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INTERNATIONAL CONGRESS OF THE

EGYPTIAN OPHTHALMOLOGICAL SOCIETY

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PKP Plus....

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Head of R&D EWH



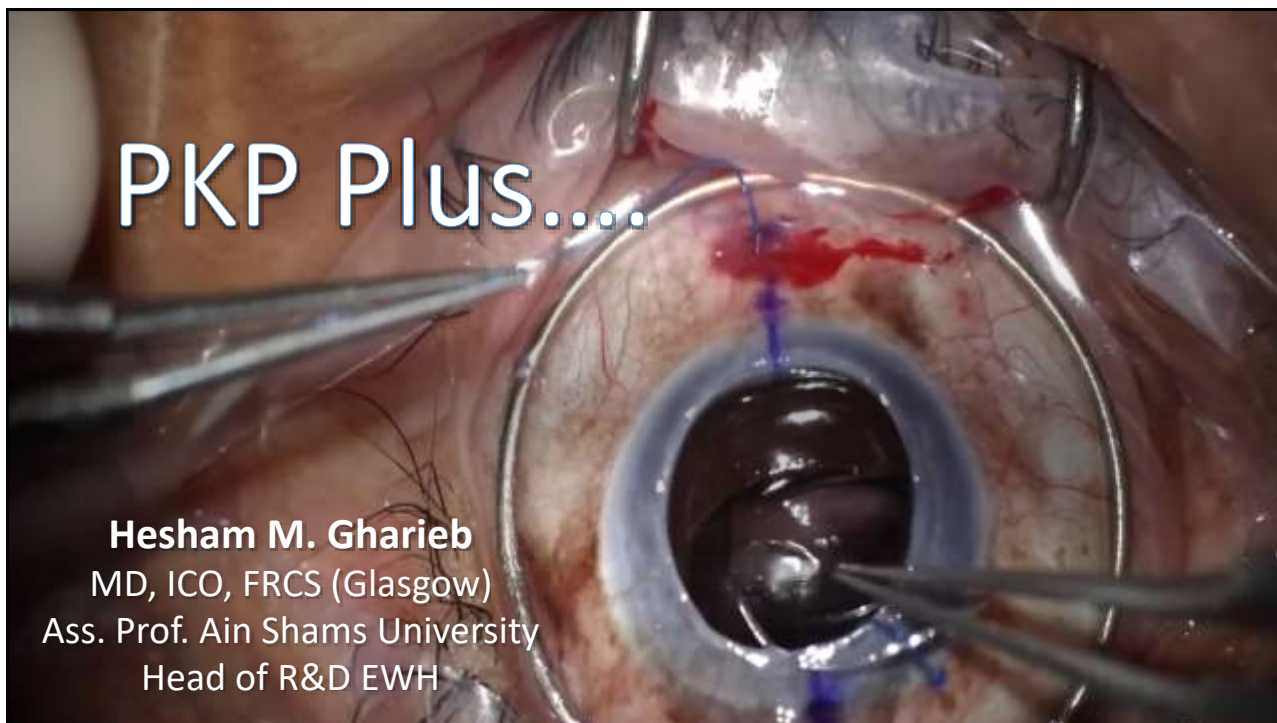
PKP Plus....

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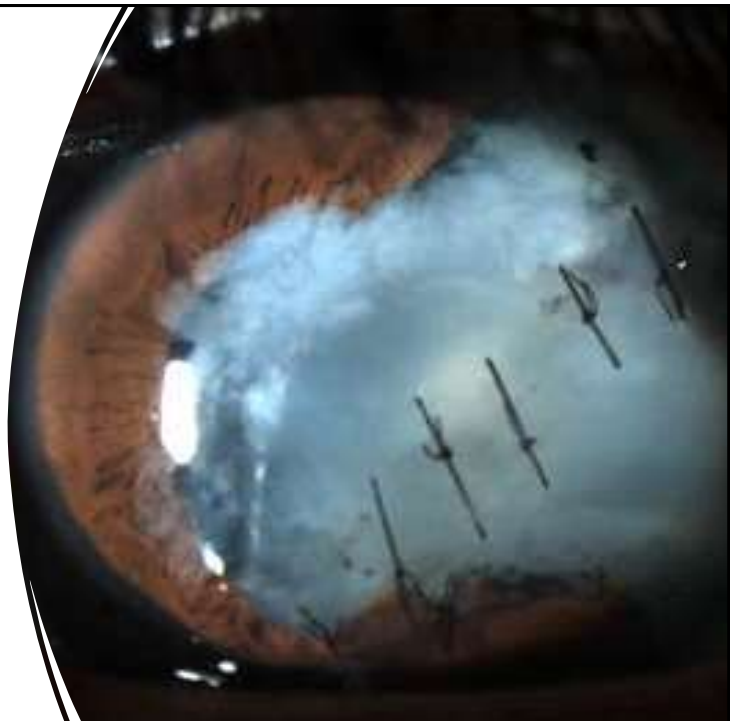
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Objectives.....PKP Plus>>>

- Lens Problems:
 - Cataract
 - IOL replacement
 - Aphakia
- Iris Problems
 - Synechia
 - Iris Tear
- Glaucoma

Cornea And the Lens



When???

