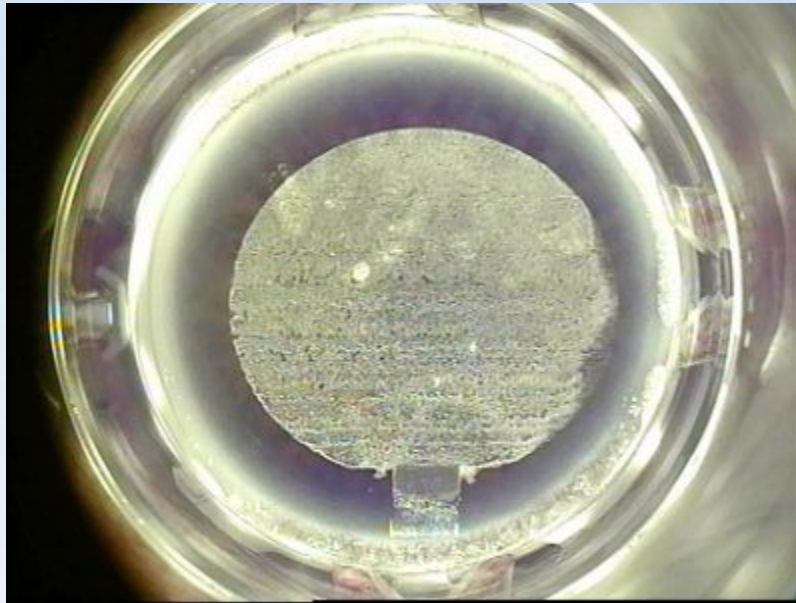
1D PostOp

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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