ZEISS TORIC CALCULATOR & MY EXPERIENCE WITH MULTIFOCAL TORIC IOLS

Dr. Nita. A. Shah
Aayush Eye Clinic,
Microsurgery and Laser Centre
Introduction-TIOL

• The Advances in Ophthalmology are due to advances in Physics & its Applications

• We have come a long way from couching - ICCE – ECCE – Phaco – Foldable – MF IOLs - Toric MF IOLs to PRELEX for refractive corrections

• We need to achieve reliable refractive outcomes in astigmatism correction which is possible with the Zeiss toric calculator – Z CALC

Dr. Nita. A. Shah
Aayush Eye Clinic,
Microsurgery and Laser Centre
Online toric IOL calculator
Z- CALC highly reliable zeiss algorithm

WWW.IOLMASTER-ONLINE.ZEISS.COM

• Z CALC™ offers:
  • Fast calculation
    • Real-time calculation
    • Real-time modification of sphere and cylinder of both eye simultaneously
  • Easy handling
    • Easy-to-use interface
    • Online help for users
  • Reliable refractive outcomes
    • Time-proven, optimized calculation algorithm
How to use Z CALC™ – Login

- After log-in to WWW.IOLMASTER-ONLINE.ZEISS.COM this will be the first screen you see.

This screen is for personal login after registration.

- Choose your preferred language here.
- Enter your User name and password.
- Tick both check box.

Conditions of Use for Z CALC - Europe

The following conditions in the version applicable at the time of use shall apply exclusively to the use of the Z CALC software to determine a refractive power recommendation by Carl Zeiss Meditec AG (“CZM”). These must be bindingly accepted by the user by pressing the confirmation button at the end of these conditions.

1. Users of Z CALC
CZM provides access to Z CALC free of charge exclusively to medical specialists in the European economic region (“users”) for the purpose stated in Section 2. The user shall not be entitled to use the IOL calculator in any other way, to manipulate the program or access Z CALC in any other way than using the provided log-in. The user shall be obliged to protect Z CALC from unauthorized access by third parties.

2. Conditions of use of Z CALC
On the basis of biometric data previously determined and input by medical specialists Z CALC calculates a non-binding recommendation based on the proposal of CZM for an IOL suitable for the patient in question.

- I have read the conditions of use applicable to my country and consent to them.
- I have read the privacy policy applicable to my country in Section 5 and consent to it.

User name: drnitashah
Password: ●●●●●●●●

Forgotten username?
Forgotten password?
New Registration

Enter Dr’s Data and preferences here

Dr Shah, Nita, Aayush Eye Clinic, Mumbai

- **Title**: Dr
- **Practitioner**: Aayush Eye Clinic
- **Street address**: 201 Coral Classic 20th R
- **Postcode**: 400071
- **City**: Mumbai
- **Country**: India

**Preset (OD / OS)**

- **AL measuring method**: IOLMaster / Immersion-US
- **Refractive index of the keratometer**: 1.3375
- **Anterior chamber depth**: Epithelium
- **SIA effect on incision axis**: 0.30
- **Standard/Advanced**: Standard

**Preset (OD / OS)**

- **AL measuring method**: No pre-selection
- **Refractive index of the keratometer**: No pre-selection
- **Anterior chamber depth**: No pre-selection
- **SIA effect on K₁/K₂**: 
- **Standard/Advanced**: Standard
**How to use Z CALC™-Patient Data Screen**

<table>
<thead>
<tr>
<th></th>
<th>Right (OD)</th>
<th>Left (OS)</th>
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<tbody>
<tr>
<td><strong>Subjective refraction</strong></td>
<td><strong>Sphere</strong></td>
<td><strong>Cylinder</strong></td>
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<tr>
<td></td>
<td>-4 dpt</td>
<td>-0.75 dpt</td>
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<tr>
<td><strong>Study No.</strong></td>
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</table>

**Patient Data Screen**

- **Last name**: Shahani
- **First name**: Rajendrasingh
- **Date of birth**: 19/10/1049
- **Sex**: male
- **ID No.**: 11-11-5/2012
- **Biometry examination date**: 12/05/2012

To proceed click on “Calculate IOL”.
How to use Z CALC™ – Calculation

- On this screen the refraction data can be entered.

