Keratometry

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What is a keratometer ??

- It is a diagnostic instrument for measuring the **curvature of the anterior surface of the cornea**, particularly for assessing the **extent and axis of astigmatism**

- Also known as **ophthalmometer**

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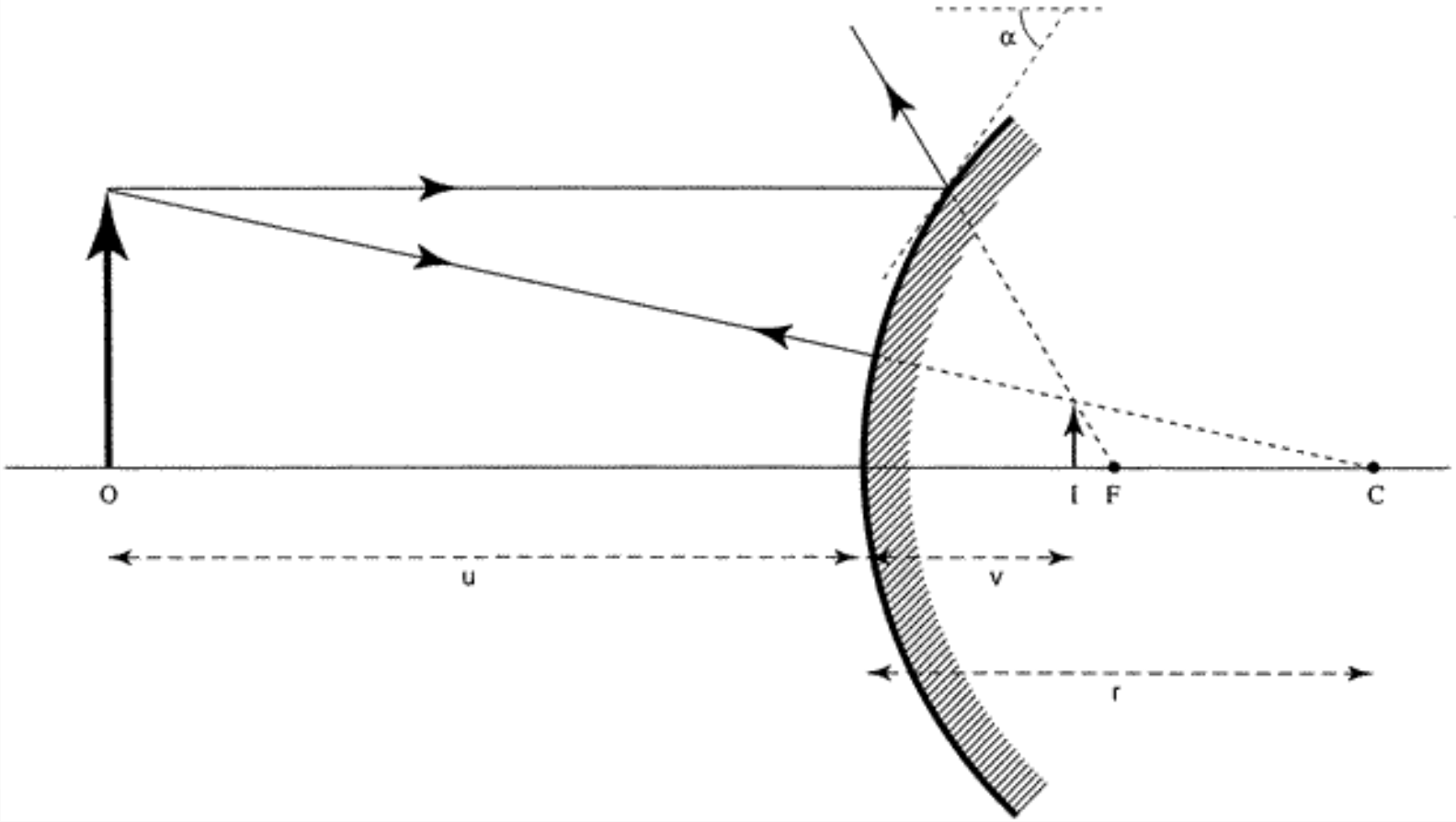
Principle

- **It is based on the fact that the anterior surface of the cornea acts as an convex mirror and the size of the image formed varies with its curvature**

- It is also based on that fact that the reflection by anterior surface allow to form a luminous pattern of mires in the centre of the cornea in an area of about 3.6mm in diameter

According to the principle



Types of keratometer

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- **Manual keratometer**
- Bausch and Lomb keratometer
- Javal-Schiotz keratometer

