ANTERIOR SEGMENT OPTICAL COHERENCE TOMOGRAPHY (CASIA)

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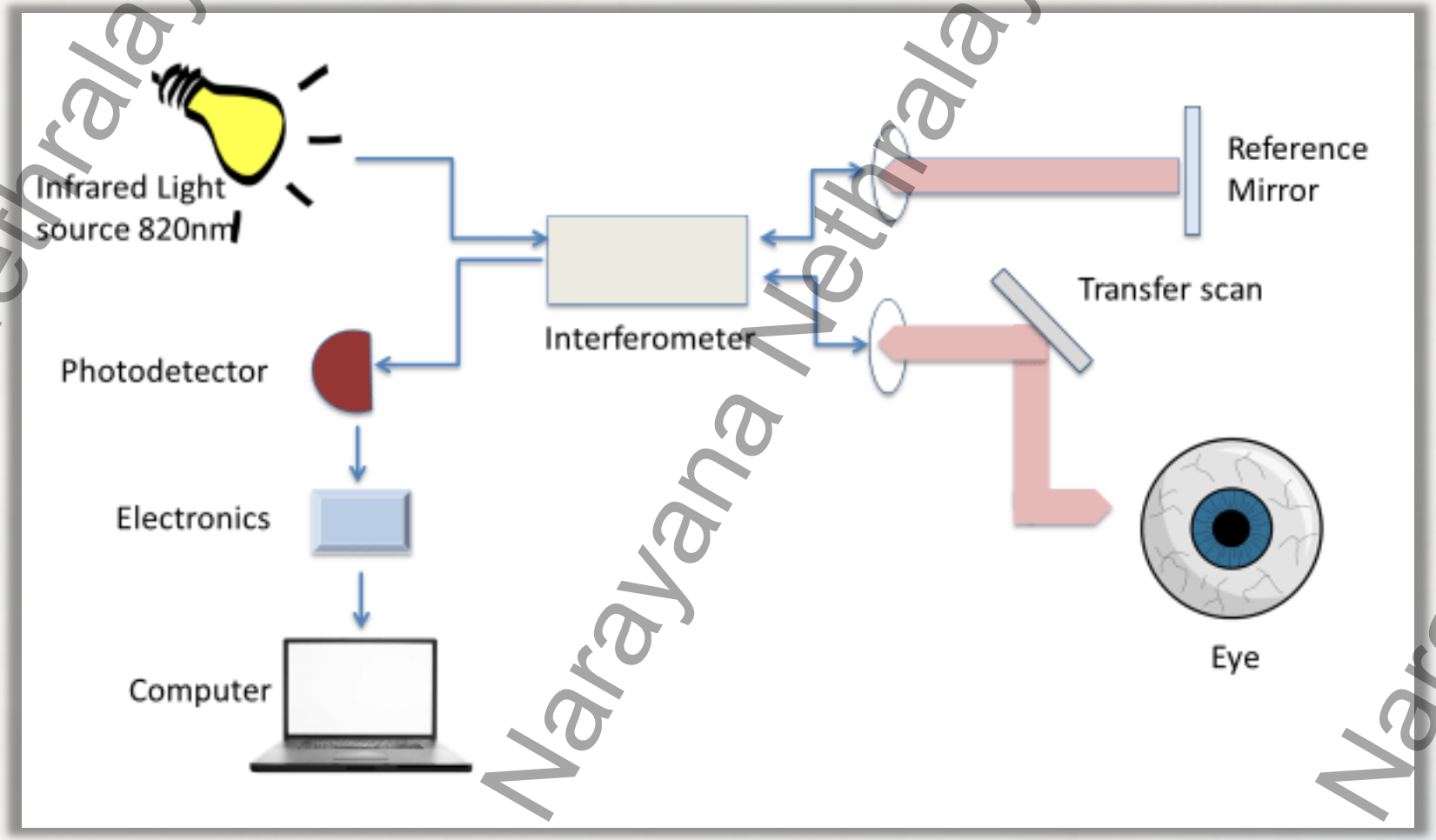
PRINCIPLE OF OCT



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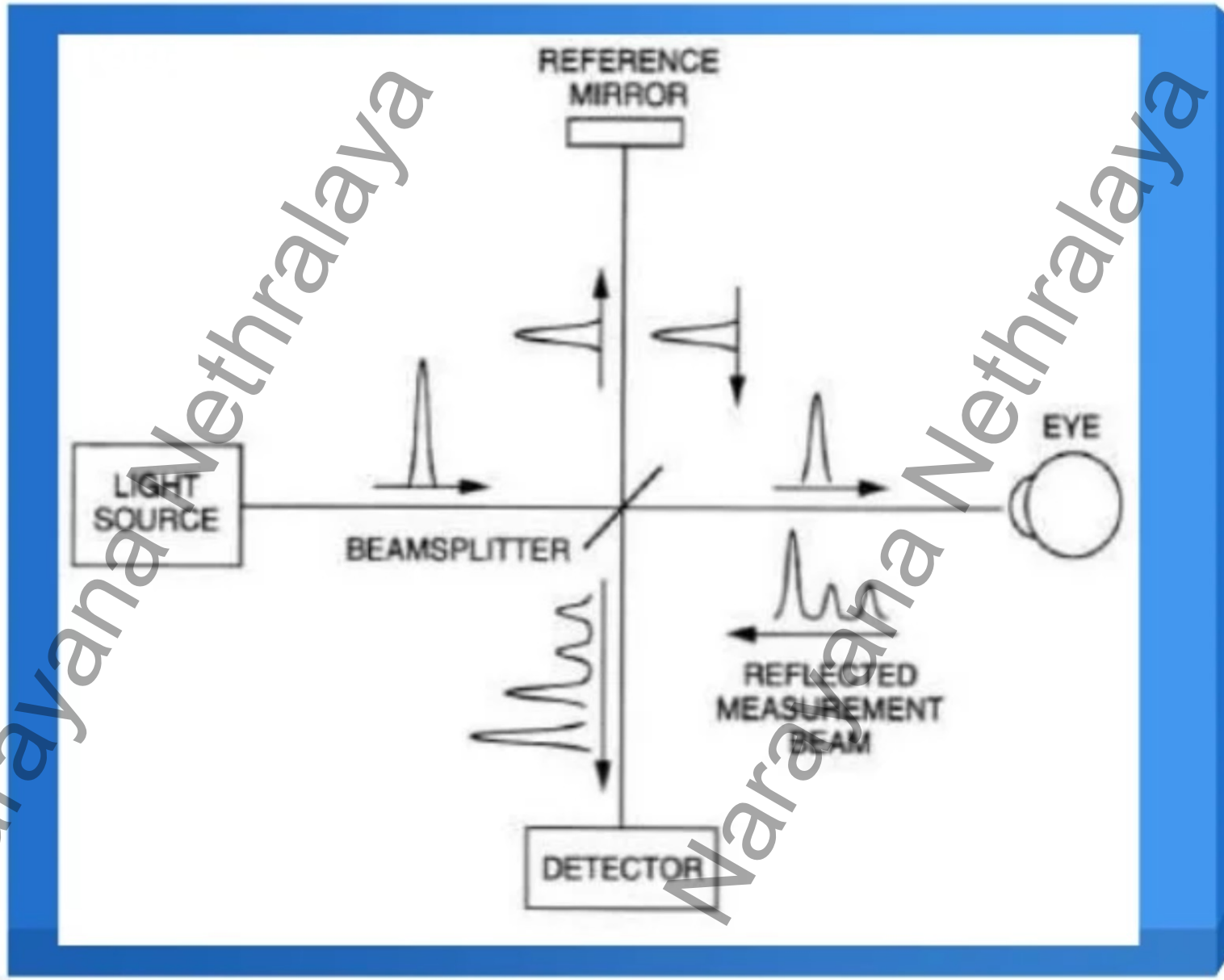

Low-Coherence Interferometry Principle

Picture courtesy: https://www.routledgehandbooks.com/doi/10.1201/9781315373027-4/

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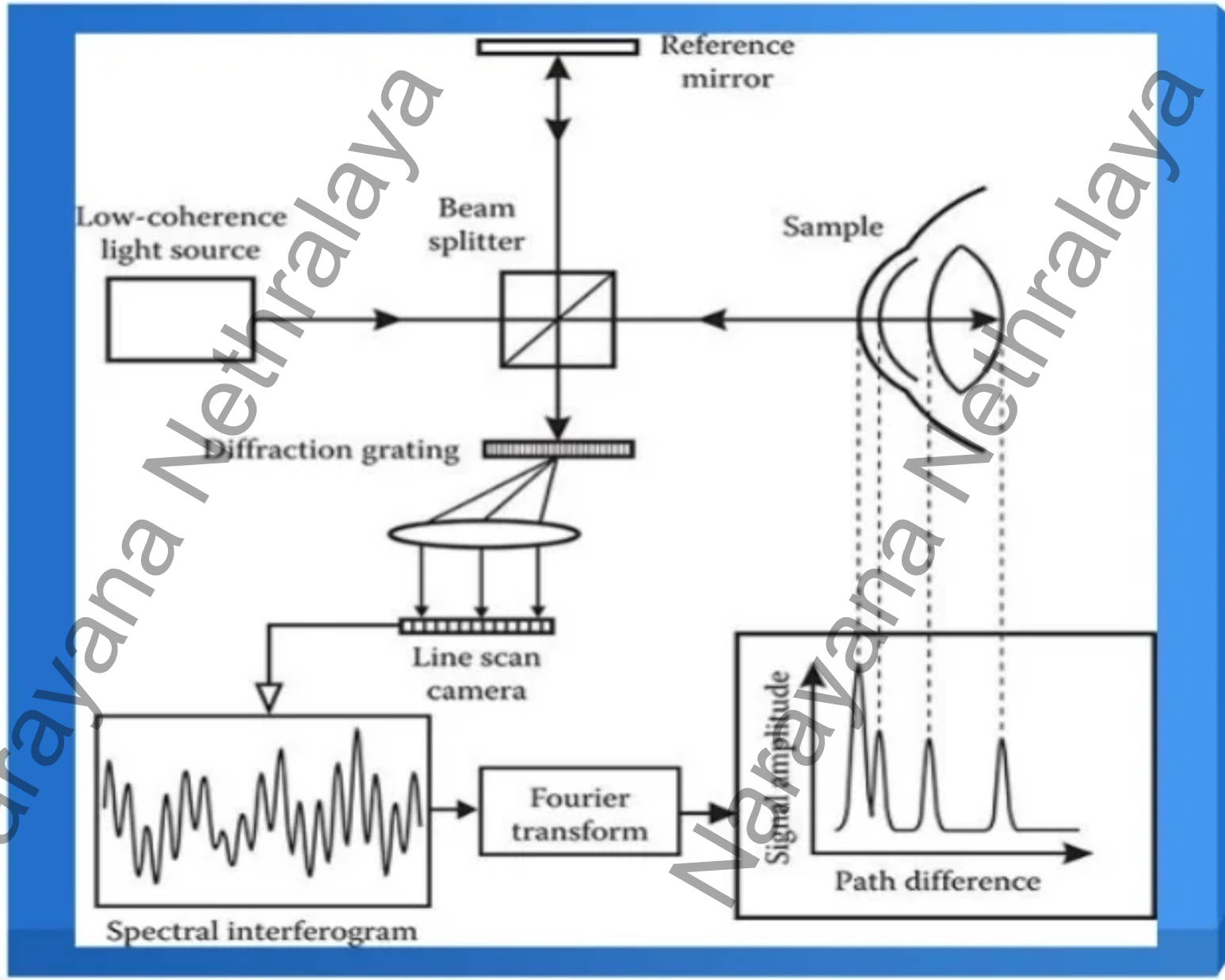