Enter in mm so that the default RI is 1.3375

Both eyes can be calculated at the same time to compare the potential post-op results

Enter SIA here

All toric IOLs by ZEISS can be calculated with Z CALC™

Please enter the measured value of the ACD. Always use “Epithelium” if measured with IOLMaster
How to use Z CALC™ – Calculation

The residual sph is shown

The residual cyl is shown

Dr Shah, Nita, Aayush Eye Clinic, Mumbai

Shahani, Rajendrasingh Patient ID: 11-11/5/2012

Right (OD)

Subjective refraction
S: -4.00 dpt C: -0.75 dpt A: 110°

Axial length
24.29 mm

Keratometry / n'
R1/K1: 7.88 mm
Axis1: 177°

R2/K2: 7.69 mm
Axis2: 87°

n': 1.3375

ΔKc: 1.06 dpt

Anterior chamber depth
3.04 mm from Epithelium

Incision orientation
0°

SIA effect on incision axis
-0.30 dpt

IOL type
AT LISA toric 909M

Standard Advanced

Residual refraction

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<td>-0.41</td>
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</table>

Post-operative anterior chamber depth
4.44 mm

IOL refraction

<table>
<thead>
<tr>
<th>Sph [dpt]</th>
<th>Cyl [dpt]</th>
<th>A [°]</th>
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<tbody>
<tr>
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<td>88</td>
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<tr>
<td>18.00</td>
<td>1.50</td>
<td>88</td>
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</table>

Left (OS)

Subjective refraction
S: -2.50 dpt C: -0.75 dpt A: 25°

Axial length
53 mm

Keratometry / n'
R1/K1: 7 mm
Axis1: 93°

R2/K2: 7 mm
Axis2: 93°

n': 1.3375

ΔKc: 1.36 dpt

Anterior chamber depth
3.05 mm from Epithelium

Incision orientation
0°

SIA effect on incision axis
-0.30 dpt

IOL type
AT LISA toric 909M

Standard Advanced

Residual refraction

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<td>-0.35</td>
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Post-operative anterior chamber depth
4.53 mm

IOL refraction

<table>
<thead>
<tr>
<th>Sph [dpt]</th>
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<th>A [°]</th>
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<tr>
<td>15.50</td>
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</table>
How to use Z CALC™ – Change in IOL Power with SIA

Dr. Shah, Nita, Aayush Eye Clinic, Mumbai

Shahani, Rajendrasingh
Patient ID: 11-11/5/2012

**Right (OD)**
- Subjective refraction: S: -4.00 dpt, C: -0.75 dpt, A: 110°
- Axial length: 24.29 mm
  - Keratometry: R1/K1: 7.88 mm, R2/K2: 7.69 mm
  - Keratometry/n°: n1 = 1.3737
- Anterior chamber depth: 3.04 mm
- Incision orientation: 0°
- IOL type: AT LISA toric 909M

**Left (OS)**
- Subjective refraction: S: -6.00 dpt, C: -2.50 dpt, A: 25°
- Axial length: 24.83 mm
  - Keratometry: R1/K1: 7.84 mm, R2/K2: 7.60 mm
  - Keratometry/n°: n1 = 1.3737
- Anterior chamber depth: 3.09 mm
- Incision orientation: 90°
- IOL type: AT LISA toric 909M

**Residual refraction**

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**IOL refraction**

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**Post-operative anterior chamber depth**

- Right (OD): 4.44 mm
- Left (OS): 4.53 mm
Sphere and cylinder of the calculated IOL can be manipulated individually to customize the post-op refraction.
How to use **Z CALC™ – TIOL recommendation**

- The choice of the toric IOL will lead to the presentation of the TIOL recommendation

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**Shahani, Rajendrasingh**  **Patient ID: 11-11/5/2012**