With Keratoplasty PKP Plus...

- Cataract (ECCE/Phaco+ PCIOL)
 - Aphakia
- IOL exchange (unstable ACIOLs, dislocated PCIOLs)
 - Fixation of PCIOL (Transscleral or Iris Fixed)

Post-Keratoplasty

- PKP only followed by Phaco / ECCE + PCIOL implantation
- PKP + cataract extraction followed by IOL implantation
- PKP + IOL explantation following by IOL Implantation

Why?? Triple Same Session

Pros

- Single Session
- Less expenses
- More feasibility
- Ease of cataract extraction
- Better visibility of the lens
- Reduce the risk of damage to the donor endothelium during cataract surgery



Cons

- Inaccuracy in IOL power prediction
- More Complications:
 - *patients with any significant posterior pressure have the risk of anterior and posterior capsular tears with subsequent vitreous loss*

Why?? Sequential Surgery

Pros

- Accuracy in IOL power prediction
- Better refractive outcomes
- Chance to correct post-keratoplasty astigmatism by implanting a toric IOL
- Less Intraoperative Complications



Cons

- 2 Sessions
- More expenses
- Long rehabilitation time
- Damage to Corneal Endothelium



Indications of Triple Surgery

- Significant Cataract – Dense
- Old patients when multiple surgeries will be difficult
 - Monocular patients
- Subjects who are likely to develop corneal decompensation following cataract surgery

Otherwise

PKP with subsequent phacoemulsification and PCIOL placement is the best option for the majority of patients

Why?? Triple Same Session

Pros

- Single Session
- Less expenses
- More feasibility
- Ease of cataract extraction
- Better visibility of the lens
- Reduce the risk of damage to the donor endothelium during cataract surgery

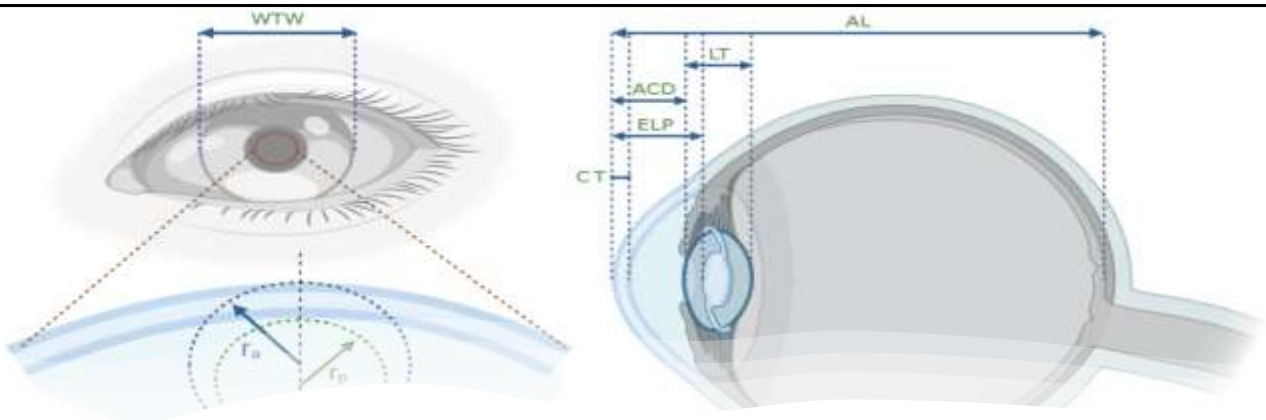


Cons

- Inaccuracy in IOL power prediction
- More Complications:
 - patients with any significant posterior pressure have the risk of anterior and posterior capsular tears with subsequent vitreous loss

Inaccuracy in IOL power prediction

- The ranges of Post-Triple surgery spherical equivalent:
 - -6.88 to +7.89D by Katz et al
 - **-5.50** to +6.62D by Crawford et al
 - -9.75 to **+12.88D** by Flowers et al
 - -6.00 to **+5.00D** by Djalilian et al.
- Number of patients within 2.00D of the desired refractive power has been low:
 - **26% to 63%** in literature



Biometry 1st

AL
ACD
LT
Keratometry

Biometry 1st Keratometry

- Preoperative keratometry (41-47D)
- Keratometry of the other eye
- Surgeon's Average Post PKP keratometry
- Standard constant keratometry
 - 44 D
 - 42.5D

**Both the surgeon and the patient
should anticipate unacceptable
refractive error, necessitating further
refractive surgery**

Biometry 1st Keratometry

- Preoperative keratometry (41-47D)
- Keratometry of the other eye



- Surgeon's Average Post PKP keratometry
- Standard constant keratometry

1- 2D greater than the value in the fellow eye
This is to compensate for the induced steepness due to oversized grafts

