Management of Post-LASIK Ectasia

Professor Dr.
Medhat M. Shawky
Professor of Ophthalmology
Zagazig Univesity

Clinical signs of post-LASIK ectasia

- Increase myopia of myopic astigmatism.
- Changes in keratometric readings (increase steepness)
- Changes in wavefront analysis (increase in higher order aberrations).
- Progressive decrease in pachymetric value.

Aim of treatment

- To restore vision.
- To prevent progression.

Treatment Options

- **Corneal Collagen Crosslinking:** To stiffen the cornea and slow or stop the progression of ectasia.
- **Spectacles and Contact Lenses:** often the initial treatment for mild cases of post-LASIK ectasia.
- **Intrastromal corneal ring segments:** corneal rings can help stabilize the cornea and improve visual outcomes in patients with mild to moderate post-LASIK ectasia.
- **Topography-guided or wavefront-guided PRK:** Custom laser ablation can improve visual outcomes by reshaping the cornea based on the corneal topography or wavefront maps.
- **Corneal transplant:** Corneal transplantation is reserved for severe cases of post-LASIK ectasia where other treatments have failed.

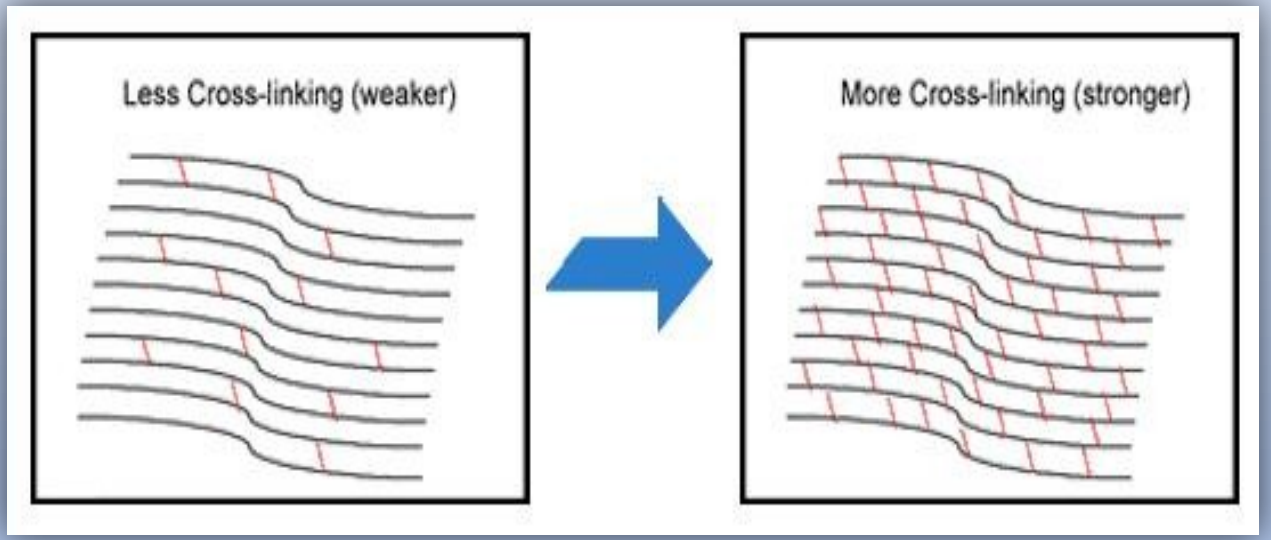
Corneal cross linking

- The primary purpose of corneal crosslinking for post-LASIK ectasia is to stiffen and strengthen the cornea by increasing the cross-linking between the corneal collagen fibers. This strengthens the cornea and can slow down or halt the progression of ectasia. The procedure involves the use of ultraviolet light combined with riboflavin drops, which penetrate the cornea and promote the formation of additional chemical bonds between the collagen fibers.

- The aim is to prevent further corneal distortion or irregularities, improving both visual acuity and stability over time for patients with post-LASIK ectasia.

- ***Procedure:*** The procedure generally involves application of riboflavin drops to the cornea, and then exposing the cornea to ultraviolet (UV) light. The UV light activates the riboflavin, which leads to cross-link formation. This strengthens the cornea and helps prevent progressive ectasia.
- ***Time and power:*** The UV light power ranges from 3mW/cm2 to 30mW/cm2 for a duration of 5-30 minutes, depending on the equipment used. The higher light intensity the shorter the treatment duration.
- ***Risks and Complications:*** The CXL procedure is generally considered safe, but as with any medical procedure, certain risks and complications are possible. These include eye infections, corneal haze, and temporary visual disturbances.
- ***Effectiveness:*** CXL is an effective treatment for post-LASIK ectasia, helping to stabilize the cornea, halt the progression of ectasia, and improve visual acuity. The exact outcomes of CXL may vary depending on the severity of ectasia and other individual patient factors.
- ***Recovery:*** After the procedure, patients may experience mild discomfort and sensitivity to light. It is normal to have blurred or hazy vision for a period of time after the procedure. Most patients are able to return to work and normal activities within a few days, but full recovery may take several weeks or months.

Corneal cross linking



Contact Lenses

- The contact lenses are customized to fit the shape of the cornea and can provide a more stable surface and better vision.
- It is important to determine the best contact lens options for treatment of different situations of post-LASIK ectasia.

Types of Contact lenses:

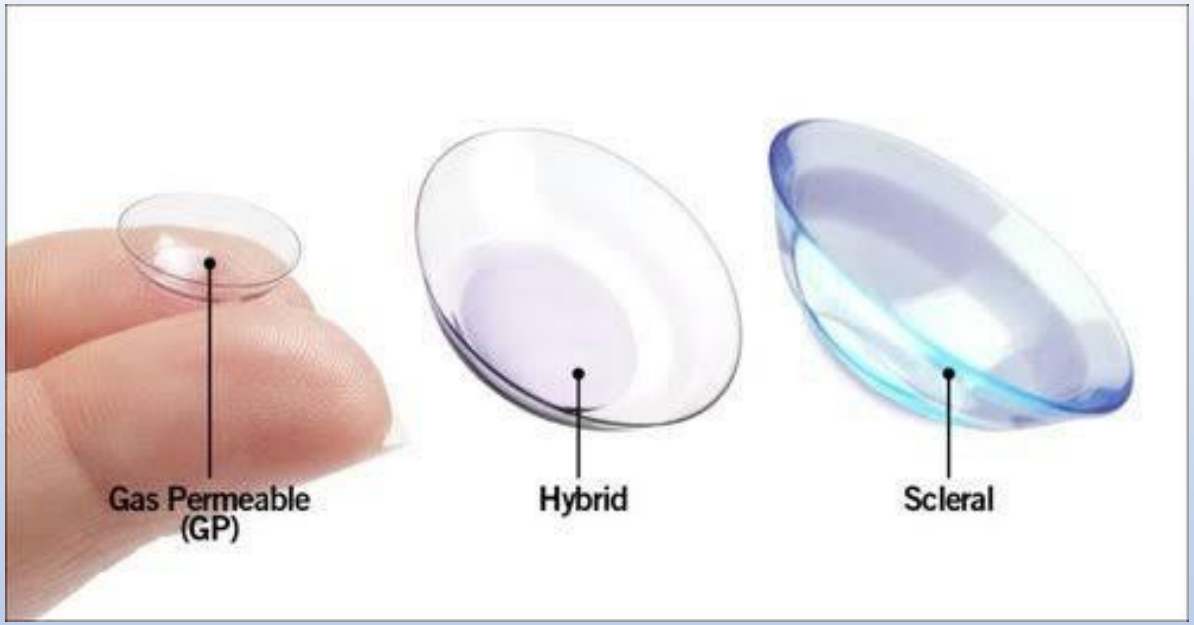
- **Gas-Permeable (GP) Contact Lenses:** GP lenses are rigid and allow oxygen to reach the cornea. These lenses are designed to flatten and regulate the cornea to improve vision. GP lenses are highly recommended for post-LASIK ectasia especially in mild and moderate cases.
- **Hybrid Contact Lenses:** Hybrid lenses have a rigid center and a soft outer ring. The center helps to correct vision, while the soft outer ring provides comfort and stability. Hybrid lenses are ideal for mild to moderate post-LASIK ectasia.
- **Scleral Contact Lenses:** These lenses are similar to GP lenses, but they have a larger diameter that covers the entire cornea and rests on the sclera. This creates a fluid-filled reservoir, which improves comfort and vision while minimizing the risk of lens dislodgement. Scleral lenses provide excellent visual acuity and are suitable for individuals with severe post-LASIK ectasia.
- **Custom toric Soft Contact lenses:** These contact lenses are designed to match the patient's corneal shape. These lenses provide good stability, but visual acuity may not be as good as GP or hybrid lenses. They are suitable for individuals with early and mild post-LASIK ectasia.