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DIFFERENTIAL FEATURES	TIME DOMAIN	SPECTRAL DOMAIN	SWEPT-SOURCE
IMAGE ACQUISITION	Superluminescent diode, 810nm Single photon detector, moving mirror	Broadband superluminescent diode source, 840nm, array of detectors, fixed mirror	Swept-source tunable laser, 1050nm Single detector
SCANNING SPEED	400 A-Scans/second	27,000-70,000 A-Scans/second	1,00,000-4,00,000 A-Scans/second
AXIAL RESOLUTION	10um	5-7um	5um
TRANSVERSE RESOLUTION	20um	14-20um	20um
RANGE OF IMAGING	Vitreoretinal interface to RPE	Posterior cortical vitreous to sclera using EDI mode	Posterior cortical vitreous to sclera (superior to SD-OCT with EDI)

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TD-OCT and SD-OCT

- Reference mirror – Varied
- Compares time delay
- Visante OCT
- Hiedelberg Slit Lamp OCT
- Wavelength – 1310nm
- Scan width – 16mm
- Scan depth – 6mm
- Resolution – **18 µm** in the axial plane and **60 µm** in the lateral plane

- Reference mirror – Stationary
- Spectrometer – Employed
- Spectralis – OCT
- Cirrus OCT
- Wavelength – 830nm
- Scan width – 3-6mm
- Scan depth – Less than TD-OCT
- Resolution – **4-7 µm** in the axial plane

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- Don't require touch
- User friendly
- Take images quickly
- Well-tolerated by patients
- Can be used by operators with varying levels of experience

Acquired images can range from 3 to 5 microns in resolution

The eventual transition from TD to SD OCT devices (also known as Fourier-domain OCT) has facilitated faster scanning speeds, greater tissue penetrance, and higher axial resolution images due to use of shorter wavelengths of light.

Images with axial resolutions ranging from less than 5 microns (considered ultra-high resolution) to greater than 5 microns (considered high resolution) can now be obtained.

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Introduction

- Optical coherence tomography (OCT) which was first developed by Huang et al. is a **non-contact imaging technology** that produces detailed **cross-sectional images** (tomography) using **low-coherence interferometer** in the biological tissues.
- Anterior segment OCT in 1994
- It is used for imaging the
  - Cornea
  - Conjunctiva
  - Sclera
  - Anterior chamber
  - Adjacent anterior segment structures

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CIRRUS

ANTERION

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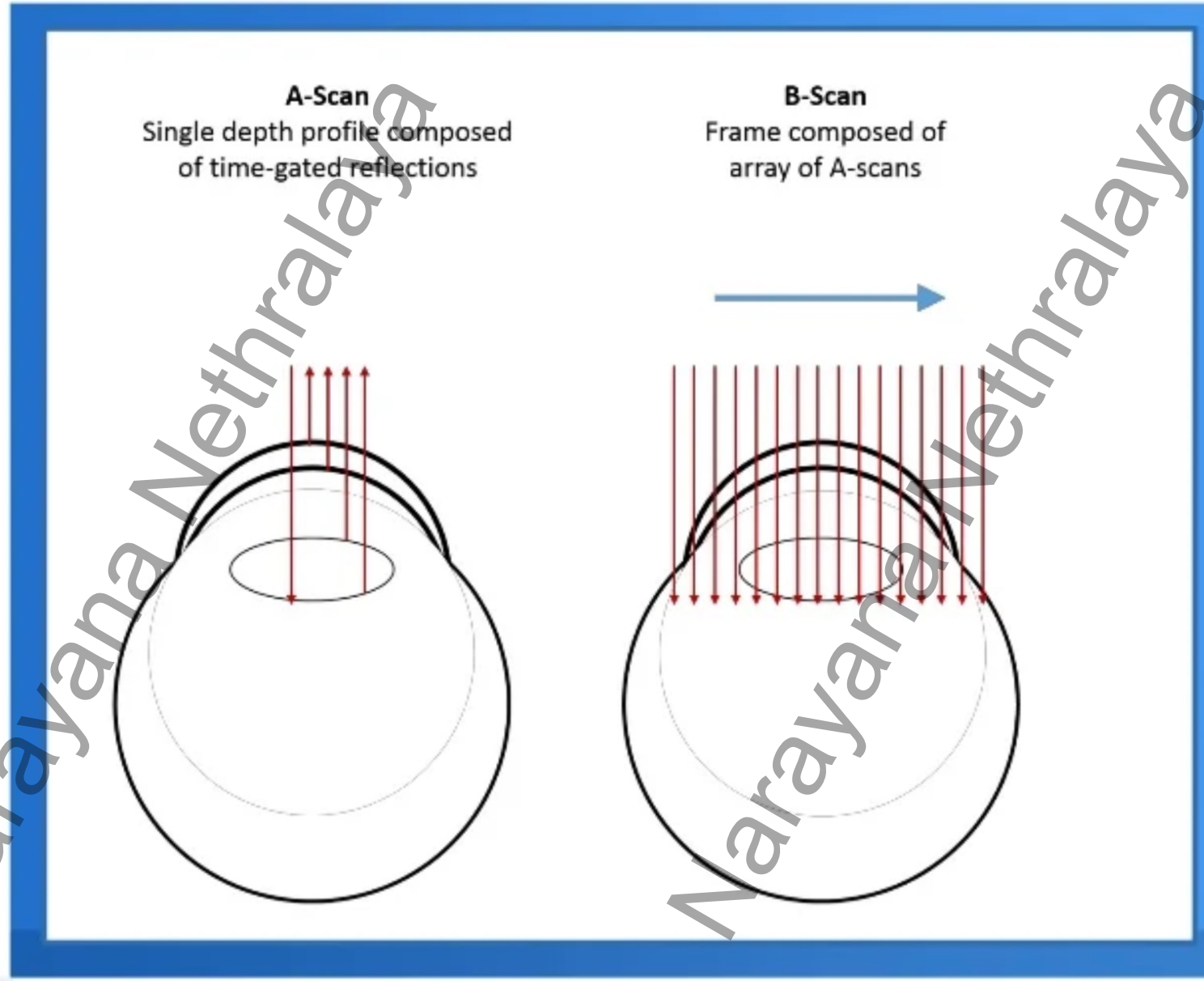
Low-Coherence Interferometry Principle



Picture courtesy: https://www.leica-microsystems.com/science-lab/what-is-oct-and-how-can-it-help-ophthalmologists-acquire-high-resolution-information-on-ocular-tissue/; https://www.slideshare.net/sealdioftal/oct-presentation