- **Automated keratometer**
- IOL Master
- Pentacam
- Orbscan
- Corneal Topography

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Manual keratometry

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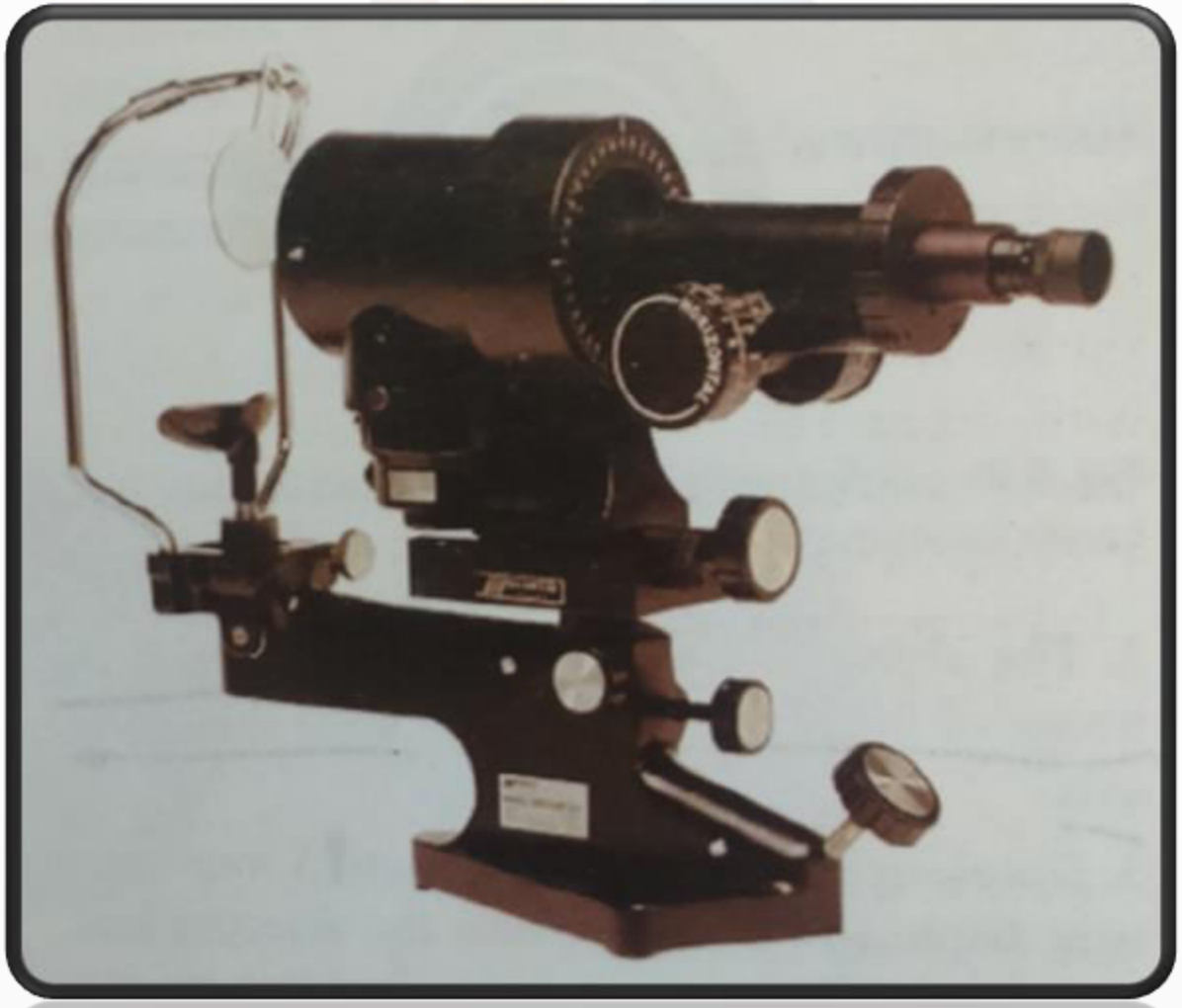
Bausch and Lomb keratometer



Bausch and Lomb keratometer

- It is a one position keratometer that gives readings in dioptric form

- Based on the principle of **constant object size** and **variable image size**

- **Range of keratometer. 36-52 D(6.5-9.38mm)**
- Its lower limit can extended upto **30D (5.6mm)**
- And upper limit upto **61D (10.9mm)**