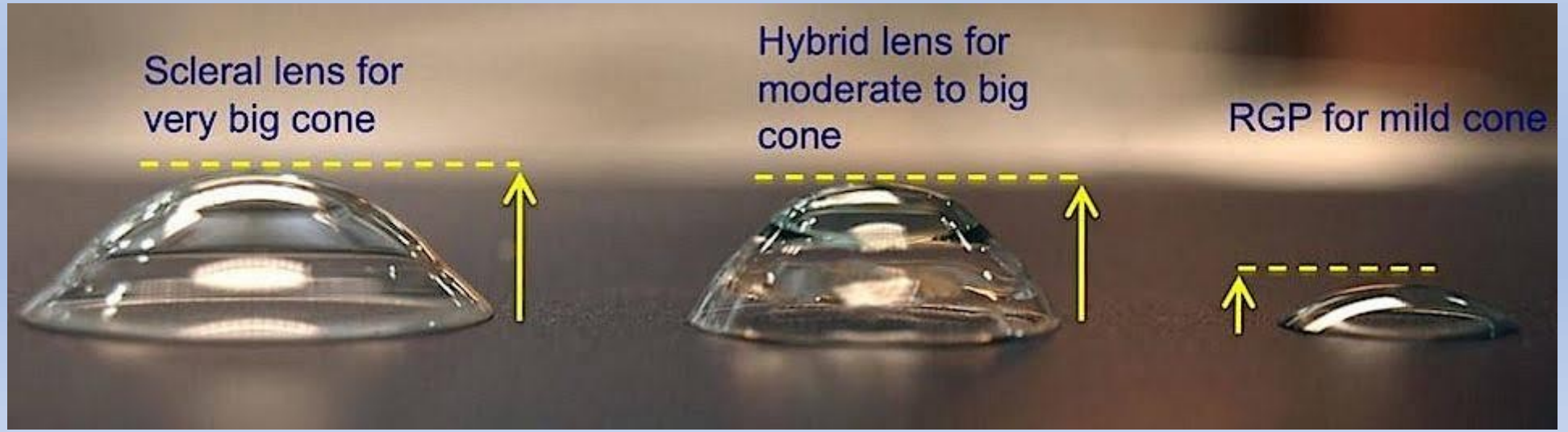
Contact Lenses

Soft Contact Lenses

Rigid Gas Permeable (RGP) Contact Lenses

Hybrid Contact Lenses





Complications

- **Corneal Abrasion:** Contact lenses may cause corneal abrasion or scratches on the cornea's surface.
- **Hypoxia:** Over-wearing of contact lenses can cause hypoxia, which occurs when the cornea doesn't receive enough oxygen.
- **Corneal Erosion:** Continuous rubbing of contact lenses against the cornea can lead to corneal erosion.
- **Infection:** Wearing contact lenses increases the risk of developing corneal infections.
- **Discomfort:** This may be due to fitting issue or lens material.

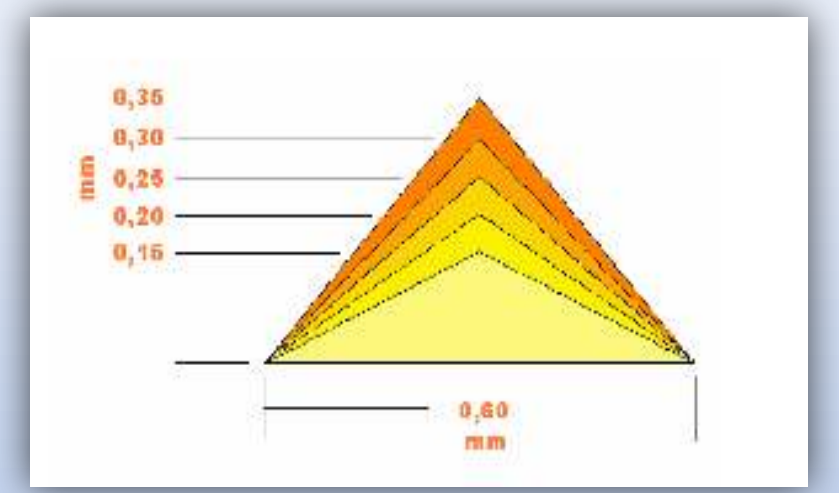
Intrastromal Corneal Rings.

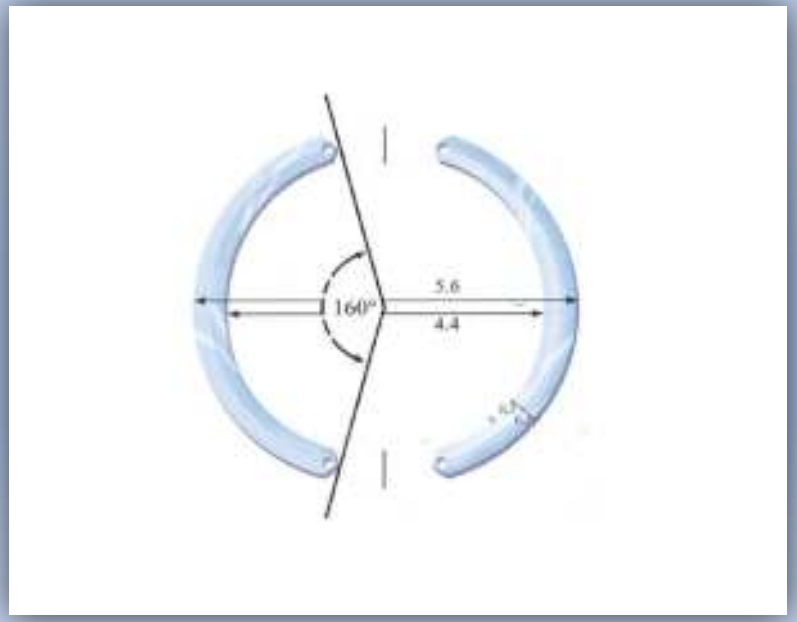
- corneal rings are a treatment option that can help stabilize the cornea and improve visual outcomes in patients with mild to moderate post-LASIK ectasia.
- Studies have shown that corneal ring implantation can improve visual acuity and reduce irregular astigmatism in patients with post-LASIK ectasia.
- After the rings are inserted, patients typically experience a temporary increase in astigmatism and visual distortion, but this usually resolves within a few days to a week.
- Corneal rings are not a permanent solution and may need to be replaced or removed over time. The surgeon can adjust or remove the rings as needed to achieve the desired level of correction.