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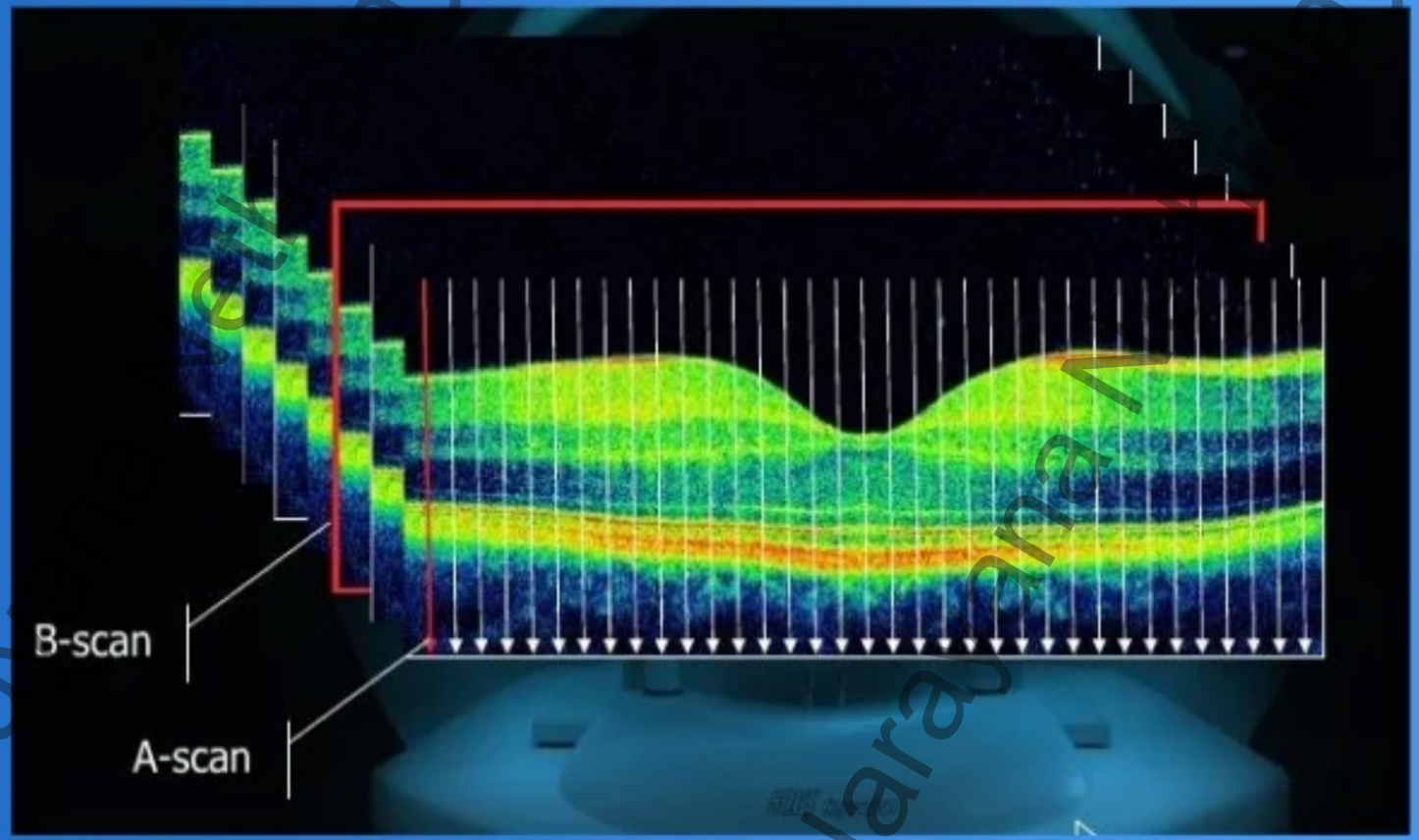

Picture courtesy: https://www.leica-microsystems.com/science-lab/what-is-oct-and-how-can-it-help-ophthalmologists-acquire-high-

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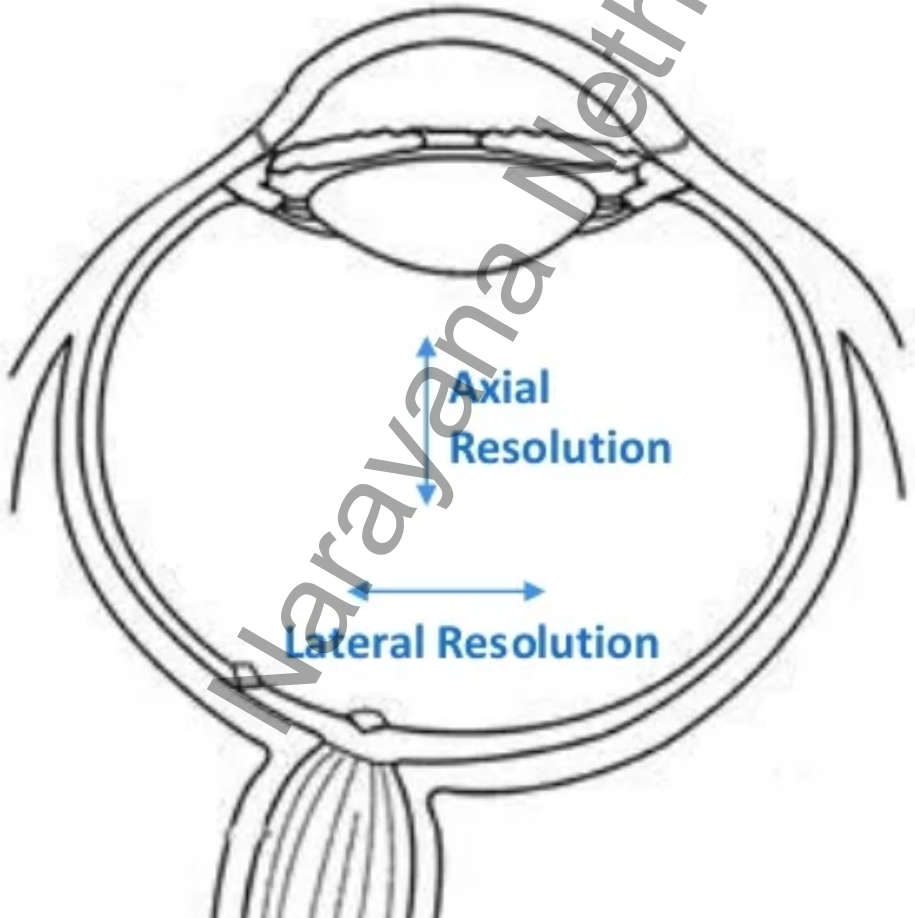
Axial and Lateral Resolution



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Imaging Modes

- High-Resolution Cornea Single – Single image will be obtained at the desired angle.
- High-Resolution Cornea Quad – 4 cross-sectional images are taken at 0 to 180, 45 to 225, 90 to 270, and 135 to 315 degrees, respectively
- Pachymetry
- Anterior Segment Single
- Anterior Segment Double – Images at pre-set angles of 20 to 200 and 160 to 340
- Anterior Segment Quad

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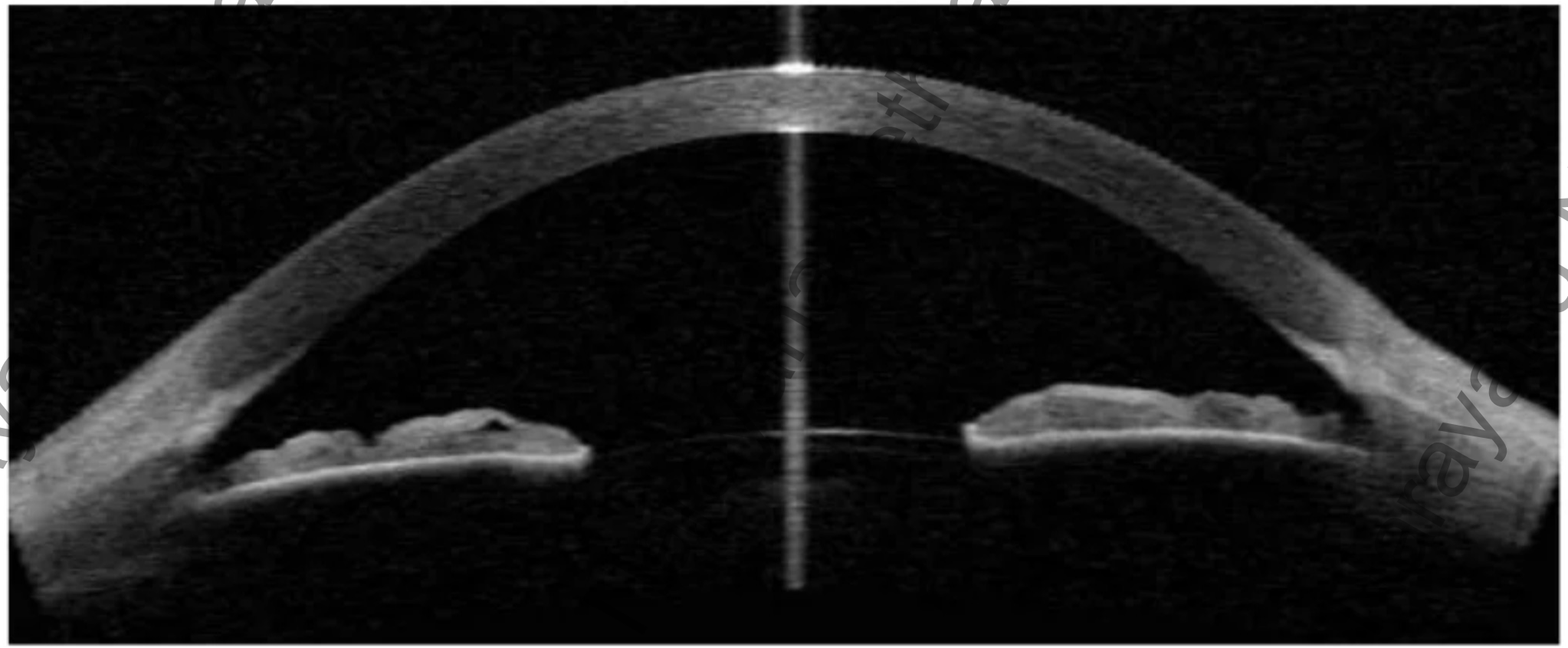
Normal AS-OCT Image



Picture courtesy: https://www.opsweb.org/page/ASOCT; Su-Ho Lim et al.