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<td>Axial length</td>
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<tr>
<td>Anterior chamber depth</td>
<td>Anterior chamber depth</td>
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<tr>
<td>Keratometry / n'</td>
<td>Keratometry / n'</td>
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<tr>
<td>R1/K1</td>
<td>R1/K1</td>
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<tr>
<td>R2/K2</td>
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<tr>
<td>SIA effect on incision axis</td>
<td>SIA effect on incision axis</td>
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<tr>
<td>Target refraction</td>
<td>Target refraction</td>
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<tr>
<td>Post-operative anterior chamber depth</td>
<td>Post-operative anterior chamber depth</td>
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<tr>
<td>IOL refraction</td>
<td>IOL refraction</td>
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<tr>
<td>Residual refraction</td>
<td>Residual refraction</td>
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<tr>
<td>IOL type</td>
<td>IOL type</td>
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<tr>
<td>-4.00dpt -0.75dpt 110°</td>
<td>-6.00dpt -2.50dpt 25°</td>
</tr>
<tr>
<td>24.29 mm</td>
<td>24.83 mm</td>
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<td>3.04 mm</td>
<td>3.09 mm</td>
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<td>1.3375</td>
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<td>7.88 mm / 177°</td>
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<td>7.69 mm / 87°</td>
<td>7.60 mm / 93°</td>
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<td>0 °</td>
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<td>-0.30 dpt</td>
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<td>0.00 dpt</td>
<td>0.00 dpt</td>
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<tr>
<td>4.44 mm</td>
<td>4.53 mm</td>
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<tr>
<td>17.50 dpt (1.50 dpt 88 °)</td>
<td>15.00 dpt (2.00 dpt 93 °)</td>
</tr>
<tr>
<td>0.05 dpt (-0.10 dpt 178 °)</td>
<td>0.08 dpt (-0.12 dpt 3 °)</td>
</tr>
<tr>
<td>-0.04 dpt</td>
<td>0.01 dpt</td>
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<tr>
<td><strong>AT LISA toric 909M</strong></td>
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</tr>
</tbody>
</table>

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Order quantity: 2  Order quantity: 2  Order reusable STACY: [ ]
Tips and Tricks of Z Calc

- The color coded yellow and red fields indicate an entry is outside the `normal` range.
- Yellow indicates values slightly beyond the most common parameters – Z CALC will continue to calculate but please verify the patient data.
- Red indicates values where Z CALC will not continue to calculate the toric IOL.
- Enter K-reading values in mm to avoid conversion errors.
- We should always compare the results of both eyes.

If historical subjective refraction is available, check with biometry for plausibility.

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Aayush Eye Clinic, Microsurgery and Laser Centre
The spherical power is different -16D

The IOL sph power is 15D
How to use Z CALC™ - Accuracy of Measurements

Parameters for IOL calculation:

- Axial length
- Anterior chamber depth
- Corneal radii [mm] or keratometer values [D]

**Note:** consider measurement technique and corneal index
(Zeiss $n=1.332$; Javal $n=1.3375$)

- SIA - Impact of surgical technique
- Induction of astigmatism!

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Z CALC - Performing a valid biometry to achieve correct data.

**Axial Length**

- Analysis of the measurement
- Minimum of 5 measurement results within 0.05 mm
- Adequate SNR to be achieved if IOL Master is used
- Axial length diff between both eyes not more than 0.5mm in 95% of all cases
- Axial length: 1mm difference to the standard is ~3D

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Aayush Eye Clinic,
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Keratometry (IOL Master)

- Measuring mark has to be centered
- The peripheral marks should have sharp haloes.
- Eye has to be opened during the measurement - marks should not be wholly or partly obscured.

Z CALC™ - Performing a valid biometry to achieve correct data.
Z CALC™ - Performing a valid biometry to achieve correct data.

- Contact lenses, depending on type absence from 2 days up to 2 weeks.
- Sicca- after a natural blink
- Measurement should be done before any other measurement which has an impact on the cornea, e.g. Tonometry, dilatation.
- K’s from corneal topographer being Sim k’s – not preferred

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Recheck Keratometry

- $K < 40$ d or $> 47$ d
- $< 40$ d may indicate previous refractive surgery
- $> 47$ may indicate Keratoconus
- $K$ correlates poorly with refraction
- Difference in $K$ values between two eyes

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Microsurgery and Laser Centre
Z CALC™ - Performing a valid biometry to achieve correct data