Types of corneal rings

1. ***Kera - Ferrara Ring :*** is a brand of corneal ring that is used to treat mild to moderate post-LASIK ectasia. The rings are made of PMMA material and can be implanted through a small incision in the cornea. They are available in different sizes and thicknesses, which can be customized to the individual patient's needs.
2. ***Intacs:*** are another brand of corneal ring that is used for the treatment of post-LASIK ectasia. Intacs are also made from (PMMA). They are implanted into the cornea through a small incision and are available in different thicknesses to suit individual requirements.

Kera IntraCorneal Ring Segment (ICRS)





Design (cross section)	Triangular
Inner diameter	4.40 mm
Outer diameter	5.60 mm
Implantation depth	80 % of the corneal thickness
Arc Length	90, 120, 160, 210, 320, 355 °

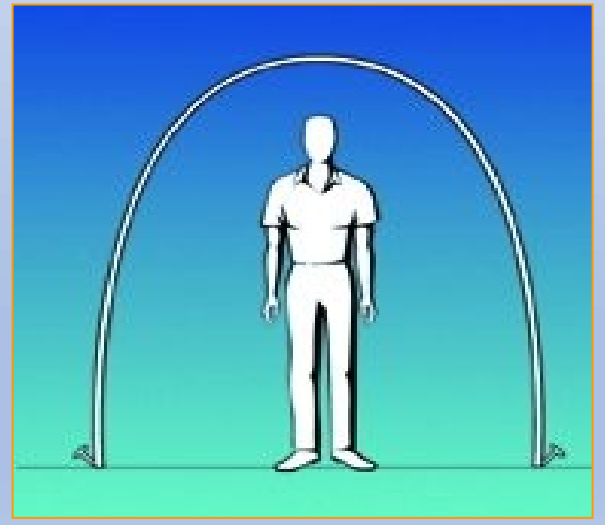
Procedure Objectives

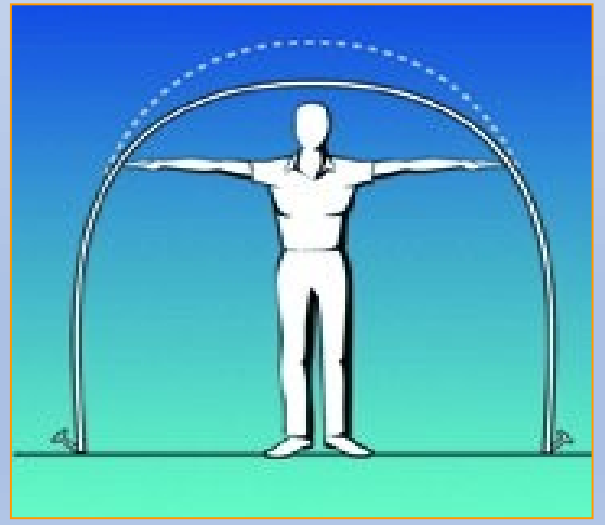
- **Stabilize or delay ectasia progression**
- **Regularize corneal surface**
  - -Reduce aberrations
  - - Improve contact Lens tolerance
  - - Allow spectacle correction