Parts of B/L keratometer

- Object
- Objective lens
- Doubling prism and diaphragm
- Eyepiece lens

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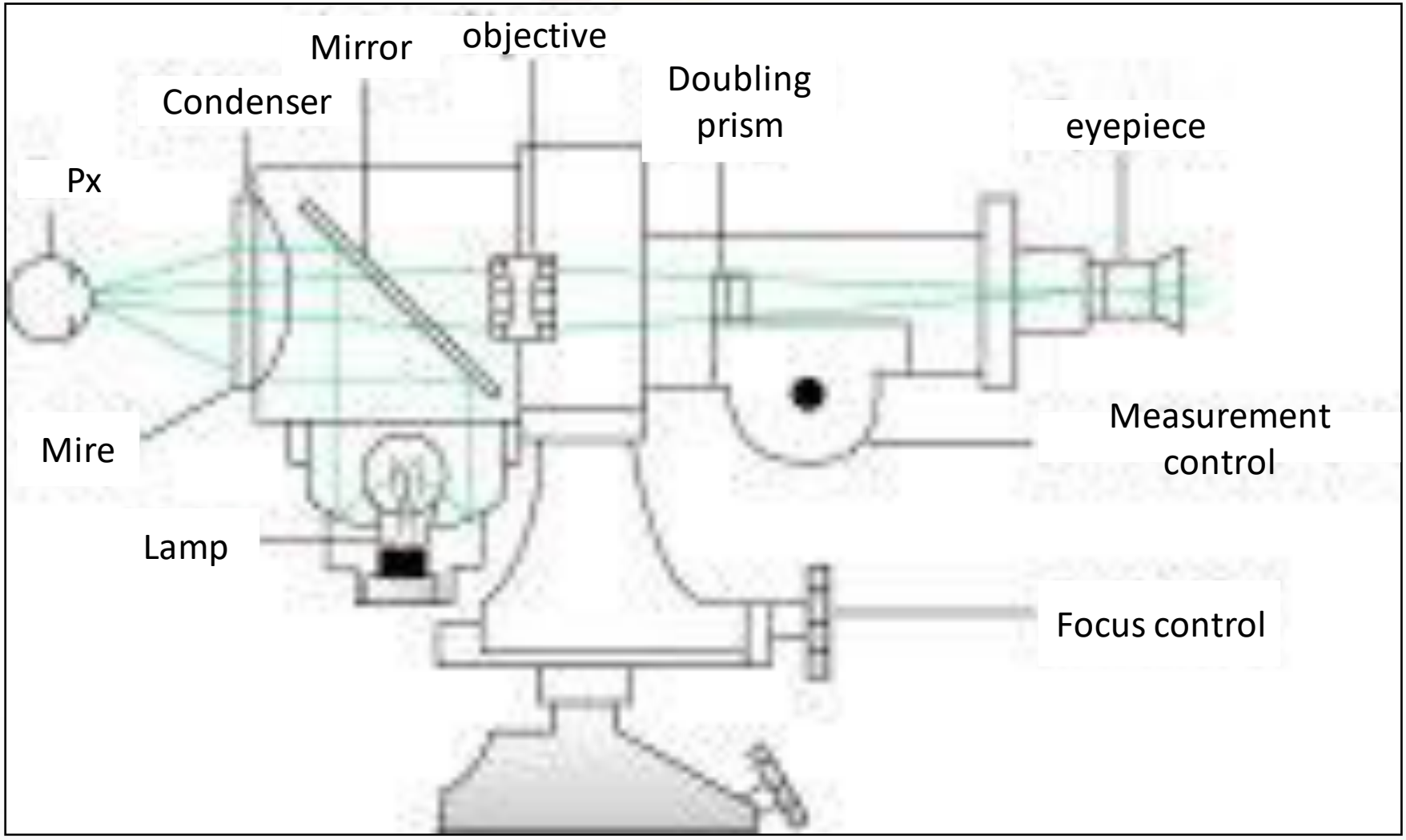
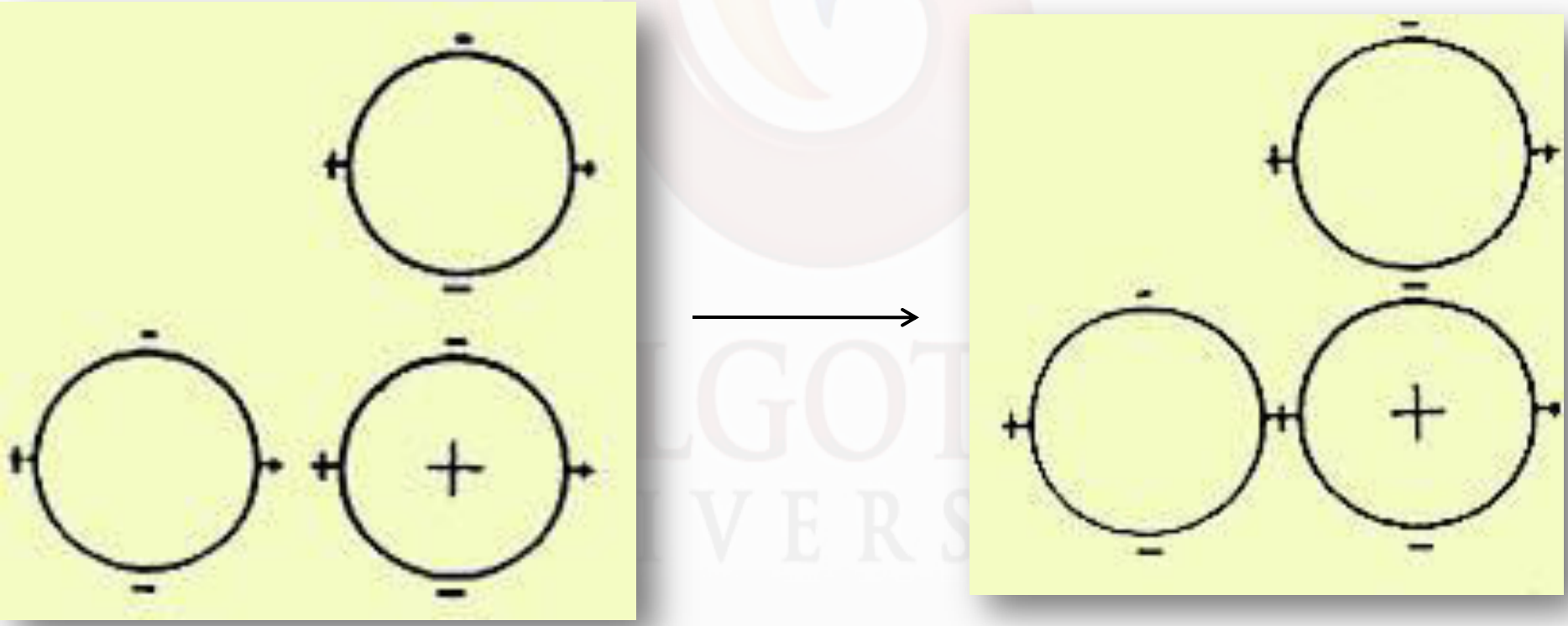