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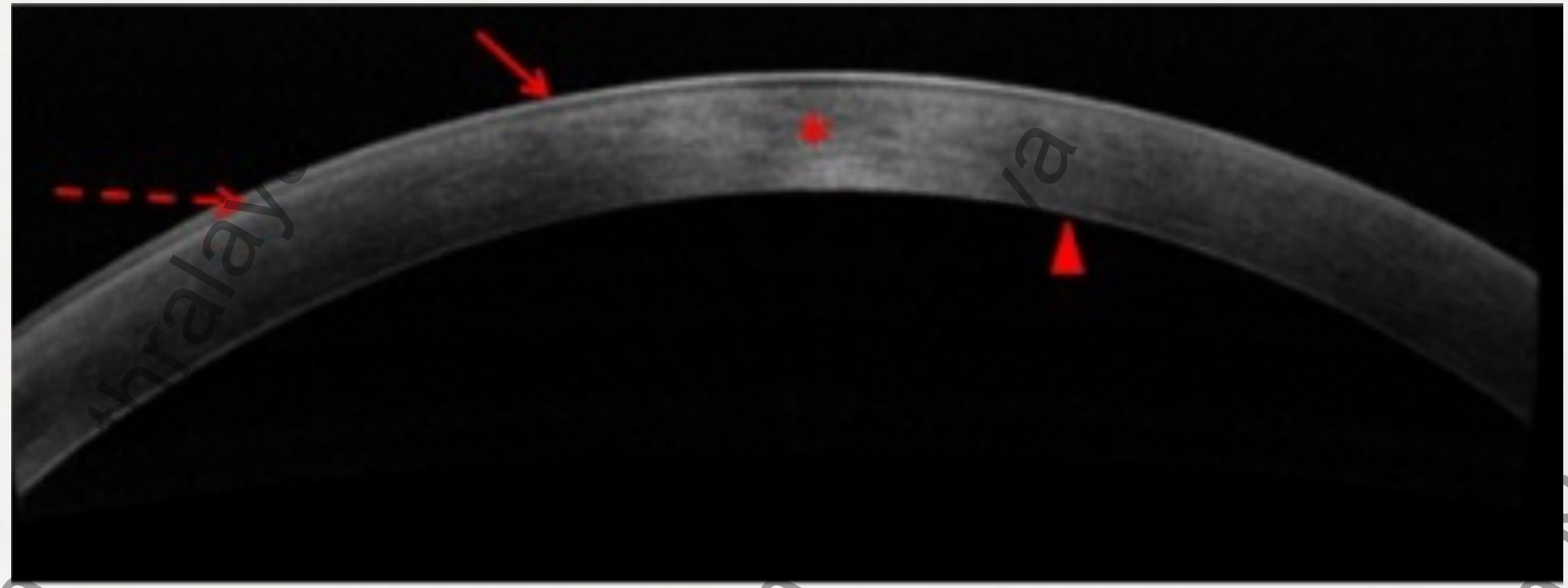

The tear film is the first, thin, hyperreflective layer.

It overlies a thin band of hyporeflective tissue which is the normal corneal epithelium (normally ~50-70 microns in thickness).

The underlying corneal stroma is thickened tissue with variable hyperreflectivity

corneal endothelium is a thin band of hyperreflective tissue

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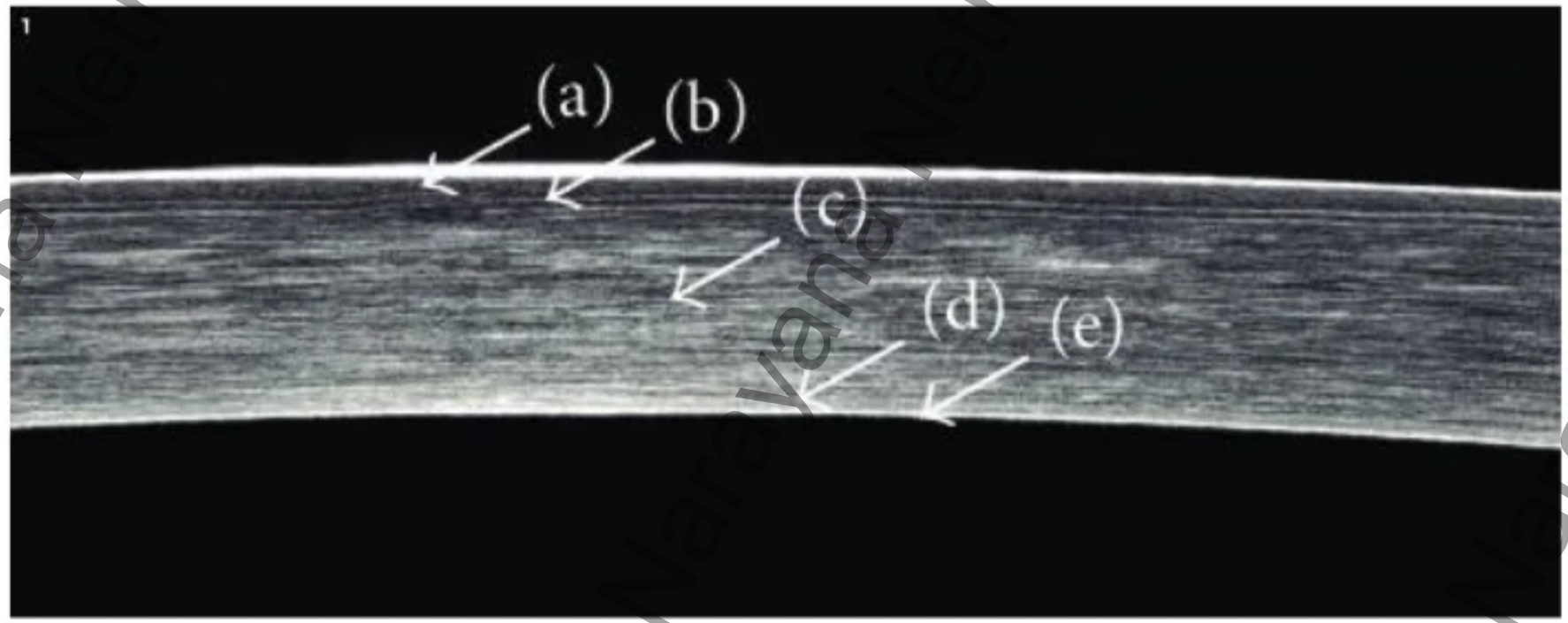
Normal AS-OCT Image



Picture courtesy: https://www.opsweb.org/page/ASOCT; Su-Ho Lim et al.

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Corneal Diagnostics

- Corneal scar
- Keratopathy
- Pre and post Lamellar transplantation procedures
- Keratoconus – Acute Hydrops, INTACS
- Pre-operative measurement for refractive surgeries
- Boston type-1 Keratoprostheses (K-Pro)
- Pathological conditions - Ocular surface squamous neoplasia and Salzmann nodular degeneration

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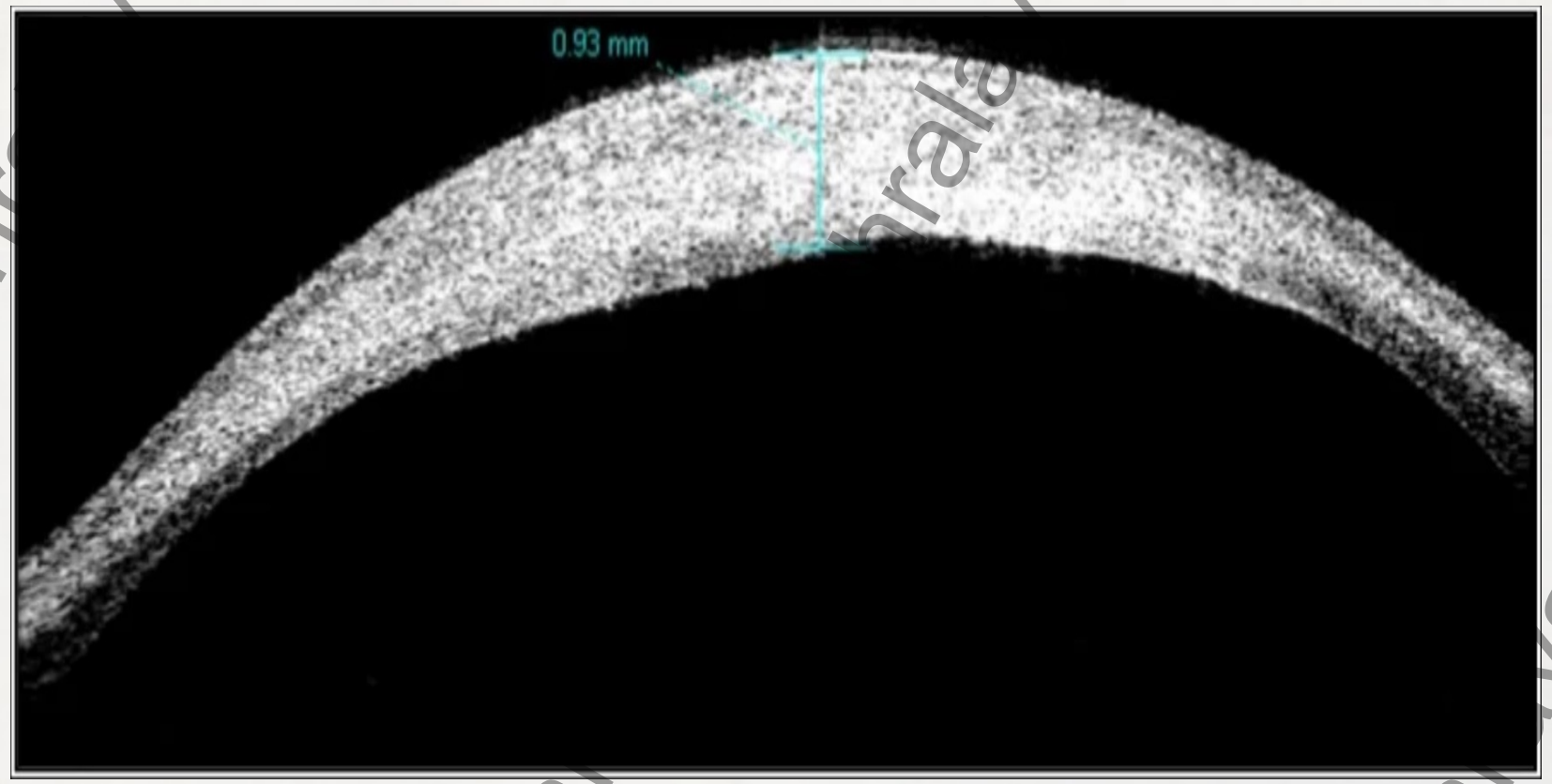