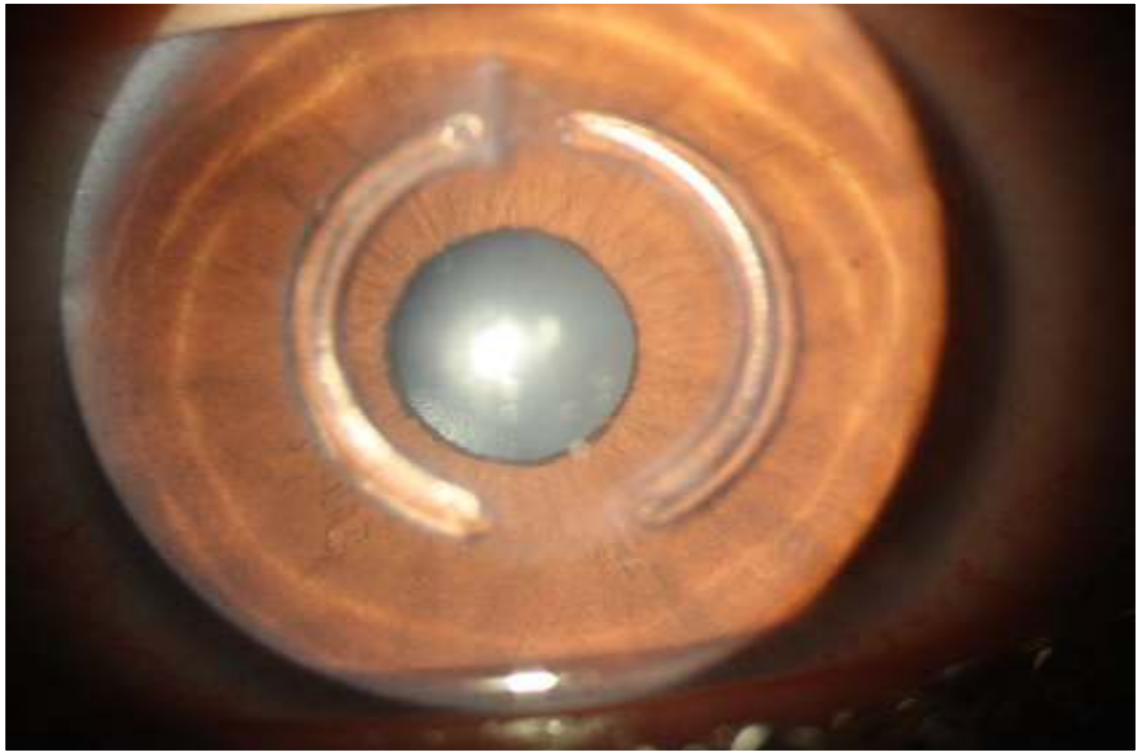
INTRACORNEAL RINGS

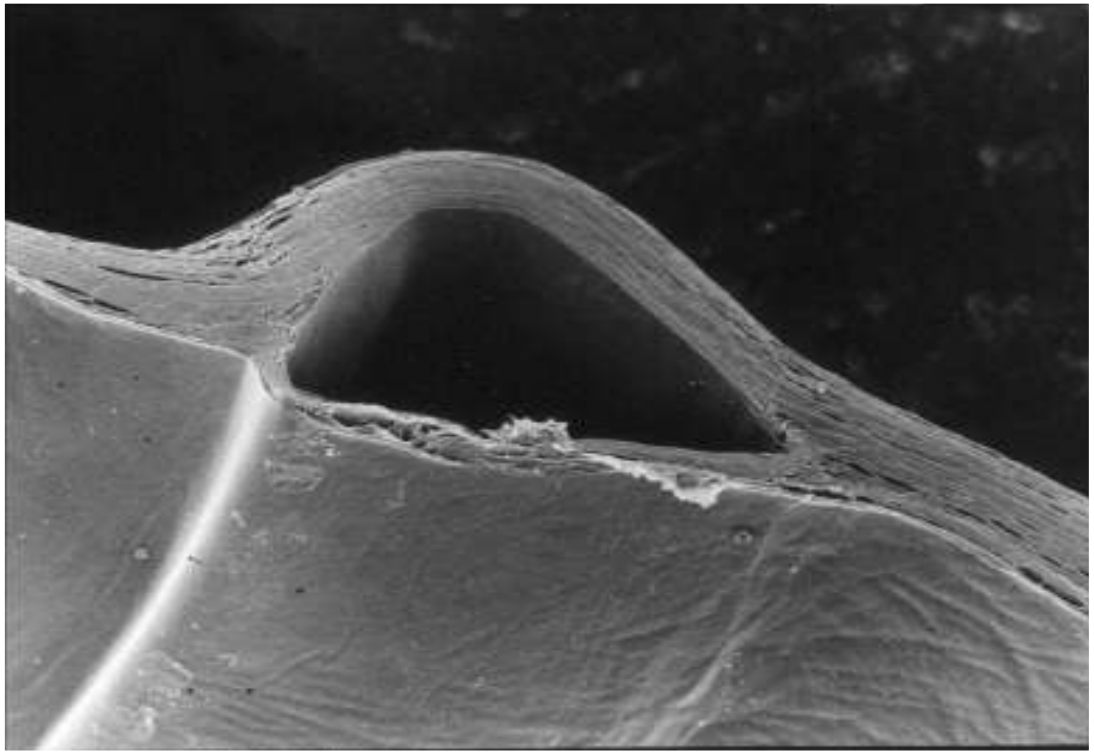
- **Mechanism of action**

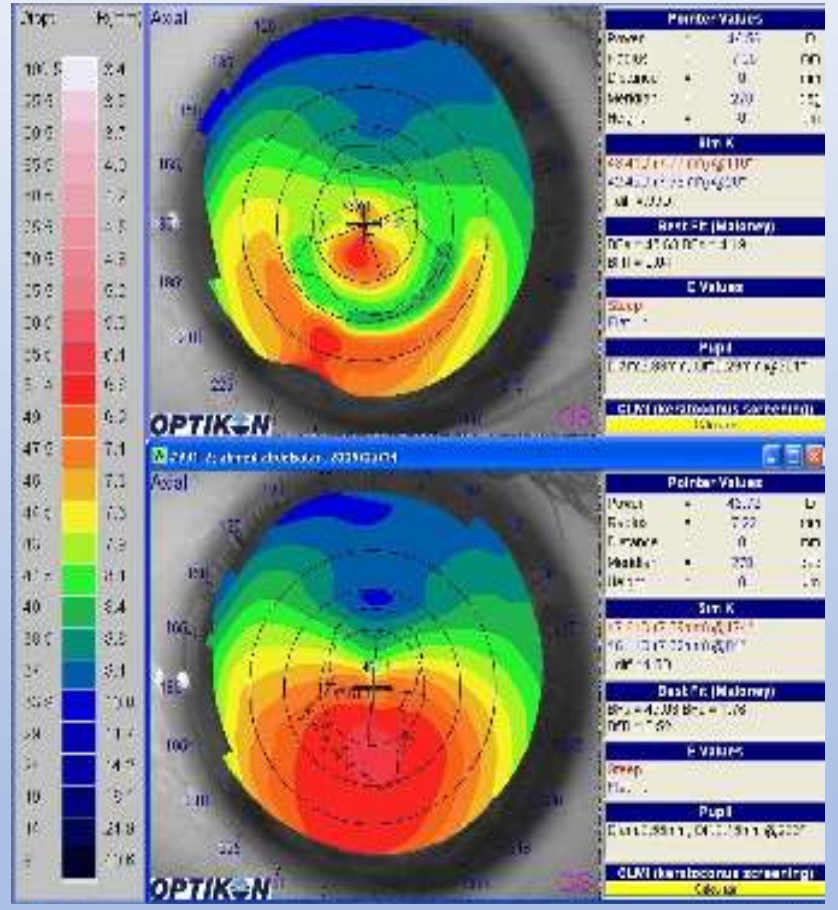
  Flattening the anterior corneal surface by an arc shortening effect without invading the central visual axis.