Mirror
objective
Condenser
Doubling
prism
eyepiece
Px
Mire
Measurement
control
Lamp
Focus control

- **Measurement of corneal curvature.** To measure the curvature in horizontal meridian, the plus signs of the central and left images are superimposed using the horizontal measuring control. Similarly, to measure the curvature in the vertical meridian, the minus signs of the central and upper images are coincided with vertical measuring control

In case of oblique astigmatism, the two plus signs will not be aligned. The instrument is then rotated till the two plus signs aligned. A scale associated with the instrument rotation indicates , in degrees, one meridian of oblique astigmatism

Keratometry procedure

- **Instrument adjustment.** The instrument is calibrated before use i.e. the mires should be in focus
- **Patient adjustment.** The patient is seated in front of the instrument with chin on the chin rest and head against the head rest. The eye not being tested should be occluded. The patients pupil and projecting knob should be at same level
- **Focusing of mire.** After adjusting the instrument and the patient, the mire is focused in the centre of the cornea



Interpreting the findings

- **Spherical cornea**

  -No difference in power between two principle meridia

  -The mires can be seen as perfect as a sphere

- **Astigmatism**

  -Difference in the power between two principle meridia

  -Horizontally oval mires are seen in with-the-rule astigmatism

  -Vertical oval mires in against-the-rule astigmatism

  -In oblique astigmatism, the principle meridia are between 30 - 60 and 120-150 °

- **Irregular anterior corneal surface**

-Irregular mires
-Doubling of mires

- **Keratoconus**
  -Jumping of mires
  -Minification of mires
  -Oval mires
  -Irregular, wavy and distorted mires

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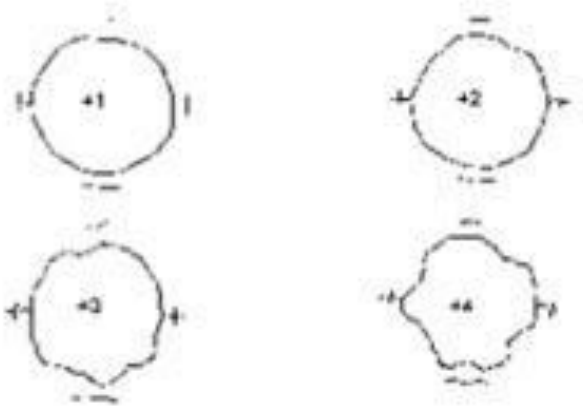
Sign: Irregular Astigmatism



- Keratometry shows irregular astigmatism, where the principal meridians are no longer 90 degree apart and the mires cannot be superimposed.