Biometry 1st IOL exchange

- The power of the original IOL can be taken for the replacement IOL

Biometry Formula

$$\text{We have: } \frac{E^2 \rho}{c^4 T_F} = \Psi^2$$

$$\text{So: } \rho = \frac{\Psi^2 c^4 T_F}{E^2}$$

$$\text{So: } \rho = \left(\frac{\Psi c^2}{E} \right)^2 \times T_F ; m = \frac{\Psi}{\sqrt{\rho}}$$

$$E = mc^2 \sqrt{T_F} \rightarrow m = \frac{E}{c^2 \sqrt{T_F}}$$

$$\text{So we have: } \rho = \frac{m}{v} \rightarrow v = \frac{m}{\rho}$$

$$\text{So: } v = \frac{E}{c^2 \sqrt{T_F}} \times \left(\frac{E}{\Psi c^2} \right)^2 \times \frac{1}{T_F} = \frac{E}{c^2 \sqrt{T_F}} \times \frac{E^2}{\Psi^2 c^4} \times \frac{m^2 c^4}{E^2}$$

$$\text{So: } v = \frac{E}{c^2 \Psi^2 \sqrt{T_F}}$$

Biometry 1stFormula

- SRK II, SRK/T, Holladay and Hoffer formulas

These newer generation formulas were able to predict **50% to 57% of the eyes within 2.0 D** of the actual postoperative refraction

The choice of IOL power formula does not affect IOL power predictions in corneal triple procedure, however, personalized constants within a formula has been found a critical factor in improving postoperative refractive predictions.

Evaluation of intraocular lens power calculation formulas in the triple procedure

Charles W. Flowers, MD, Stephen D. McLeod, MD, Peter J. McDonnell, MD, John A. Irvine, MD, Ronald E. Smith, MD

ABSTRACT

Purpose: To determine whether the choice of intraocular lens (IOL) power formula improves IOL power predictions and whether personalized constants within the IOL power formula are critical factors in improving refractive predictions after combined cataract extraction, iridectomy, and IOL implantation.

Methods: Records of 45 patients who had the triple procedure between January 1988 and December 1988 were evaluated using the SRK II, SRK/T, Holladay, and Hoffer Q formulas to predict the postoperative spherical equivalent refraction for implanted lens power. Calculations were carried out with and without the use of personalized constants. The predictive accuracy of each formula was assessed by comparing the actual postoperative spherical equivalent refractive error with that predicted by the formula. The predictive error and the distribution of predictive errors were used to assess predictive accuracy.

Results: There was no difference in the mean absolute predictive errors and the distribution of predictive errors for the four formulas evaluated ($P > .05$). The use of personalized formula constants significantly reduced the mean absolute predictive error for the SRK II, SRK/T, and Holladay formulas ($P < .001$) and approached significance for the Hoffer Q formula.

Conclusions: The findings suggest that the choice of IOL power formula does not affect IOL power predictions in the corneal triple procedure; however, personalized constants within a formula appears to be a critical factor in improving postoperative refractive predictions. *J Cataract Refract Surg* 1996; 22:116-122

The corneal triple procedure (removing keratoconus, cataract extraction, and intraocular lens [IOL] implantation) is an established method of restoring vi-

sion with corneal opacities and cataracts. Since Taylor¹ reported the first results of combined penetrating keratoplasty, cataract extraction, and IOL implantation in 1976, numerous studies have shown good results with the triple procedure.²⁻⁷ Despite the overall astigmatic success, however, the refractive constants have been less than ideal. Previously published studies report that 26% to 67% of eyes obtain postoperative refractive errors within 2.0 diopters (D) of emmetropia.^{2,3,6-8} With conventional cataract surgery, more than 90% of postoperative refractions are within 2.0 D of emmetropia.⁹ One obstacle to achieving better refractive results is the inability to predict the IOL power that will produce

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Presented in part at the annual meeting of the Association for Research in Vision and Ophthalmology, Toronto, May 1996.

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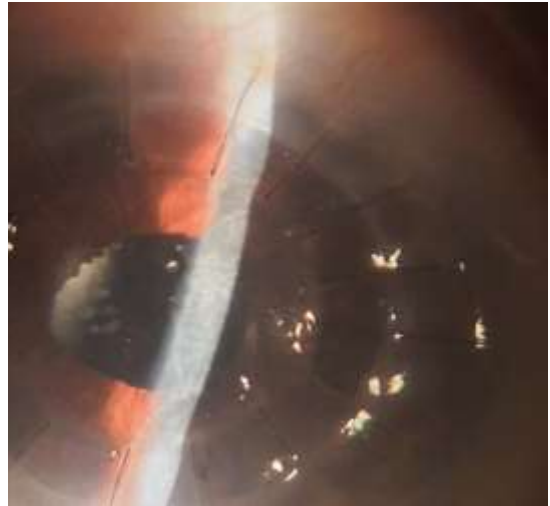
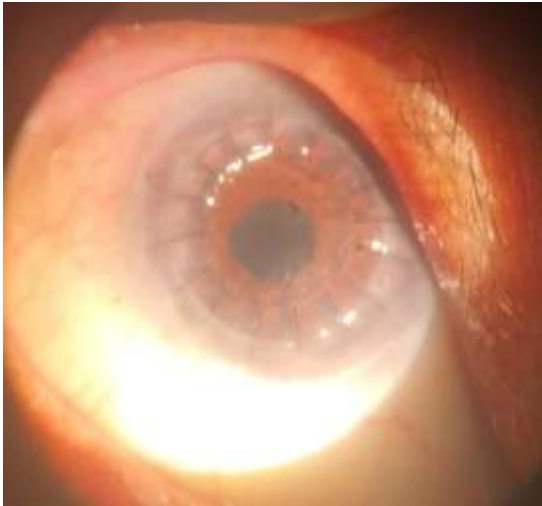
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J CATARACT REFRACT SURG—VOL 22, 116-122, 1996