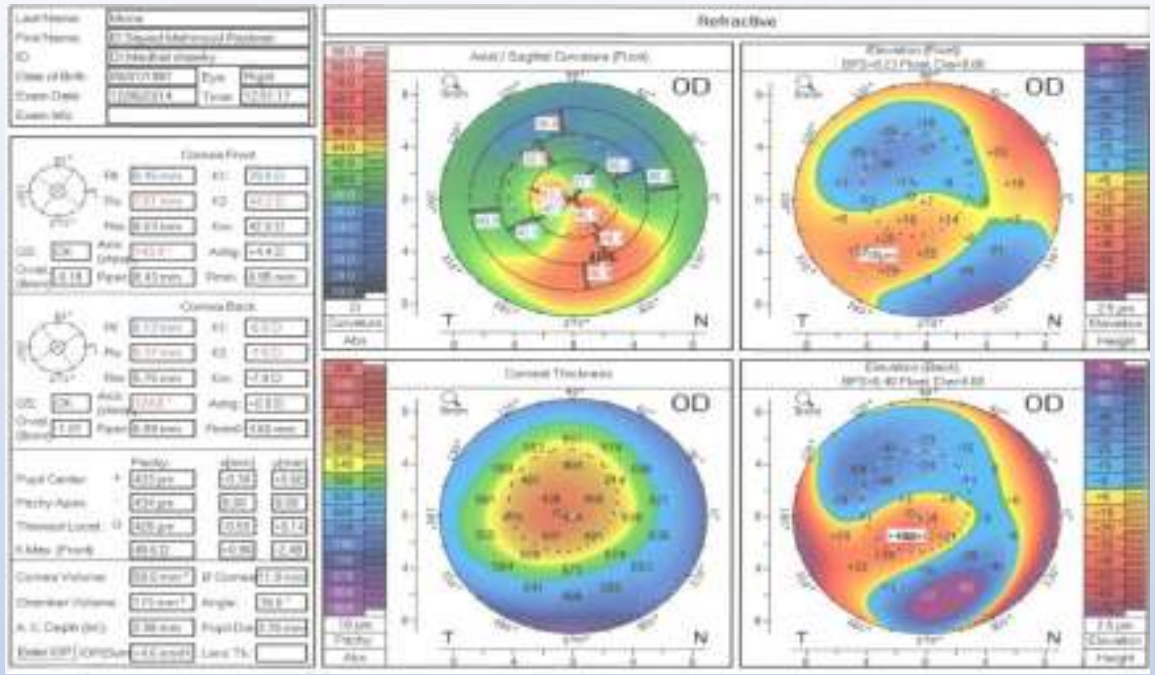


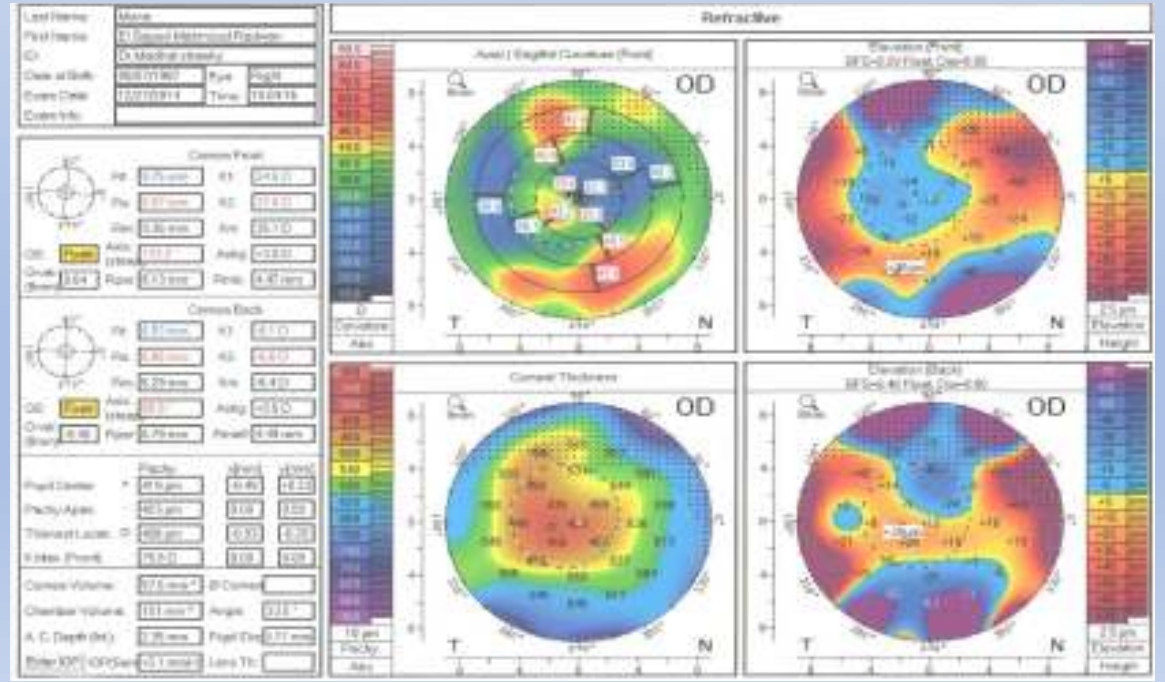




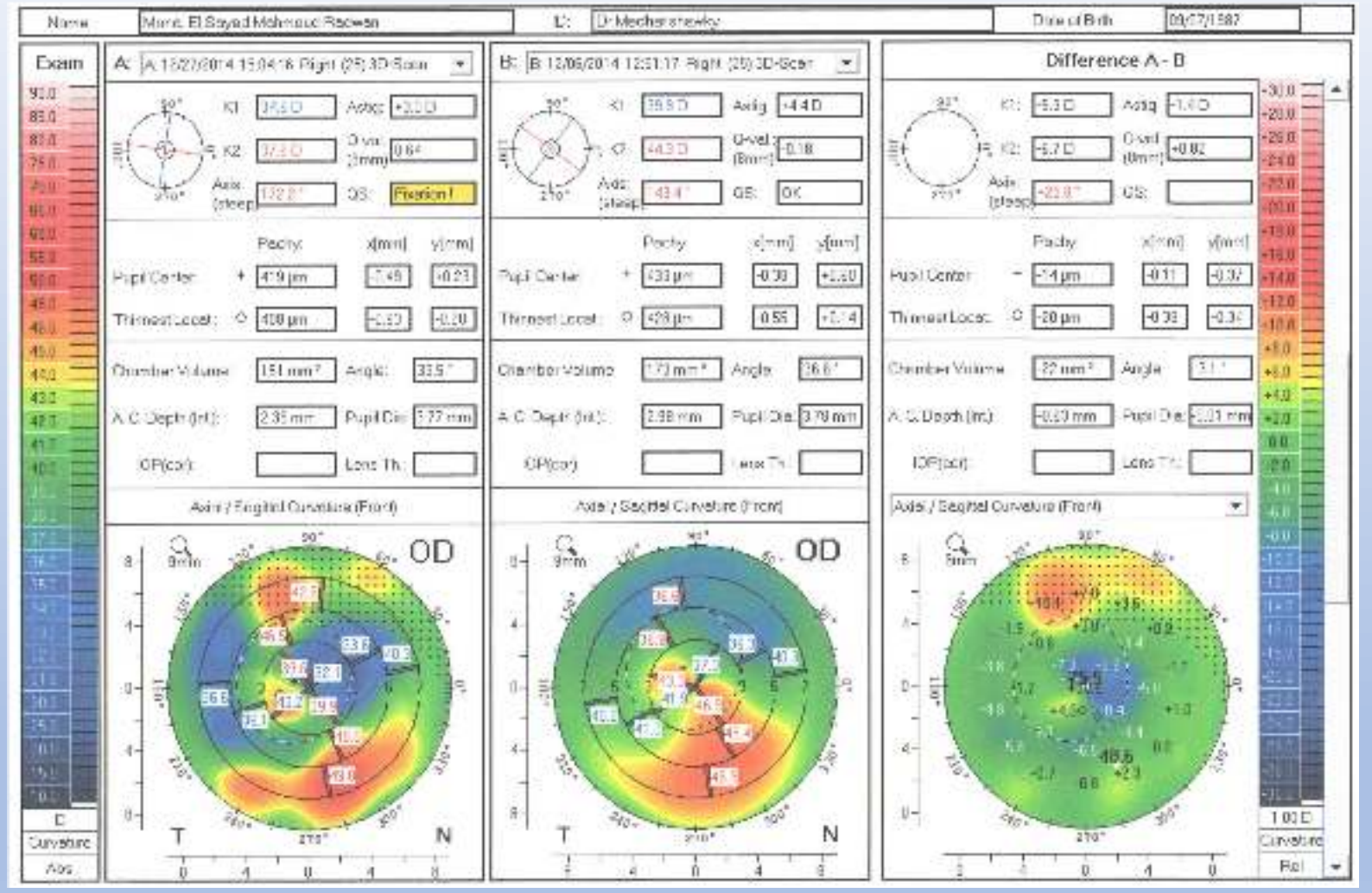



Axial
OPTIKON
Pointer Values
Sim K
Best Fit Sphere
E Values
Pupil
Axial
OPTIKON
Pointer Values
Sim K
Best Fit Sphere
E Values
Pupil