CORNEAL SCAR

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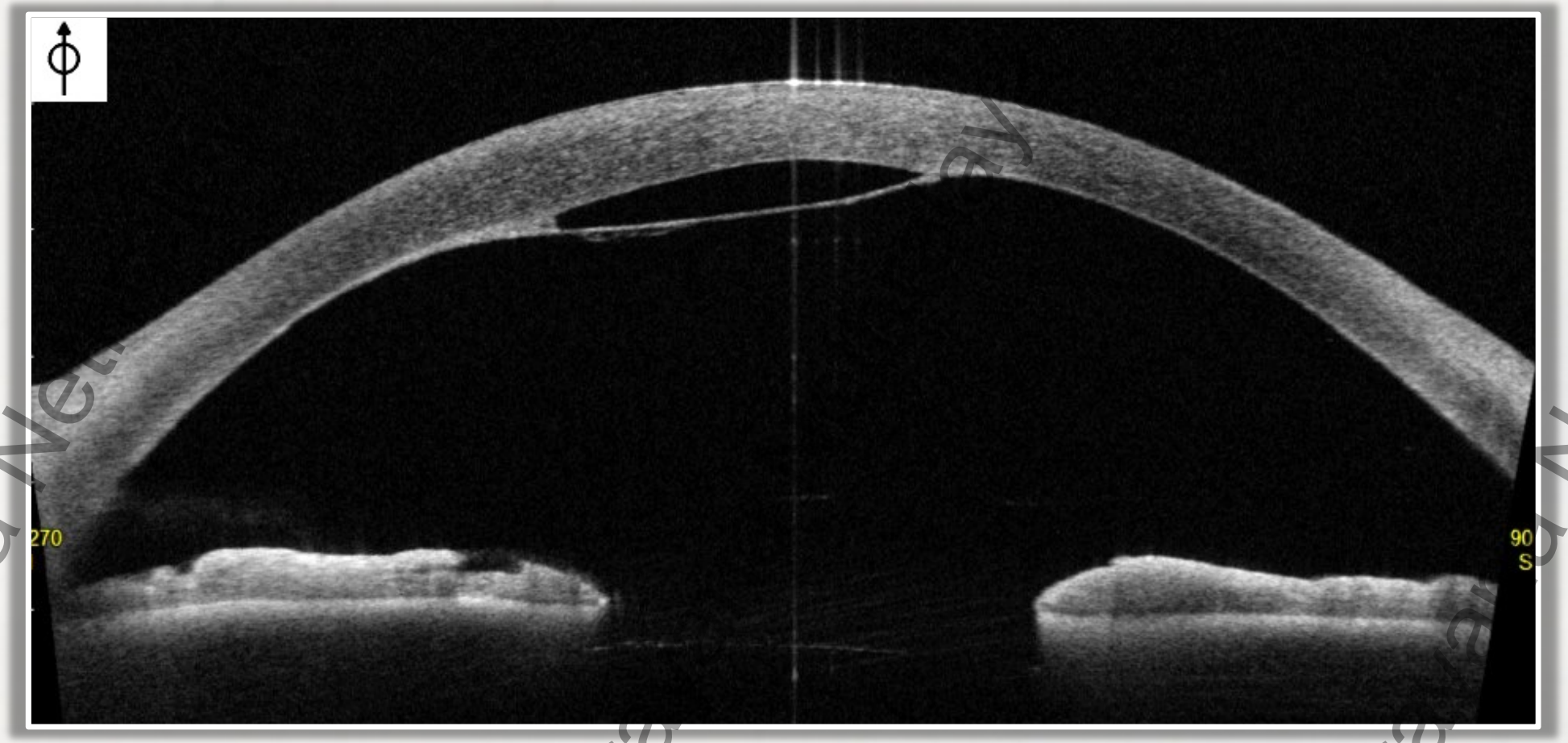

DESCEMET MEMBRANE DETACHMENT

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A 22-year old female prefers to have refractive surgery with -18.50DS in her right eye. What would be your suggestion for the type of surgery?

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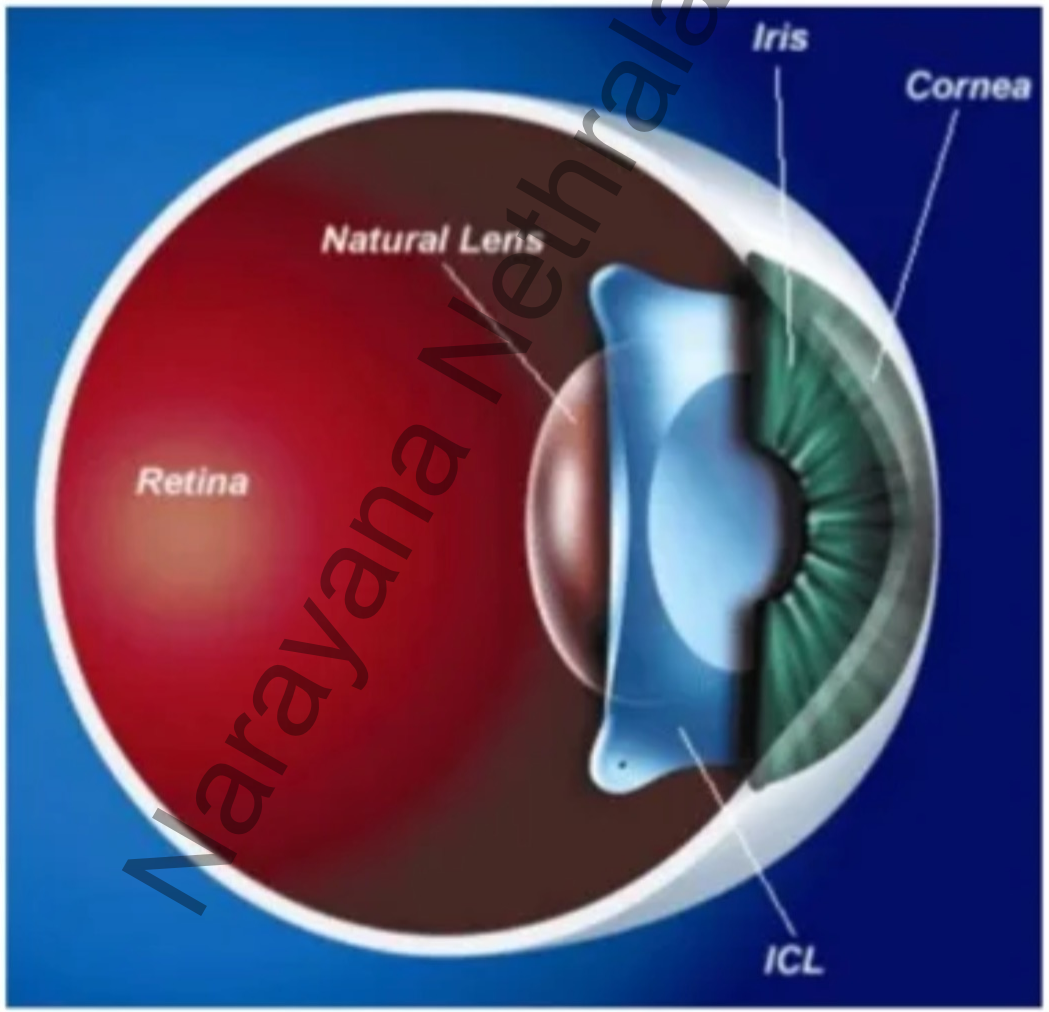
Picture Courtesy: https://groups.hyvor.com/EyeHealthBlog/322/myopia-nearsightedness

Implantable Collamer lens



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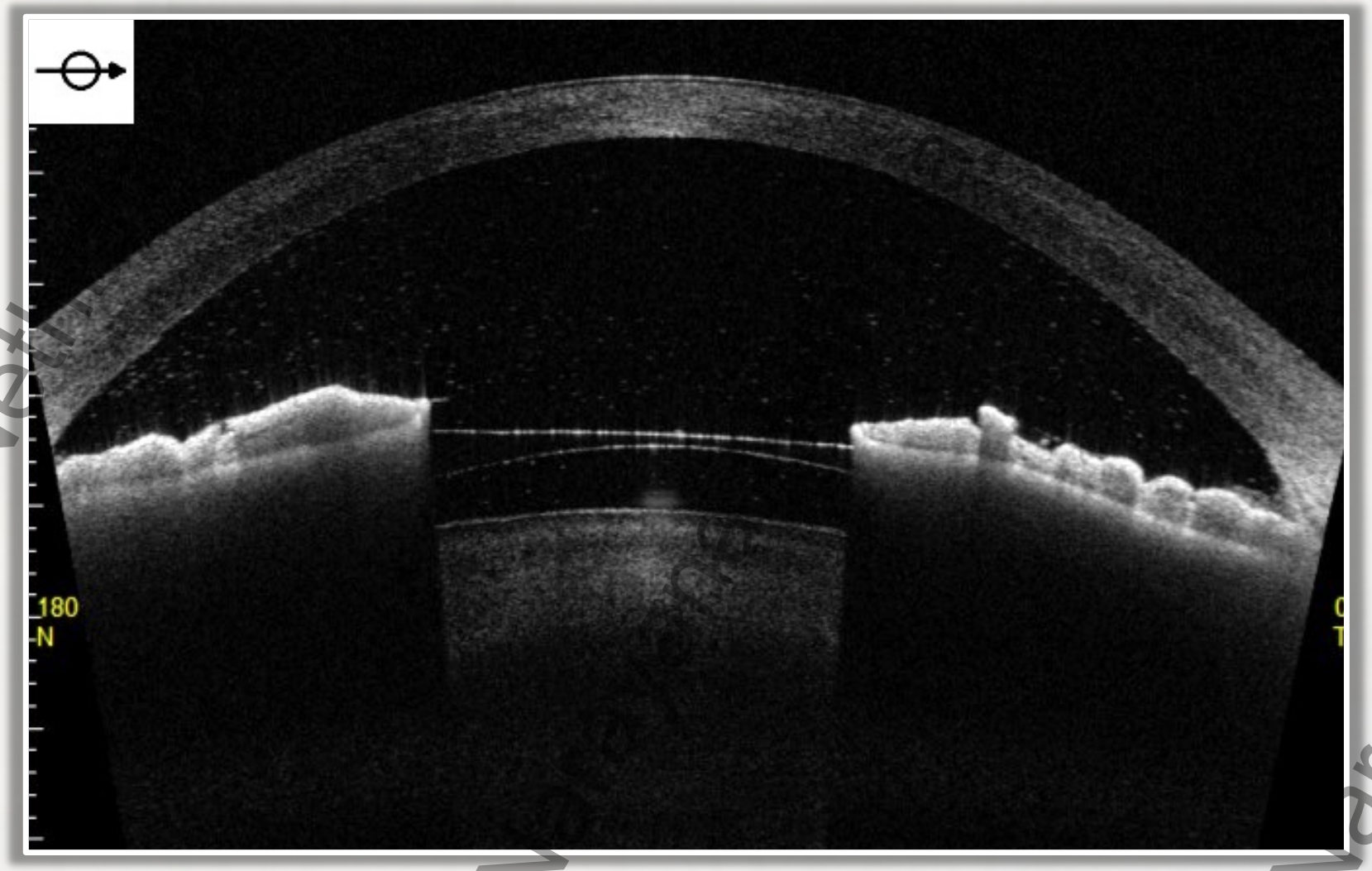