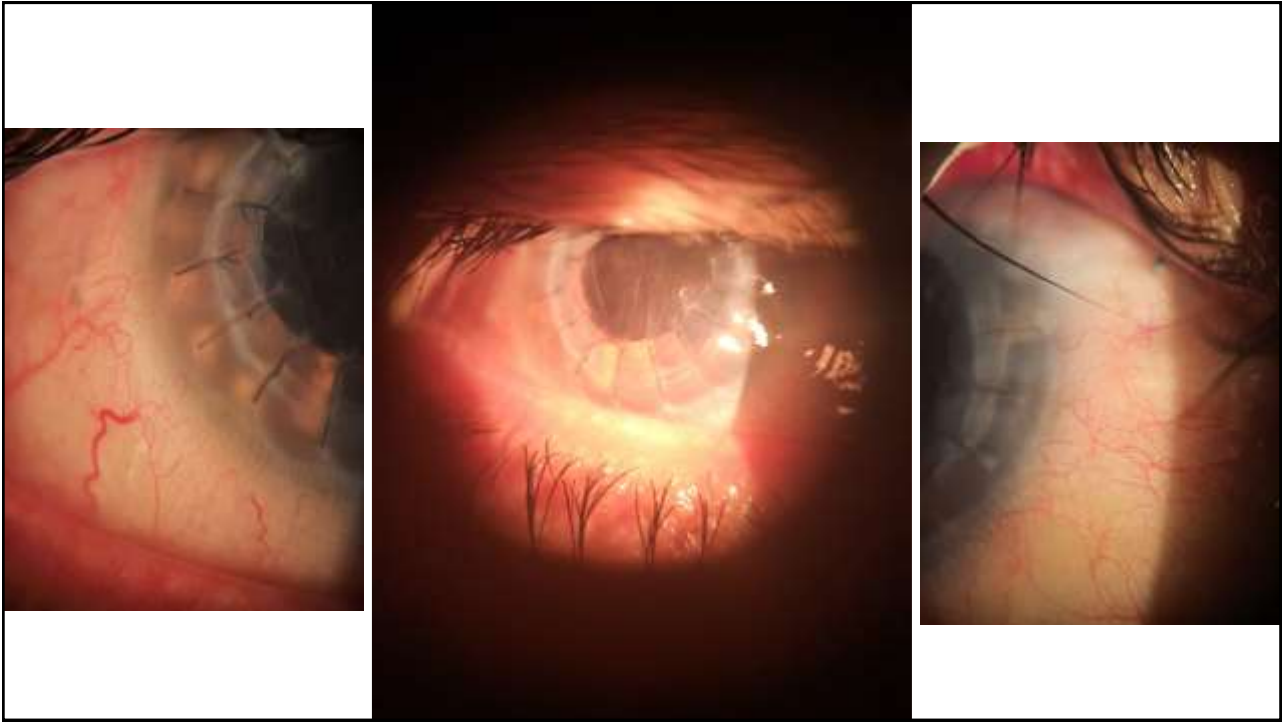
Flowers, C.W., McLeod, S.D., McDonnell, P.J., Irvine, J.A. and Smith, R.E., 1996. Evaluation of intraocular lens power calculation formulas in the triple procedure. *Journal of Cataract & Refractive Surgery*, 22(1), pp.116-122.