Refractive
OD
T
N


Refractive
OD
T
N

Customizing the Ring

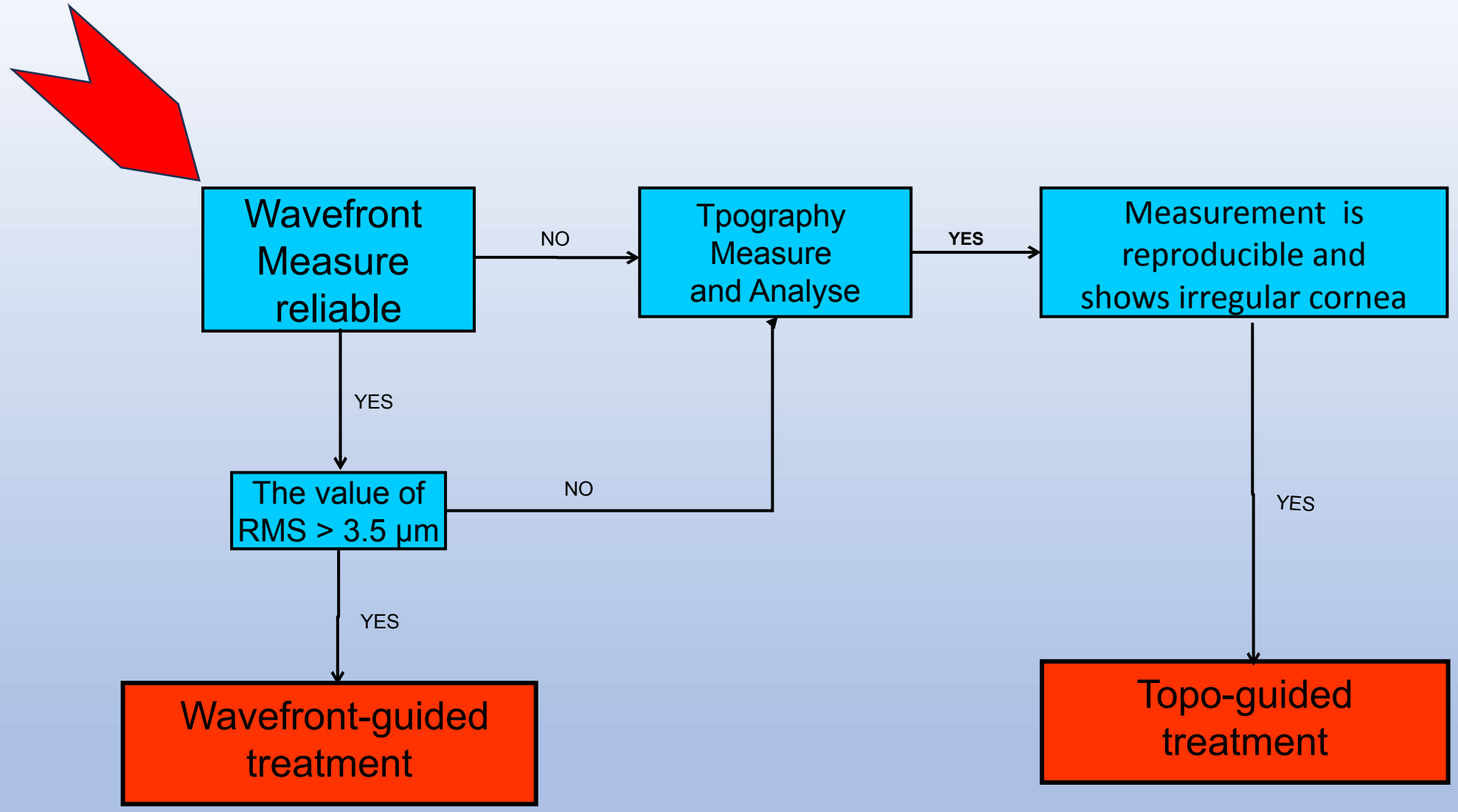

Name
Exam
Difference A - B
Axial / Sagittal Curvature (Front)
OD
T
N

ICRs

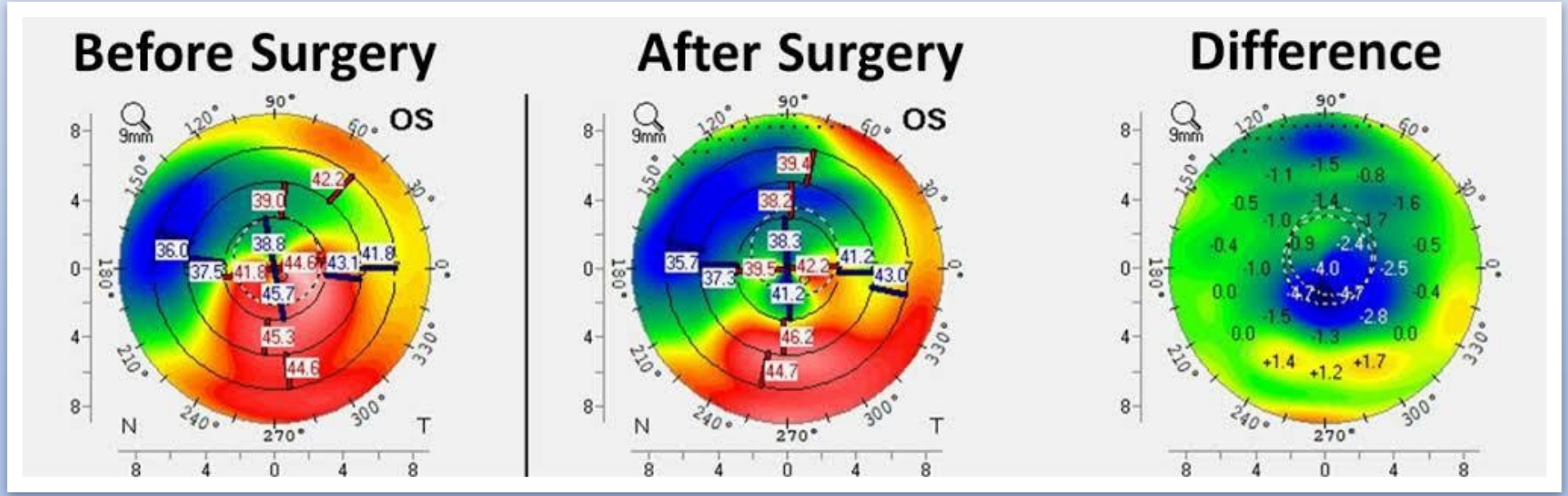
- Safe and effective when used as directed
- Reversible
- Readjustable
- Relatively low complication rates
- Delays or avoids penetrating or lamelar keratoplasty
- Fast visual rehabilitation
- Does not compromise corneal transplantation if required in the future

Topography and wavefront guided laser ablation for treatment of post-LASIK ectasia

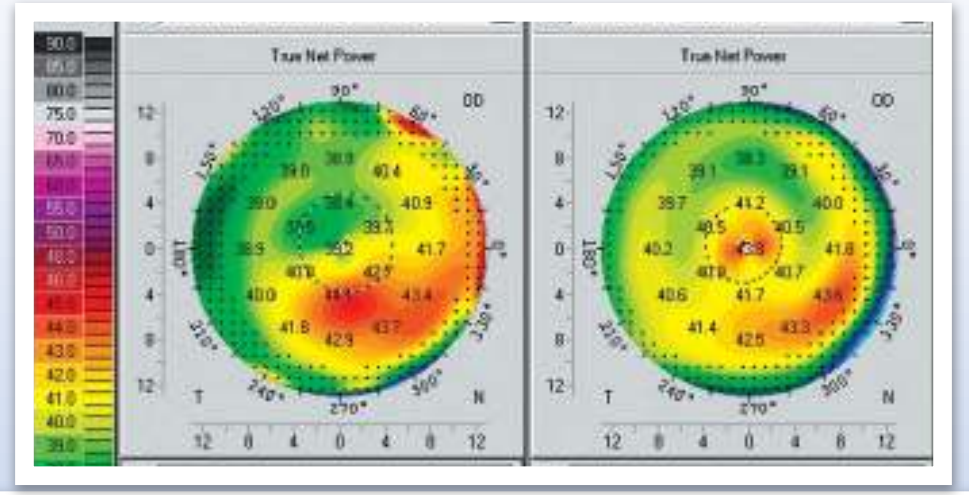
- Topography or wavefront guided laser ablation involves using precise computerized measurements and maps of the cornea to guide laser removal of tissue, reshaping the cornea and correcting the ectasia.
- ***Topography guided laser ablation*** can reduce or eliminate the corneal irregularities that cause corneal aberrations in patients with post-LASIK ectasia by precisely reshaping the cornea, leading to improved visual acuity.
- ***The wavefront-guided laser ablation*** is precisely removes tissue based on the individualized map, allowing for better correction of higher-order aberrations, which are irregularities in the cornea's shape that cannot be corrected with traditional LASIK.
- Not all patients with ectasia are candidates for topography guided or wavefront laser ablation and a thorough evaluation by a qualified ophthalmologist is necessary to determine the best course of treatment.