IPCL

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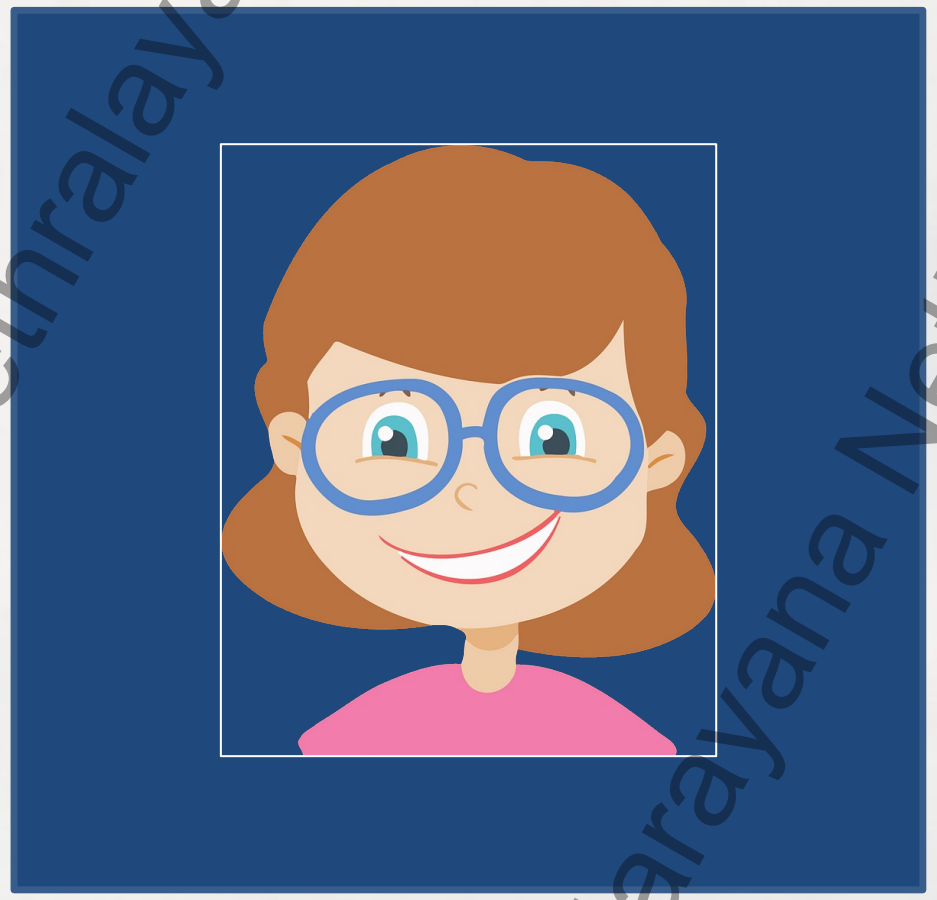
25 years old female who comes for refractive surgery opinion with refraction of -7.0 DS -1.25 @ 180 in one eye with poor biomechanical indices with a good pachymetry. What would be a good option for refractive surgery for her ?



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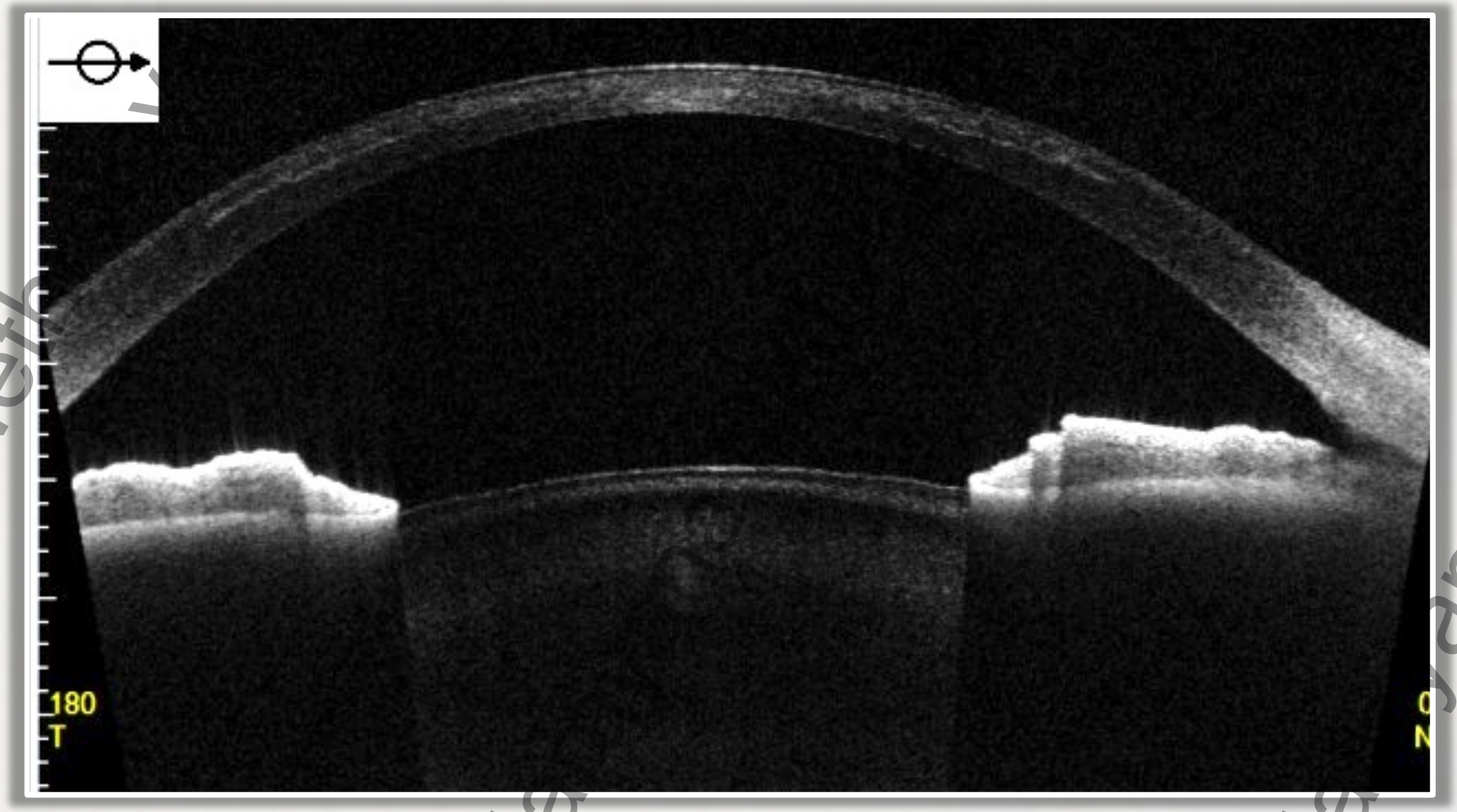

SMILE POST-OP 1 month

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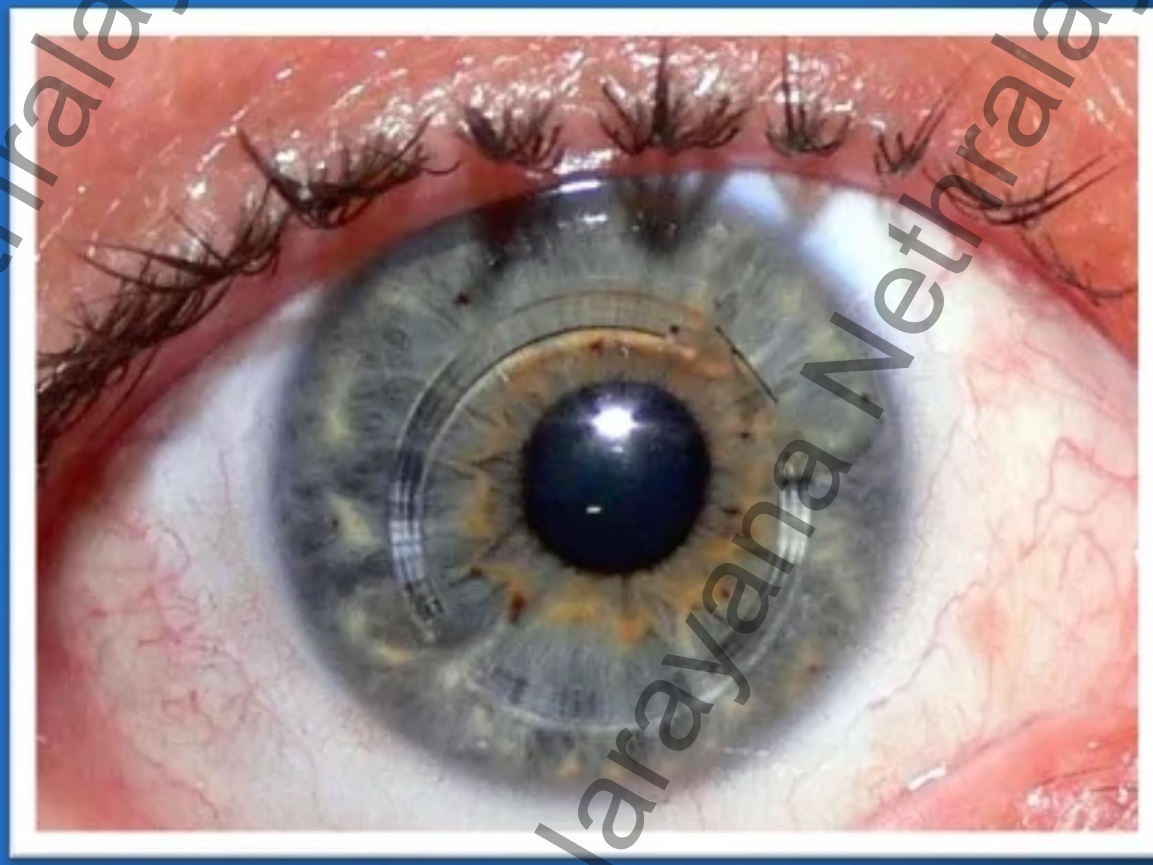
What do you see in this image?