Triple PKP : With ECCE

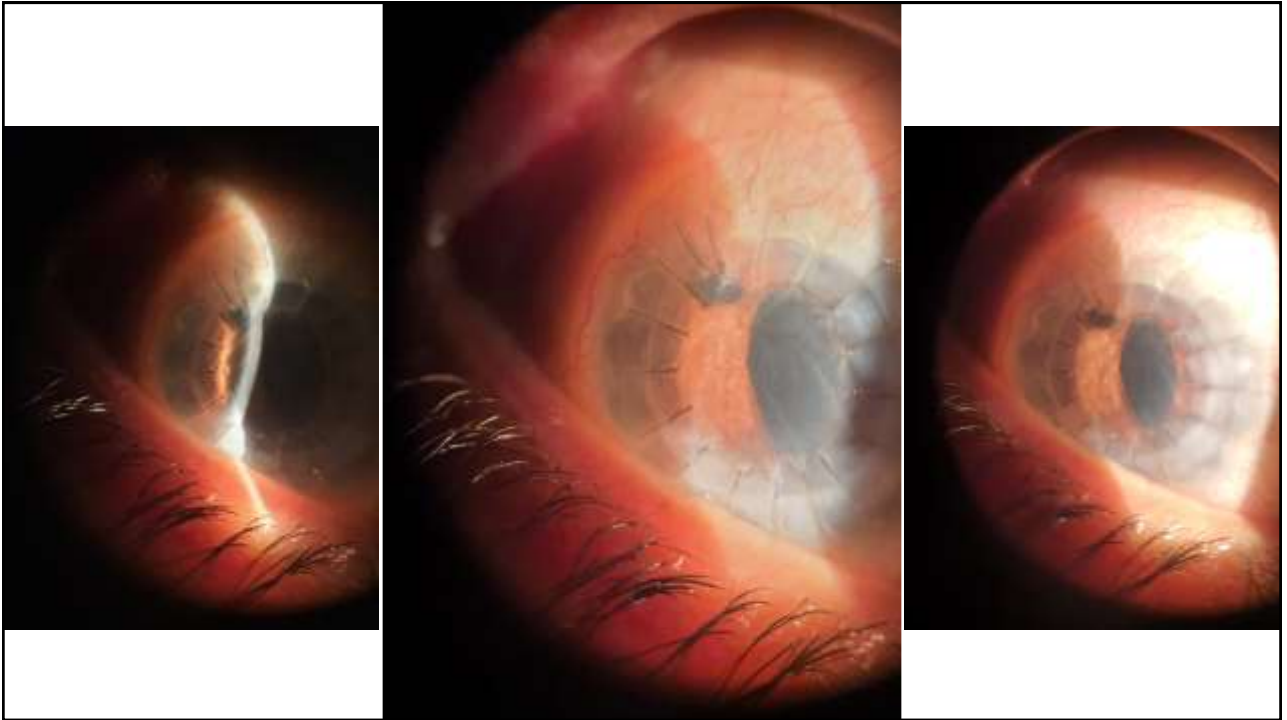
Triple PKP : With ECCE



Triple PKP : IOL Scleral Fixation



Triple PKP : IOL Iris Fixation



Triple PKP : With Phaco

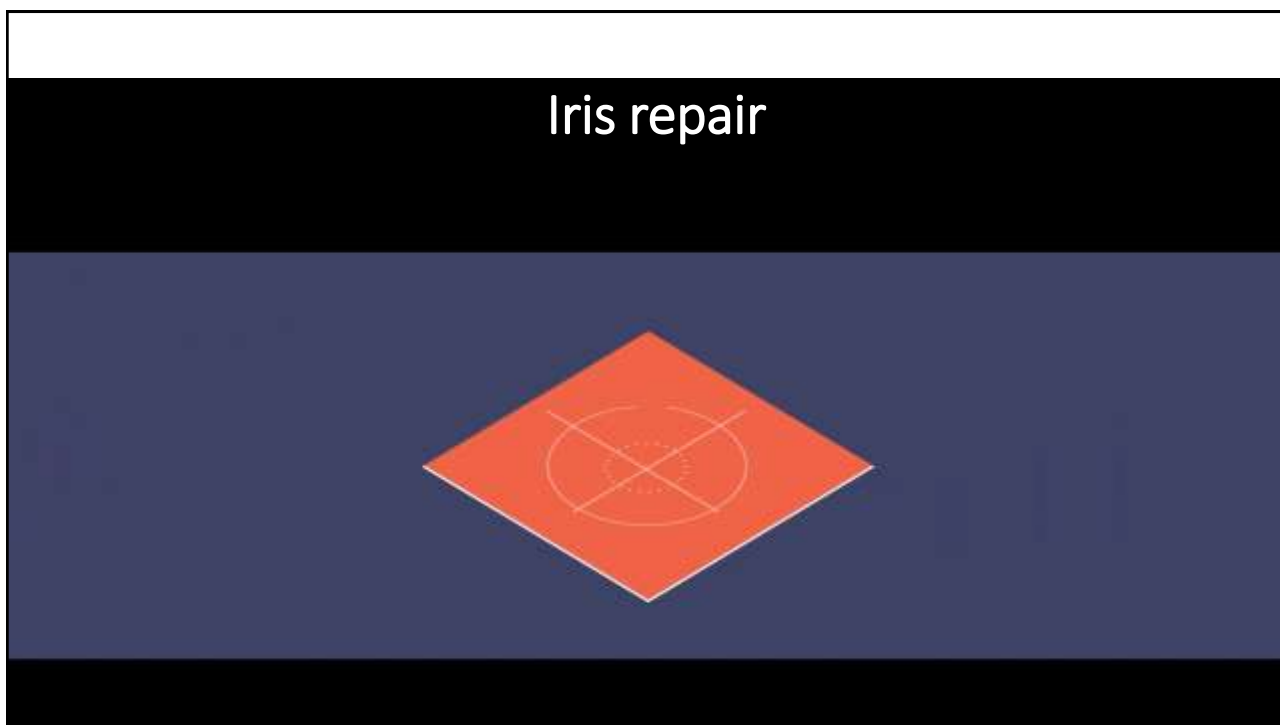
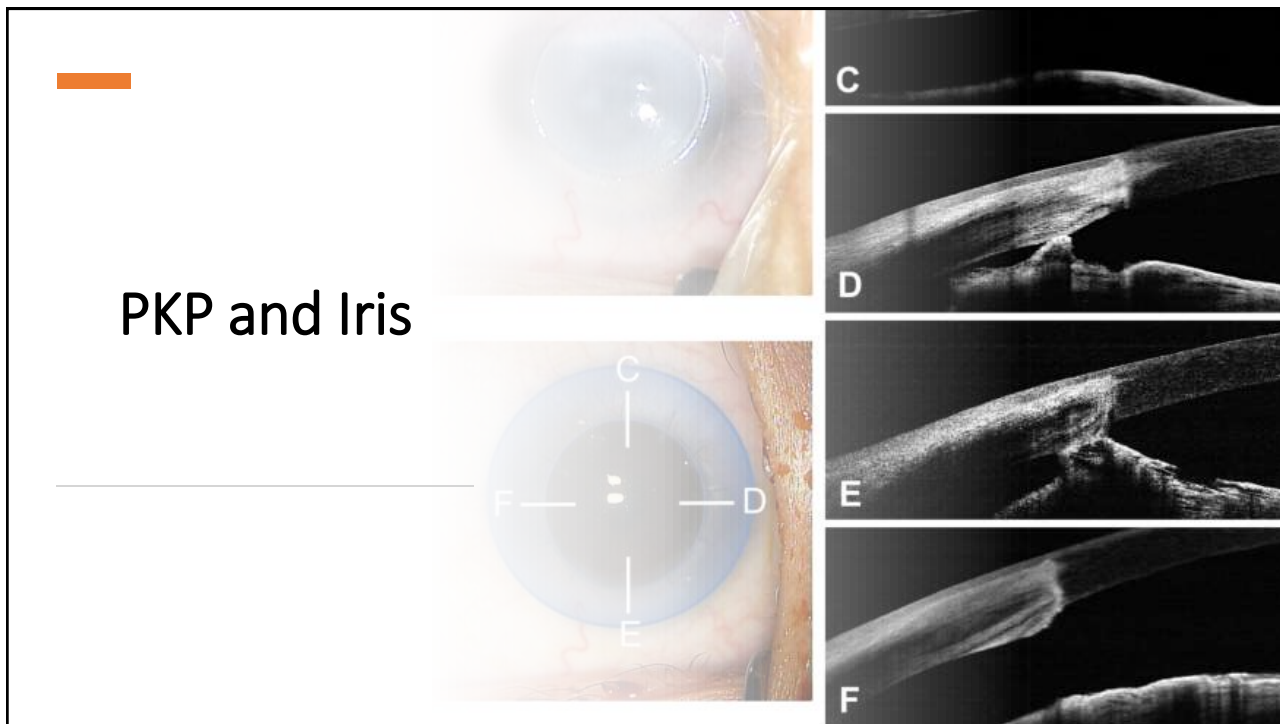
- Through clear corneal incision or a scleral tunnel incision
- If good or enhanced visualization
- After implanting the PCIOL, the surgeon constricts the pupil and completes the PKP