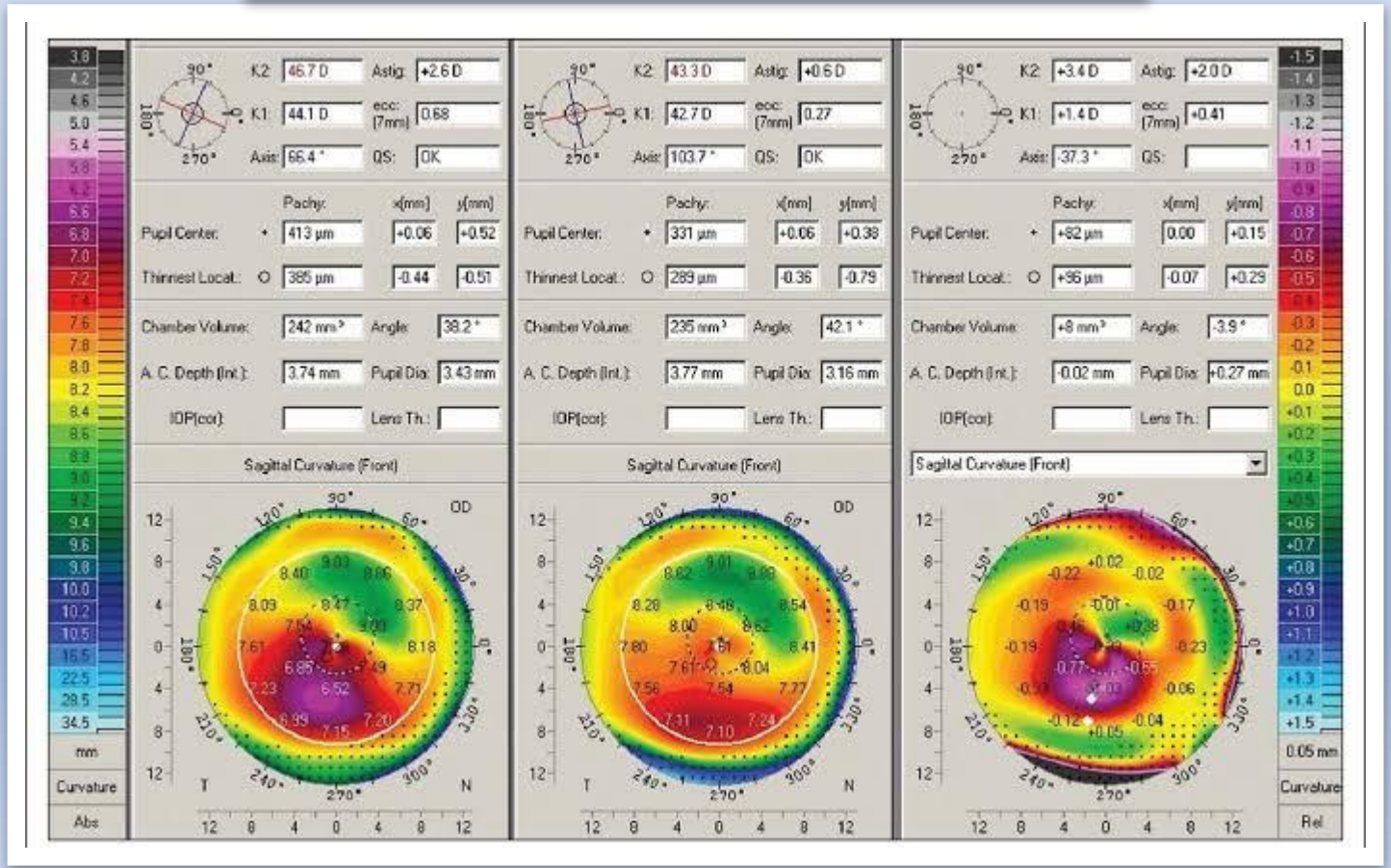

Wavefront Measure reliable
NO
Tpography Measure and Analyse
YES
Measurement is reproducible and shows irregular cornea
YES
The value of RMS > 3.5 µm
NO
YES
YES
Wavefront-guided treatment
Topo-guided treatment

Topo-G


Before Surgery
OS
9mm
42.2
39.0
38.8
36.0
37.5
41.8
44.6
43.1
41.8
45.7
45.3
44.6
N
T
After Surgery
OS
9mm
39.4
38.2
38.3
35.7
37.3
39.5
42.2
41.2
43.0
41.2
46.2
44.7
N
T
Difference
9mm
-1.1
-1.5
-0.8
-0.5
-1.4
-1.6
-1.0
-1.7
-0.4
-0.9
-2.4
-0.5
-1.0
-4.0
-2.5
0.0
-4.7
-4.7
-0.4
-1.5
-2.8
0.0
0.0
-1.3
+1.4
+1.2
+1.7

WF-G


True Net Power
True Net Power
OD
OD
T
N
T
N


K2: 46.7 D
Astig: +2.6 D
K1: 44.1 D
ecc: (7mm) 0.68
Axis: 66.4 °
QS: OK
Pachy:
x(mm)
y(mm)
Pupil Center: 413 µm +0.06 +0.52
Thinnest Local.: 385 µm -0.44 -0.51
Chamber Volume: 242 mm³
Angle: 38.2 °
A. C. Depth (Int.): 3.74 mm
Pupil Dia: 3.43 mm
IOP(cor):
Lens Th.:
Sagittal Curvature (Front)
K2: 43.3 D
Astig: +0.6 D
K1: 42.7 D
ecc: (7mm) 0.27
Axis: 103.7 °
QS: OK
Pupil Center: 331 µm +0.06 +0.38
Thinnest Local.: 289 µm -0.36 -0.79
Chamber Volume: 235 mm³
Angle: 42.1 °
A. C. Depth (Int.): 3.77 mm
Pupil Dia: 3.16 mm
Sagittal Curvature (Front)
K2: +3.4 D
Astig: +2.0 D
K1: +1.4 D
ecc: (7mm) +0.41
Axis: -37.3 °
QS:
Pupil Center: +82 µm 0.00 +0.15
Thinnest Local.: +96 µm -0.07 +0.29
Chamber Volume: +8 mm³
Angle: -3.9 °
A. C. Depth (Int.): -0.02 mm
Pupil Dia: +0.27 mm
Sagittal Curvature (Front)
mm
Curvature
Abs
0.05 mm
Curvature
Rel

Advantages of custom laser treatment:

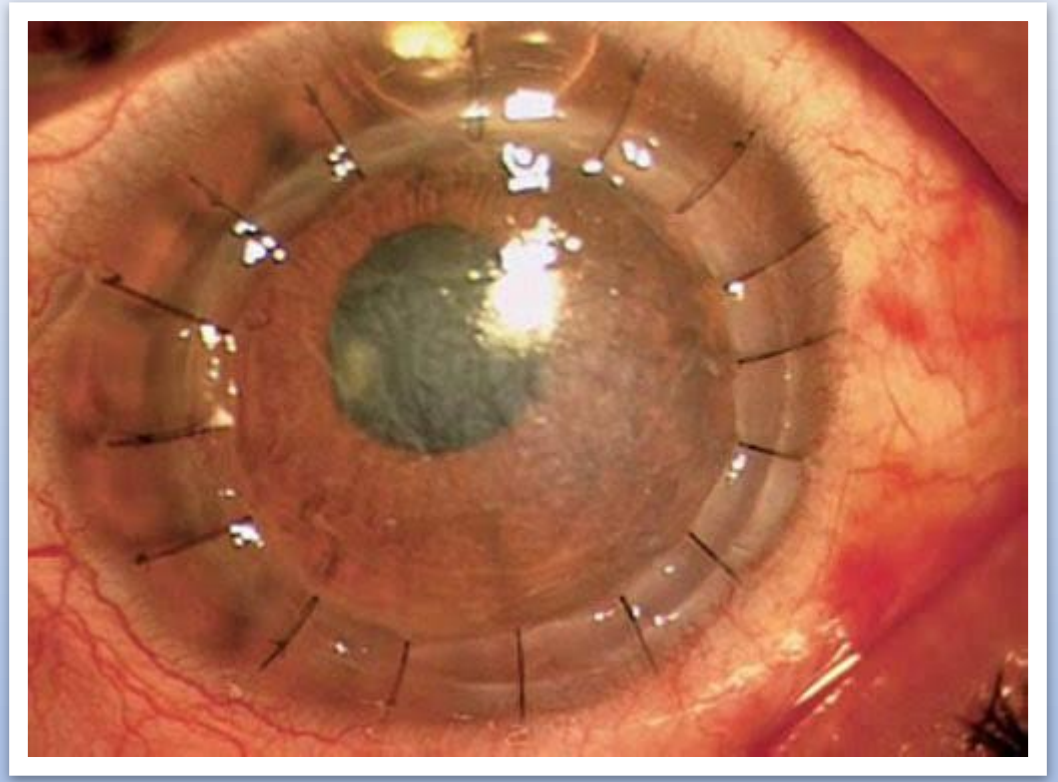
- **Combined therapy:** Can be done with CXL either simultaneously or sequentially.
- **Precise customization:** Both topography or wavefront guided laser ablation uses computerized measurements and maps of the cornea to provide a highly customized treatment plan for each patient. This individualized approach ensures a more accurate and precise treatment outcome, resulting in better visual acuity and fewer complications.
- **Improved visual outcome:** Topography guided laser ablation has been shown to effectively reduces corneal irregularities, while wavefront guided laser ablation reduces higher order aberrations. both techniques improve visual outcomes for patients with post-LASIK ectasia
- **Long-lasting results:** Patients usually experience long-lasting results, and the procedure only needs to be repeated in rare cases.
- Overall, either topography or wavefront guided laser ablation is an **effective and safe** treatment option for post-LASIK ectasia.