Anterior Chamber Depth

• Results depend on the position of the patient
• Patients need to fixate in the light of the slit in case of IOL Master
• Results have to be consistent
• If IOL Master measurement has been done, surgeons have to choose Epithelium within Z CALC

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Z CALC™ – Advantages

- Raytracing for maximum precision calculation
- Individual changes of sphere and cylinder for the recommended TIOL
- Real calculation of the IOL, independent from devices used for measuring the eye
- Both eyes can be calculated simultaneously on the same screen,
- Surgeon can play with different post-op scenarios
Z Calc – Limitations

IOLs

• Phakic IOLs
• Lens models implanted in Sulcus or in the AC
• It is approved for use for Zeiss Lenses only.

Corneal Conditions

• Post Corneal Refr Sx
• Irregular Astigmatism-Corneal Degenerations, Trauma etc

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Microsurgery and Laser Centre
Difference between Z CALC and the other calculators

**Z-CALC**

- Real calculation of the IOL, independent from devices used for A Scan
- Both eyes can be calculated simultaneously on the same screen, the Surgeon can play with different post op scenarios.

**Other TIOL Calculators**

- Do not calculate the spherical part of the IOL power
- The Surgeon has to fill in the “Spherical Equivalent” already calculated on Biometry.
- Thus they consider only the Average Corneal Radius

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An Example

Toric cornea:  
K1: 7.8mm -> 43.27D  0°
K2: 7.4mm -> 45.61D  90°
cyl: 2.34D

Z Calc calculates the necessary IOL power in 0° and in 90°

• taking all given individual biometry data (including ACD) into account
• The difference between the two calculated spherical powers for the main meridians is the cylinder.
• In that case it could be 20D in 90° and 22.5D in 0° --> cyl. 2.5D

Recommended IOL power: Sph. +20D  Cyl. +2.5D @90°
Biometry (viz IOL Master) calculates..

• An average radius, which in this case is: 7.6mm (44.41D).

• It doesn't take into account the toricity of the cornea but calculates a sphere with only one radius!

• The more astigmatic a cornea is the more inexact is the calculation.

• The result would be more precise only if it is nearly a spherical cornea (e.g. K1: 7.8mm / K2: 7.75mm)
Finally the result with diff Toric IOL calc tools

Z Calc: Sph +20.00D cyl +2.5D 90°
Other TIOL: Sph +21.50D T5 90°

In the other TIOL calculator the cylinder on corneal plane was 2.06D that means on IOL plane 2.68D.

The possible other Toric Lens cylinder power (T5) is 3.00D. Thus there would be an astigmatic overcorrection with the other TIOL
My Experience with Toric Multifocal lens

• After using Toric & Multifocal lenses over the years with encouraging results it was disheartening to refuse pts with Astigmatism for Multifocals.

• I am sure all of us have had the spectacled family members of multifocal Implanted patients asking for Surgery.
Expected Standards in Cataract Outcomes

- UCVA
- Quality of vision
- Immediate restoration
- Minimal or no spectacle dependance
• Advent of Multifocal toric IOLs offer outstanding functional Multifocality & Astigmatism Correction for excellent quality of Vn that can be offered to our pts

• Cornea and TIOL together focus both meridians at the retina

• TIOL is compensating the different powers of the meridians of the cornea
My Experience with Toric MF lens

• Light distributed asymmetrically between distant (65%) and near focus (35%) for improved intermediate vision and greatly reduced halos and glare

• Independency from pupil size due to high performance diffractive-refractive micro-structure covering the complete 6.0 mm optical diameter

• SMP Technology (smooth MICRO PHASE) for a lens surface without any sharp angles for ideal optical imaging quality with reduced light scattering

• Aberration correcting optimized aspheric optic for better contrast sensitivity, depth of field and sharper vision

AT LISA 909M
AT LISA Tri 839M

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Pre op Considerations and TIOL Calc on Z CALC

- **Accurate Biometry**
  - AL min of 5 measurements within 0.05 mm
  - Diff of AL between OD / OS is < 0.5 mm in 95% eyes

- **Accurate Keratometry**

- **Recheck if**
  - < 40 D or > 47 D
  - K correlates poorly with refraction
  - Diff in K values between the 2 eyes

- **Topography**

- **Factor SIA**

- **Target Emmetropia**

- Slightly undercorrect WTR & overcorrect ATR as the posterior corneal Astigmatism is not under consideration.