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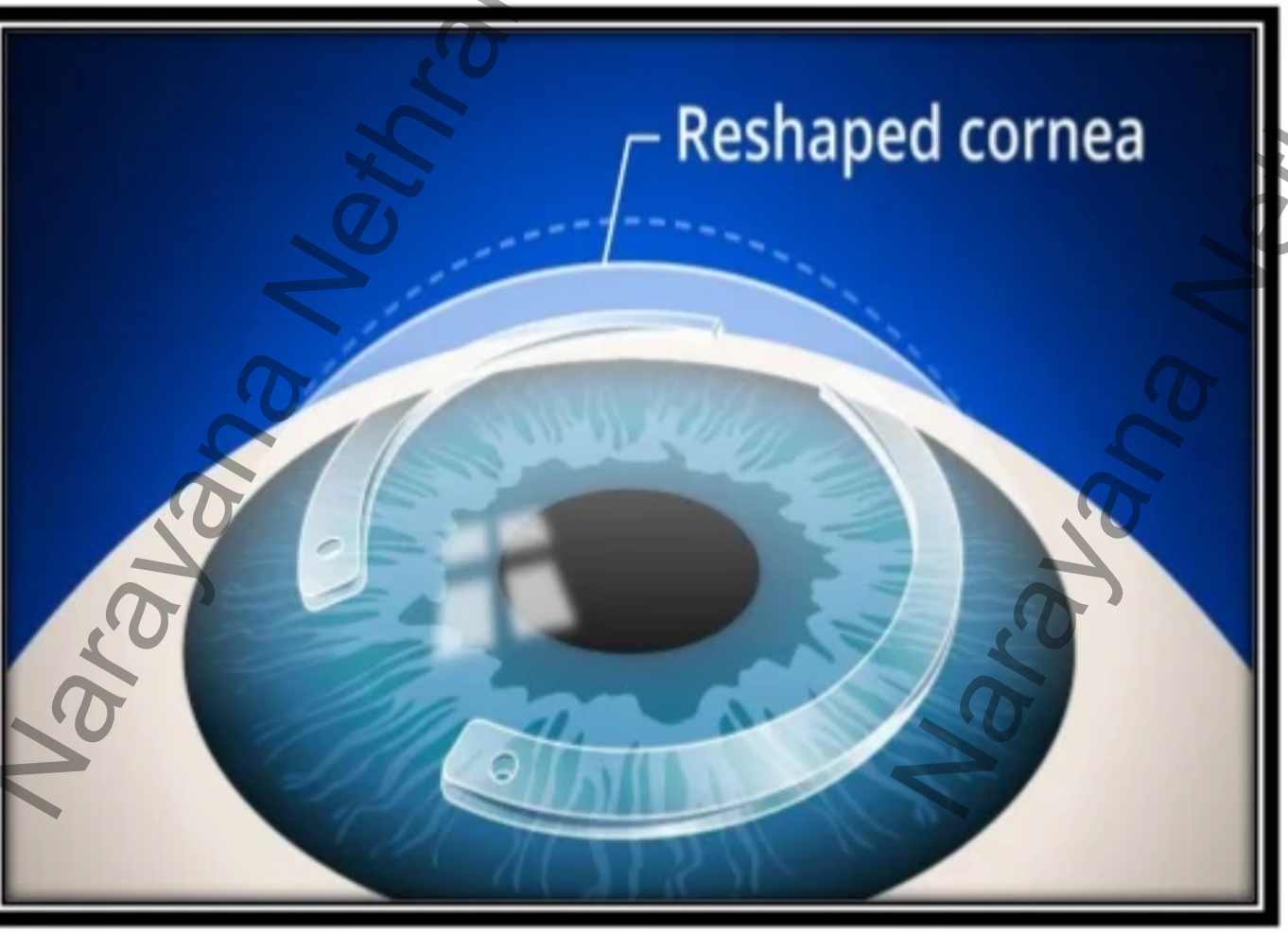
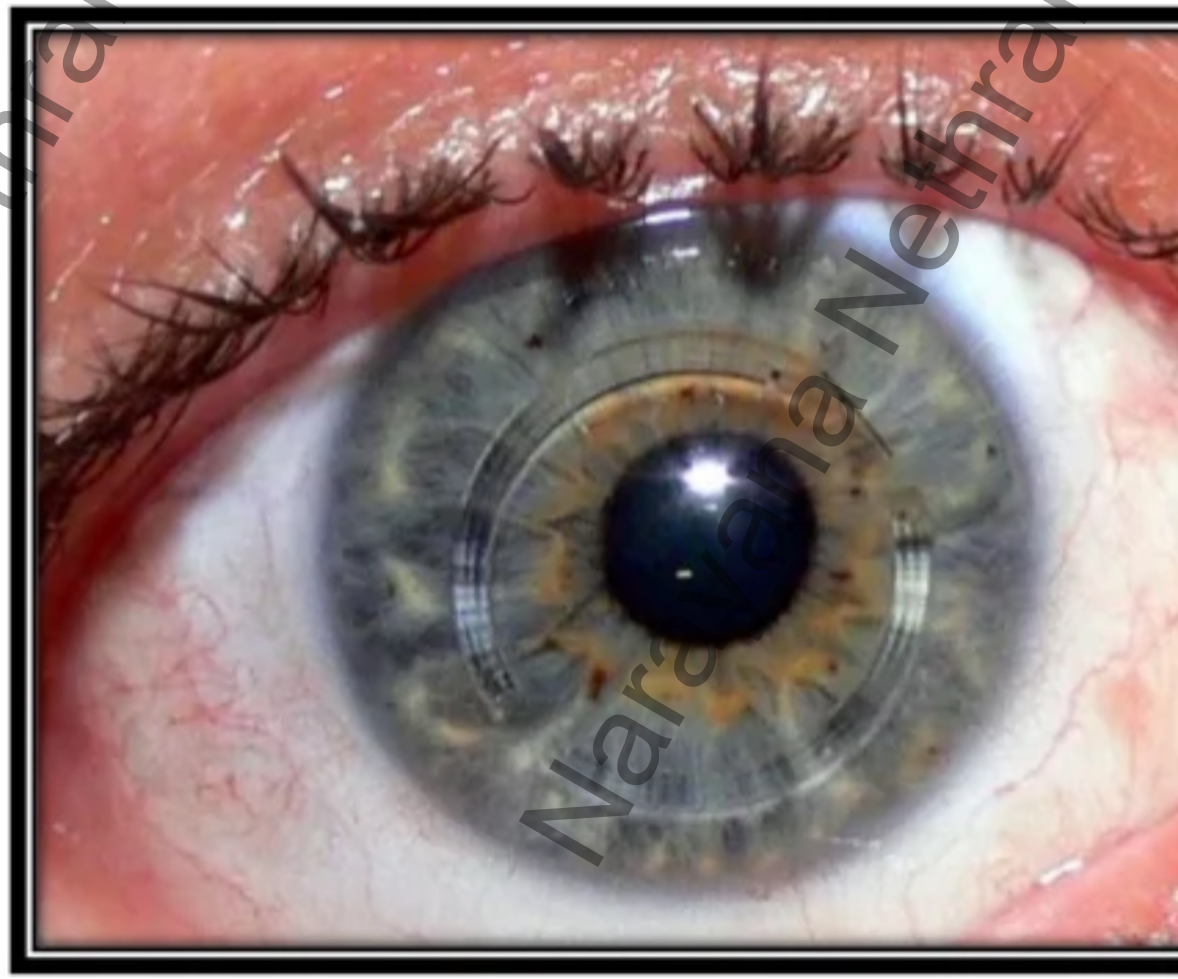
Intrastromal Corneal Ring Segments