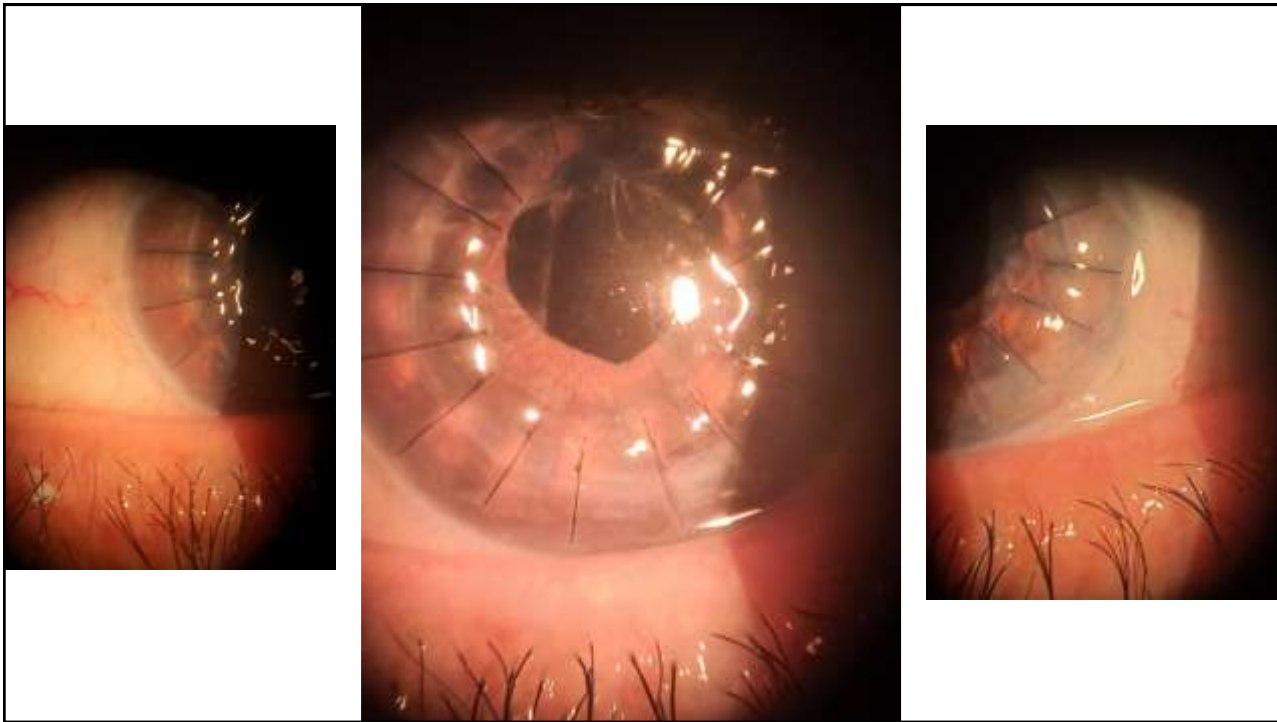
Pros

- controlled cataract extraction and lens placement
 - less risk of capsular tear
 - Shorter open sky time