Corneal transplantation for post LASIK ectasia.

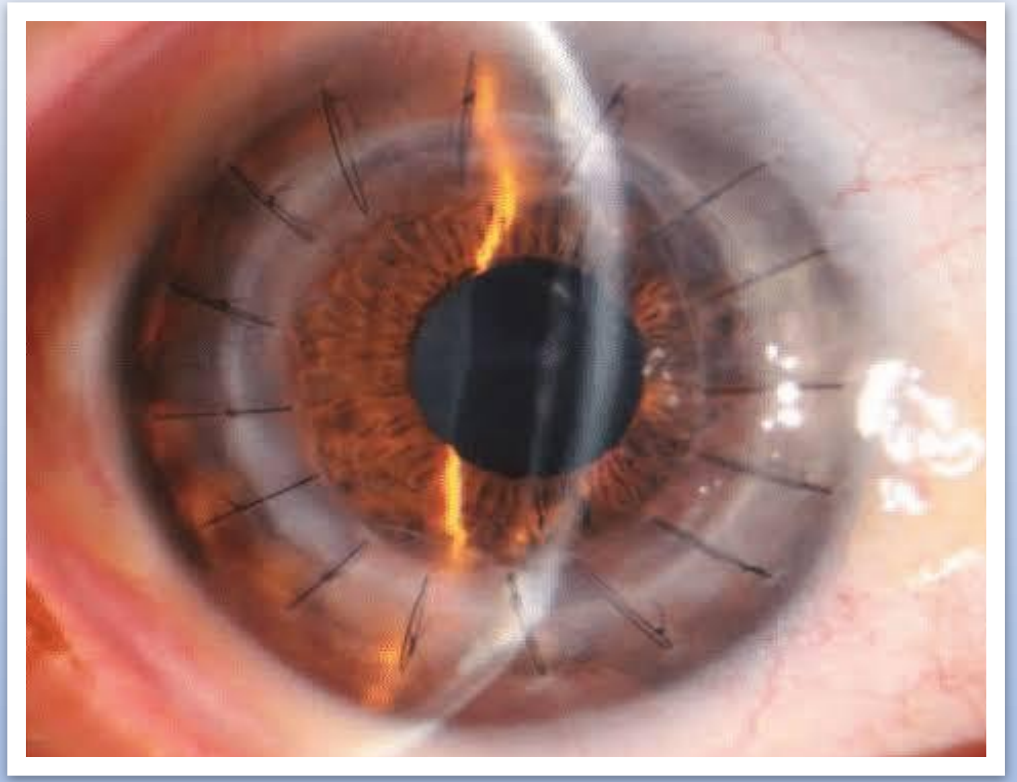
- **Penetrating Keratoplasty (PKP):** This is a traditional full-thickness corneal transplant surgery that involves removing the entire damaged or diseased cornea and replacing it with a healthy donor cornea. This procedure is commonly used for advanced stages of post LASIK ectasia.
- **Deep Anterior Lamellar Keratoplasty (DALK):** This is a partial-thickness corneal transplant surgery that involves replacing the outermost layers of the damaged cornea with a healthy donor cornea while preserving the innermost layers (Descemet's membrane and Endothelium). DALK is usually recommended for early to moderate stage post LASIK ectasia.

Why DALK is preferred for post-LASIK ectasia:

- ***Preservation of the Endothelium:*** DALK preserves the endothelium, which is responsible for maintaining the cornea's clarity and regulating fluid exchange. Preserving the endothelium reduces the risk of rejection and improves the visual outcome.
- ***Reduced Complications:*** DALK has a lower rate of complications such as graft rejection, infection, and wound dehiscence than PKP.
- ***Lesser Dependency on Donor Availability:*** In DALK, only the anterior part of the cornea is replaced, leaving the innermost layers intact and hence, it reduces the dependency on the availability of a suitable donor.
- Overall, these advantages make DALK a preferred surgical option over PKP for the treatment of post LASIK ectasia. However, PKP may still be necessary in more advanced stages of post LASIK ectasia when DALK is not feasible.



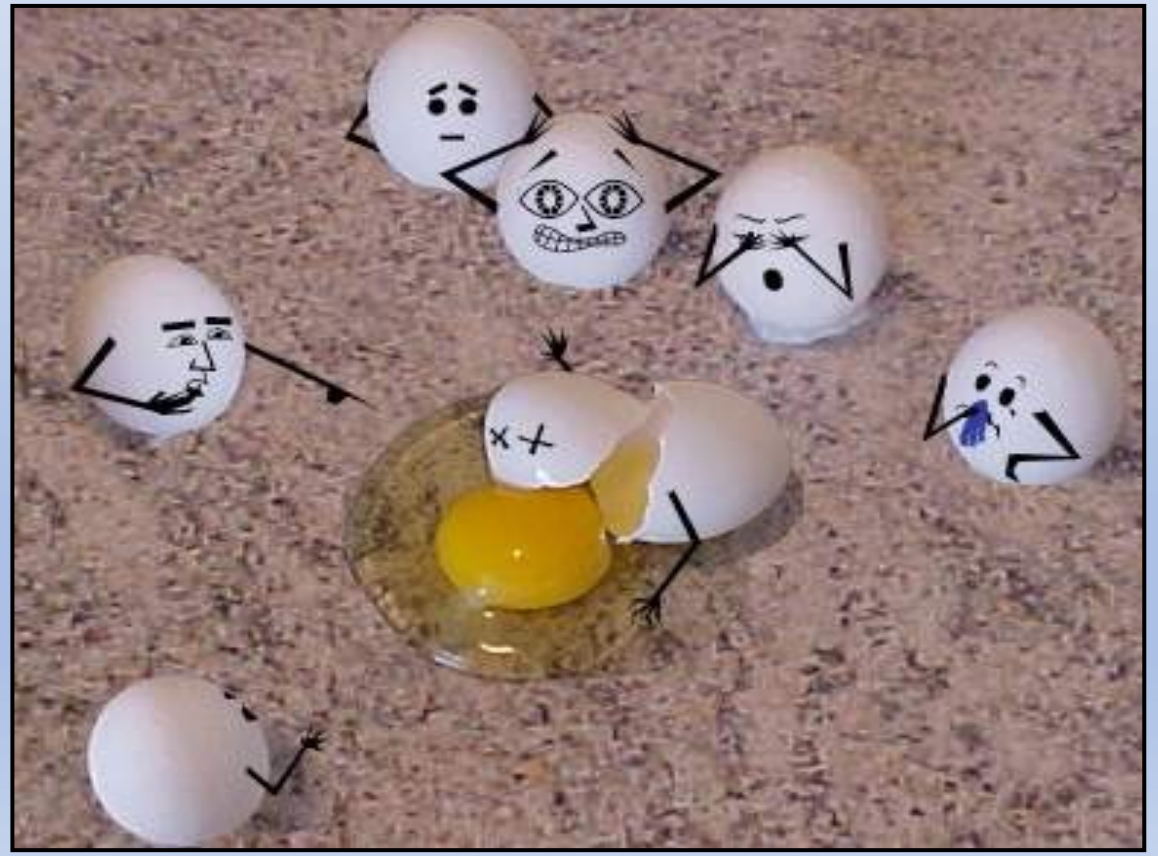
PKP



DALK

Take home message:

The best treatment of post-LASIK ectasia is to know how to prevent its occurrence.



THANK YOU

For your attention