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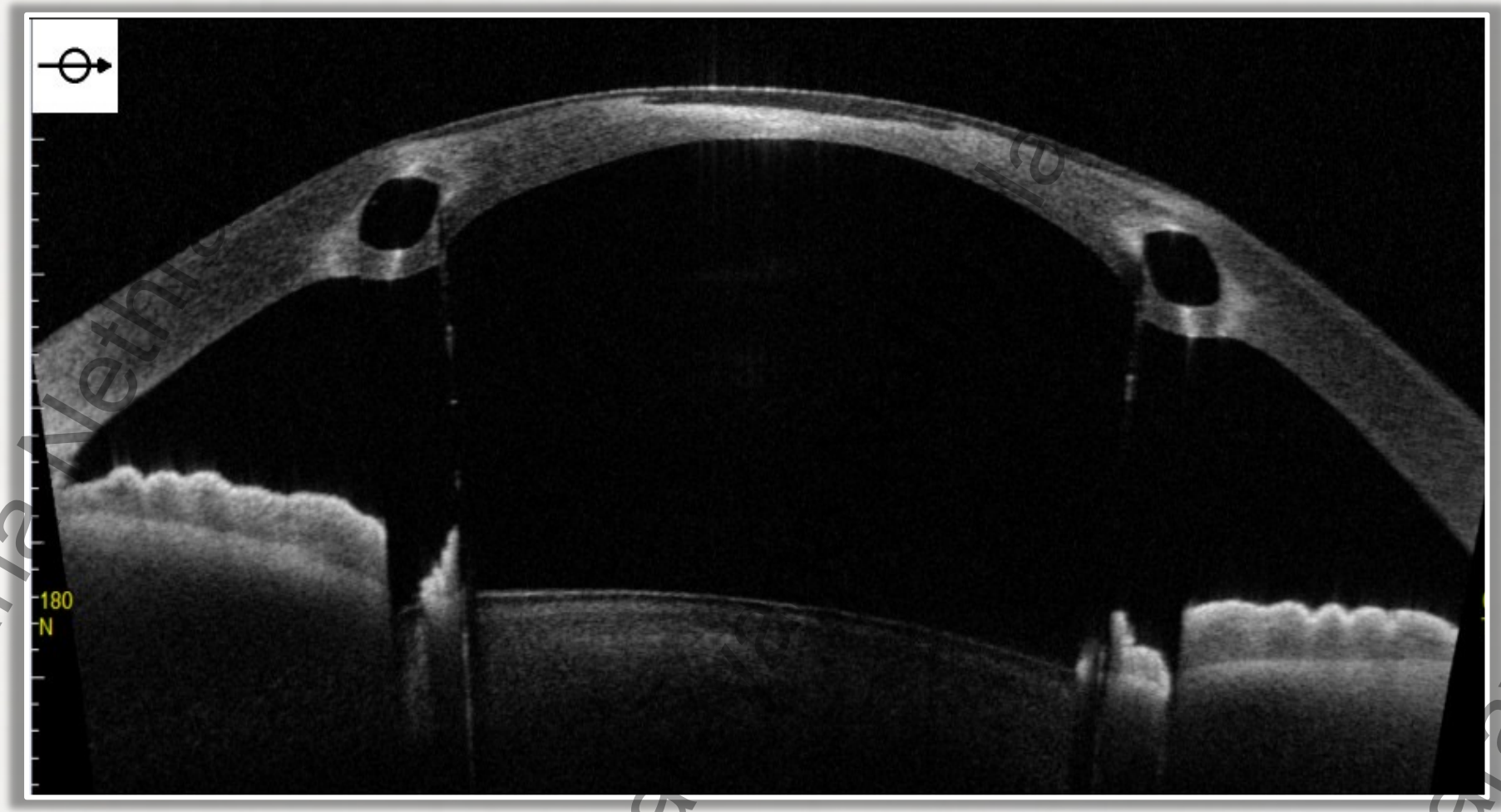
Picture Courtesy: https://www.allaboutvision.com/conditions/inserts.htm



INTRA CORNEAL RING SEGMENT (INTACS)

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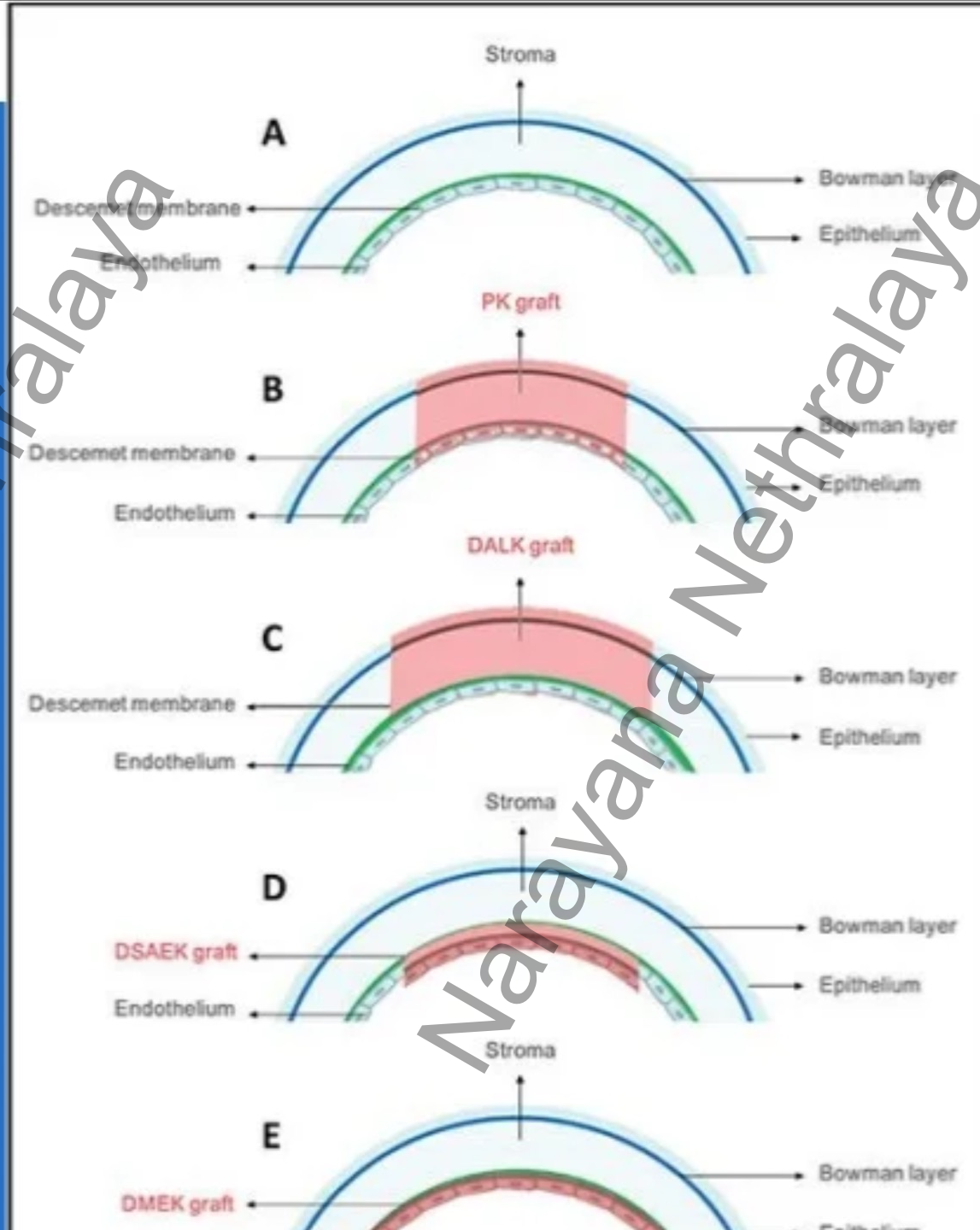
Corneal Grafts

- Penetrating Keratoplasty
- Deep anterior lamellar keratoplasty
- Descemet's stripping endothelial keratoplasty
- Descemet membrane endothelial keratoplasty



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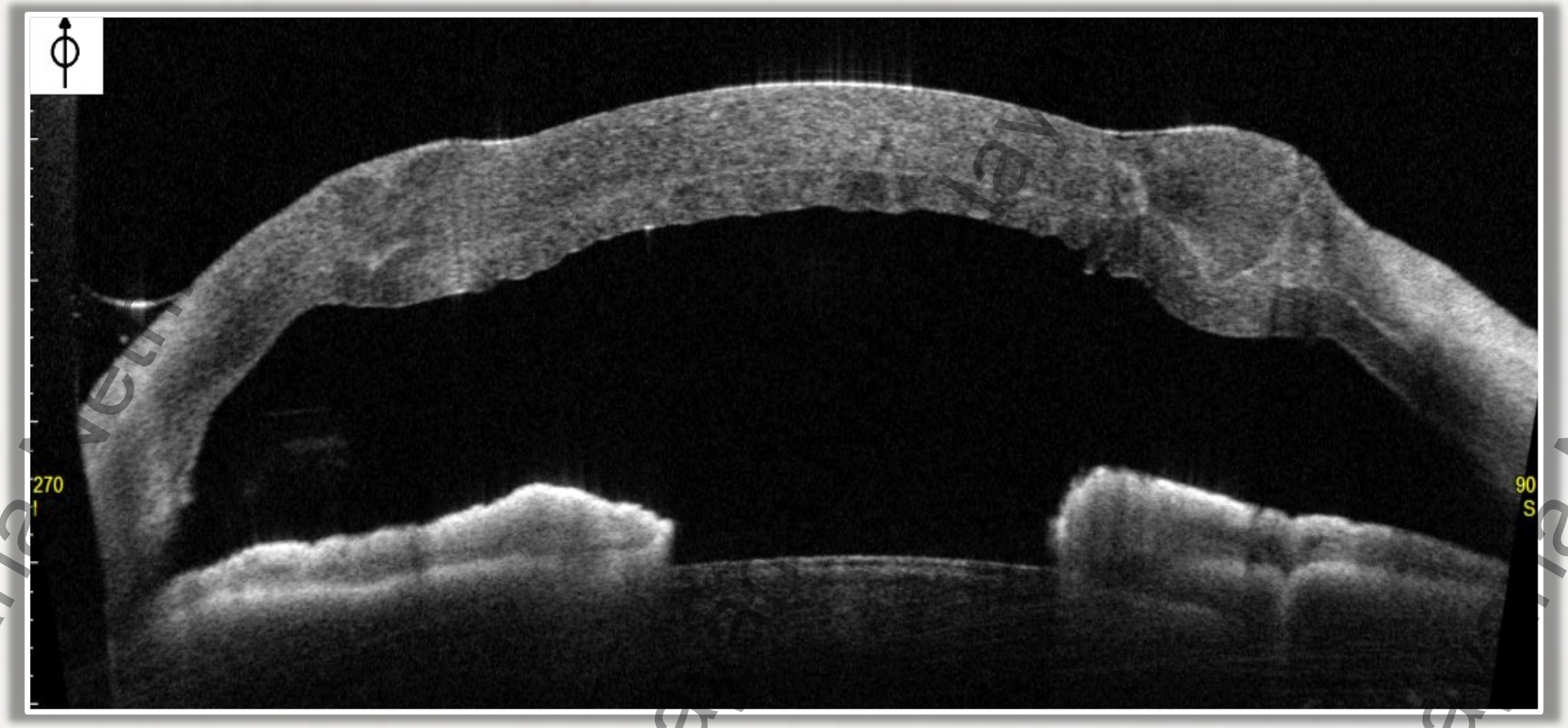

DEEP LAMELLAR ANTERIOR KERATOPLASTY - POSTOP

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