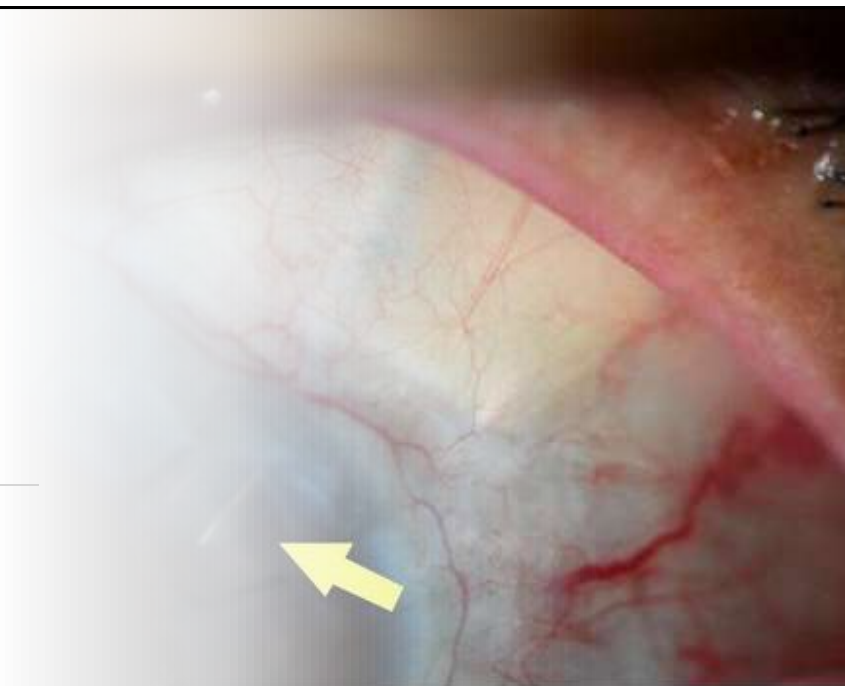
Cons

- slightly longer surgical time
- second incision made in the eye





PKP and
Glaucoma
(PKPG)



PKP Glaucoma (PKPG)

Graft rejection and secondary glaucoma development are the 2 leading causes of graft failure after PKP