Astigmatism-Horizontal meridian

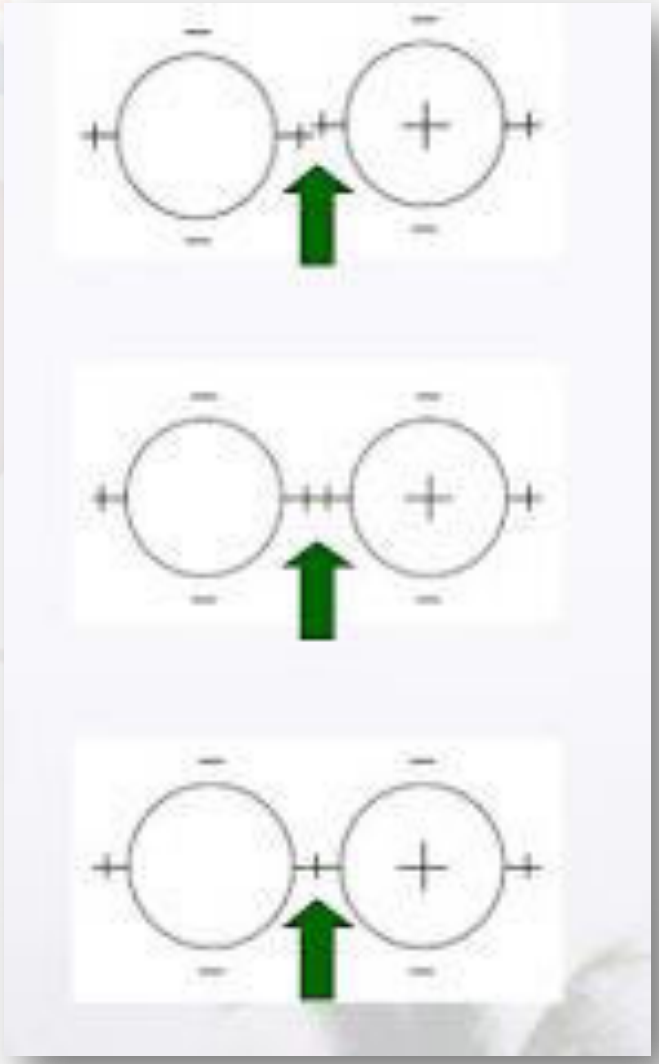
- Vertical misalignment of plus sign indicates astigmatism

- Correct axis alignment when the horizontal lines of the plus appear continuous

- **Measuring the horizontal meridian**

-Turn the horizontal measuring drum to superimpose the plus sign

-Leave horizontal measuring drum in this position



Keratoconus

- It is a degenerative disease of the cornea causing abnormal and irregular steepening of the cornea that results in reduced vision, scarring, and perforation of the cornea
- If the K readings are outside of what is considered a normal range or if there is irregularity in the mires, that instantly clues you into the potential pathology of keratoconus

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Clinical uses of keratometers

- Measurement of corneal astigmatic error
- It helps to estimate the radius of curvature of the anterior surface of the cornea
- Keratometer is used to monitor the shape of the cornea in keratoconus and keratoglobus
- Assess the refractive error in cases with hazy media
- It is used to monitor pre- and post- surgical astigmatism

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Limitation of keratometry

- It measures the refractive status of a very small central area of cornea **(3-4mm),** ignoring the peripheral corneal zones
- It loses its accuracy when measuring very flat or very steep cornea

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Manual Vs Automated keratometer

- **Manual keratometer** is preferred in patients

  With poor fixation

  Corneal abnormalities

  With distorted mires

  When cornea is highly toric

  When cornea is dry

- **Automated keratometry** is preferred in patients with readings less than 40 dioptres or greater than 46 dioptres

References

- Optics & Refraction, A K Khurana
- Clinical Optics, A R Elkington
- Optics for Optometry students
- Geometric,Physical and Visual Optics, Michael Keating
- Geometrical and Visual Optics, 2nd edition, Steven Schwartz

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