- **A realistic Picture should be portrayed to the patient.**

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Microsurgery and Laser Centre
After the IOL selection process.

• For ordering, we can print a copy of the lens calculation/order request and fax or email the request page to the Carl Zeiss Meditec Representative.

• For maximum precision we have two options for ZEISS toric IOL alignment.
Stacy

We can use either the screen transparency available to print directly from Z CALC™ or the reusable STACY transparency provided by Carl Zeiss Meditec.
Z Align

Z ALIGN a part of Calistoeye, is a user friendly touchscreen system for video documentation and Toric IOL Alignment assistance. Z ALIGN is an innovative Video supported tool that offers greater convenience, reliability and speed for Intraoperative Toric IOL Alignment.

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Aayush Eye Clinic, Microsurgery and Laser Centre
Pre-Operative Marking

• An appropriate marking of the eye for the implantation of toric IOLs is important for the success of the surgery. The pre-operative reference marking is applied before anaesthesia while the patient is sitting upright with both eyes open.

The instruments necessary for marking are:

• A corneal marker

A slit lamp with a grading ring

• Reference points of the eye

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Microsurgery and Laser Centre
Marking on the slit lamp.

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Aayush Eye Clinic,
Microsurgery and Laser Centre
Optimal Incision

• The incision size for a ZEISS toric IOL implantation is less than 2.0 mm to avoid inducing additional astigmatism and to optimize the predictability of the outcome.

• I use 2.2 mm incision and factor my SIA in the calculation, for different incisions sites & sizes.

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Accurate Lens alignment

ACCURATE CENTRATION IS CRITICAL

- Rhexis - 5.5 mm
- On Insertion the Lens is aligned a few degrees (20°) shy off the marked axis prior to Polishing of the Ant capsule.
- After Complete visco removal above and below the IOL Markings on IOL should be lined up precisely with the axis placement markings.
- In case of parallax concentrate on the proximal 0° mark and the 90° as the distal mark may seem off.

Patient asked to look into the Microscope light and the center of the lens is tapped.

Air may be injected for Tamponade
Pitfalls

• Minimize all variables
  – Poor K
  – Poor Ref Mark / Head tilt
  – Bent axis marker / Circular marker off the eye center
  – Lens not aligned because of parallax

• If all are added - lot of opportunity for error
Pitfalls

• Rotation about 1° causes approx. 3.3% of astigmatism.
• Rotation about 30° will not correct astigmatism - simply axial rotation
• Rotation above 30° may increases astigmatism
Contraindication

**Pre op**

- Keratoconus if no C3R
- Amblyopia
- Unstable Corneal Astigmatism
- Irregular Astigmatism

**Intra op**

- PC rupture
- Zonular Damage
- If Primary PCC is planned
- If 360° overlap of rhexis margin is not there.
Surgical Technique
Post Operative management

• Post-operative checks are performed one day, one week and four weeks after surgery.

• A subjective refraction for distance and near is obtained (an autorefractor is not recommended).

• A topography is performed

• The second eye should be operated within a few weeks.

Progressive lenses are not prescribed.
50% of population > 60 years have more than 1D astigmatism

22% of cataract surgery candidates have persisting astigmatism exceeding 1.5D

Auckland cataract study: the mean refractive cylinder was 1.2 D
Astigmatism treatment Options

- Positioning and enlarging the Incision.
- OCCI, LRI, AK.
- Bioptics.
- Toric IOLs give the most predictable results.
Conclusion

Is there anything more wonderful than seeing life – effortlessly?
This patient achieved 6/6 and N6.
The dream of a Complete Refractive Surgery has arrived.
The need of the day is to become a Phaco Refractive Surgeon to make our practice grow with happy patients.

Dr. Nita. A. Shah
Aayush Eye Clinic,
Microsurgery and Laser Centre
Thank You

Dr. Nita. A. Shah
Aayush Eye Clinic,
Microsurgery and Laser Centre