Incidence of PKPG

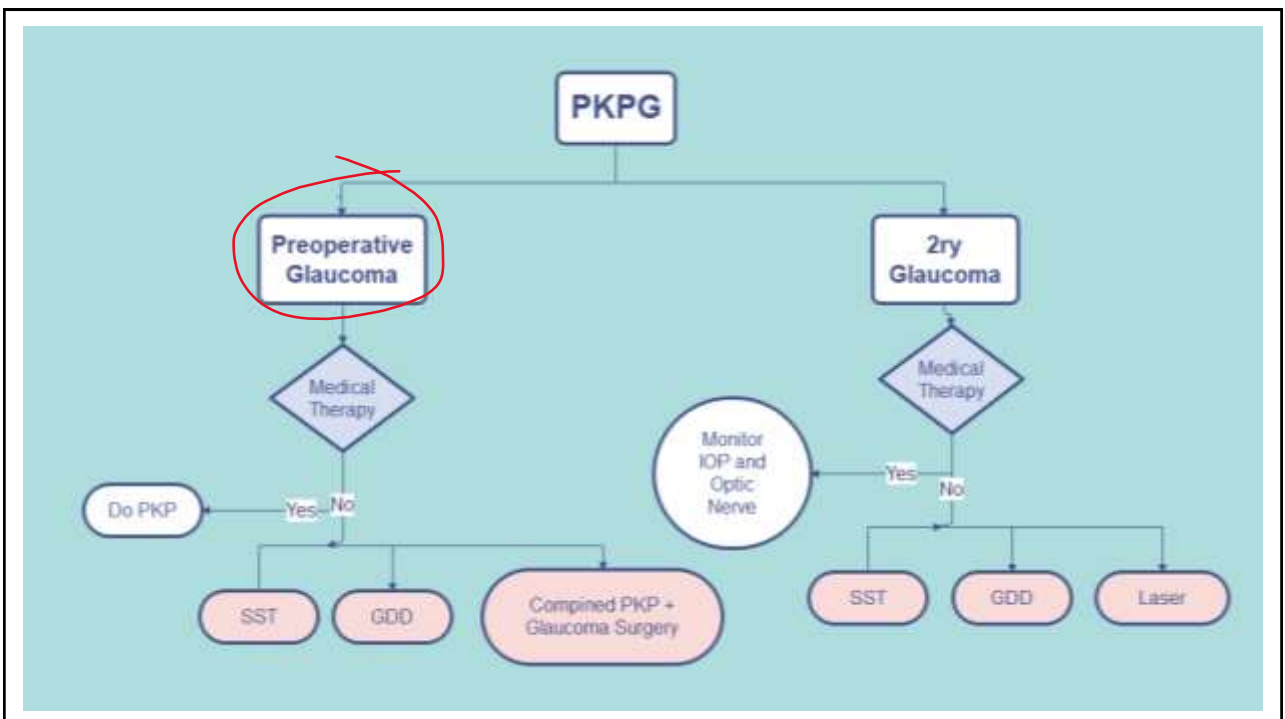
9 to 50%

In early postoperative (first few wks.) \approx 9 to 13%

In late postoperative period (several wks. to ms.) \approx 18 to 35%

Graft Survival PKPG

Long-term prognosis for graft survival \approx 40 to 60%



Pre-operative Control

Post-operative Control

Pathophysiology- Types of PKPG*

Closed-angle glaucoma (59%)

Steroid induced (21%)

Open-angle glaucoma (11%)

Angle recession (3%)

Aqueous misdirection (3%)

Unknown (3%)

*Rumelt, S., Bersudsky, V., Blum-Hareuveni, T. and Rehany, U., 2002. Preexisting and postoperative glaucoma in repeated corneal transplantation. *Cornea*, 21(8), pp.759-765

Risk factors –PKPG*

- Preoperative glaucoma (or IOP > 20 mm Hg)
- Postoperative aphakia
- Intraocular lens removal or exchange associated with keratoplasty
- As indication for PKP:
 - ❖ Bullous keratopathy
 - ❖ Trauma
 - ❖ Herpes simplex infection
 - ❖ Bacterial corneal ulceration or perforations

*Borderie, V.M., Loriaut, P., Bouheraoua, N. and Nordmann, J.P., 2016. Incidence of intraocular pressure elevation and glaucoma after lamellar versus full-thickness penetrating keratoplasty. *Ophthalmology*, 123(7), pp.1428-1434.

Surgical Tips to decrease PKPG

Sutures:

- less tight wounds
- Deep bites
- careful wound closure to prevent postoperative wound leaks

Smaller trephine sizes

- *donor corneal size should be kept in the range of 7.5 mm to 8.5 mm*
- *Oversized donor of 0.5 mm*

Iris management:

- Goniosynechialysis in the presence of peripheral anterior synechiae,
- Iridoplasty (iris-tightening procedure) in cases of a floppy iris.

Removal of viscoelastic material at the end of the operation

Workup

Early Postop.

- IOP

Measure IOP every Visit

Late Postop.

- IOP
- Optic disc changes
- Progressive visual field changes

Exams should be performed at least once per year

Management Pearls

Medical

Surgery

Laser

β -Adrenergic blocking agents:

- The adverse effects of β -blockers:
 - Superficial punctate keratopathy
 - Corneal anesthesia
 - Dry eye state.
 - All of these may have an adverse effect on the graft epithelium that might compromise graft function.

Adrenergic agents:

- Brimonidine tartrate 0.2%
- Should be used with caution in patients with aphakia or pseudophakia because they can produce cystoid macular edema

Topical carbonic anhydrase inhibitors:

- Dorzolamide, brinzolamide
- They should be used with caution in:
 - history of graft rejection, compromised endothelial function, reduced endothelial cell counts

These agents can contribute to an irreversible corneal decompensation

Management Pearls

Medical

Prostaglandin analogues:

latanoprost

- most common adverse effects:

- Punctate keratitis and ocular hyperemia.

Surgery

- Used with caution in:

- History of herpes simplex keratitis because it has been reported to induce recurrent herpetic infection in humans.

Laser

- Aphakia and pseudophakia, latanoprost has been reported to cause cystoid macular edema

Management Pearls - SST

Medical

Indications:

- Limited or no superior limbal conjunctival scarring
- No extensive peripheral anterior synechiae
- No aphakia
- No severe shallow AC

Surgery

PostOperative Period:

- Avoid shallow or flat anterior chambers in the postoperative period because this could compromise the graft endothelium.
- Monitor patients for dellen formation, which can trigger thinning of the adjacent graft cornea, leaking blebs, and bleb-related infections.

Laser

Results:

- IOP control 67 to 91%
- Rate of graft failure is 12 to 18%

Management Pearls - GDD

Medical

Indications:

- superior limbal conjunctival scarring
- Extensive peripheral anterior synechiae
- Aphakia
- Shallow AC
- Failed Trabeculectomy

Surgery

Results:

- IOP control 71-96% at 1 year, 44-87% at 2 years, and 71-83% at 5 years
- Graft failure 10 to 51% (with an average of 36.2%) : more than SST

Laser

Management Pearls - Lasers

Medical

Selective laser Trabeculoplasty

Micropulse CPC

Surgery

Cyclodestructive Diode Laser

- Graft Failure 20-50%

Laser

**THANK
YOU!**

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