

# Femtosecond Assisted Lasik for Post PKP Myopic Astigmatism

## Introduction

High residual refractive error can be a disappointing end point to an otherwise successful penetrating keratoplasty, it can prevent the patient attaining satisfactory visual acuity.

## Causes of astigmatism post PKP

- i. Size and shape difference between donor and host
- ii. Eccentric placement
- iii. Scarring at graft host junction
- iv. Asymmetric forces in the cornea resulting in altered shape

## Astigmatic patterns

- I. According to ESCRS istanbul (Dr Rudy niujts)
- II. 4 to 5 D and anisometropia
- III. 30% shows > 5 D
- IV. 25% regular
- V. 75% irregular

## Vision correction options after keratoplasty

### Non surgical

- i. Spectacles.
- ii. Contact lenses

### Surgical

- I. PRK ... (disadvantage) haze and scar.
- II. Corneal relaxing incision, wedge resection, along with  $\pm$  compression sutures..... (disadvantage) Wound dehiscence, corneal topographic changes, low predictability of the results, lack of internationally accepted nomograms.
- III. Lasik using microkeratome or femtosecond laser.
- IV. Implantable contact lenses.
- V. ICRS
  - i. Femtosecond laser-assisted
  - ii. Intrastromal corneal ring
  - iii. Segment implantation for high
  - iv. Astigmatism correction after
  - v. Penetrating keratoplasty
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Perspective

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## Femtosecond laser

- I. Ultra-short pulse duration (10-15 sec.) has the ability to deliver laser energy with minimal collateral damage to the adjacent tissue ( $1\mu\text{m}$ ).

## Femtosecond laser

- i. Mechanism of action
- ii. Photo disruption
- iii. FSL energy is absorbed by the tissue, resulting in plasma formation.
- iv. This plasma of free electrons and ionized molecules rapidly expands, creating cavitation bubbles.
- v. The force of the cavitation bubble creation separates the tissue (Figure 1).

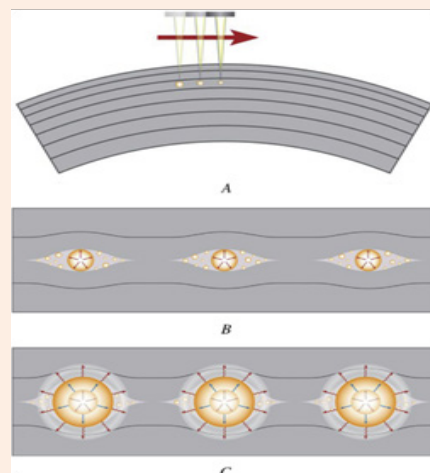


Figure 1: Femto laser.

**Femto laser**

Why femto?

- I. The only reliable and predictable way of creating the flap within the graft.

**Why Femto (cont'd)**

- i. Reduced incidence of flap complications like buttonholes, free caps, irregular cuts etc.
- ii. Control over flap diameter and thickness; side cut angle, hinge position and length.
- iii. Increased precision with improved flap safety and better thickness predictability.
- iv. Capability of cutting thinner flaps to accommodate thin corneas and high refractive errors.

**Why femto (cont'd)**

- I. Stronger flap adherence.
- II. Better contrast sensitivity.
- III. Decreased incidence of epithelial in growth.
- IV. Extremely low incidence of graft wound dehiscence secondary to less increase in IOP required. (20 to 35 mm) compared to microkeratome (55 to 70).
- V. NB. The fibrotic edge of the graft was also an additional safety factor for us for the prevention of a possible transplant wound rupture.

**Why femto (cont'd)**

- i. Lesser incidence of dry eye due to higher epithelial stability.
- ii. Lesser hemorrhage from limbal vessels.
- iii. The ability to retreat immediately if there is incomplete FS laser ablation.

**Why Femto?**

- I. It is capable, to a certain extent, of passing through optically hazy media, such as an edematous cornea.
- II. The laser may be applied in multiple geometric patterns including vertical, spiral, or zigzag cuts.
- III. It can be focused anywhere within or behind the cornea.

**Why Femto?**

- i. It is not a blade! (Figure 2).

**Aim of the study**

- I. The purpose of this study is to determine the efficacy and stability of LASIK for the correction of post keratoplasty myopic astigmatism using a femtosecond laser for flap creation.

**Study design**

- i. Retrospective study, 40 eyes of 35 patients

- ii. Time between PKP and femtosecond lasik 18 to 65 months mean (41.5)
- iii. Interval at least 8 months after suture removal
- iv. AGE: 25 years TO 54 years MEAN 39.5
- v. Follow up 1, 3 and 12 months



**Figure 2:** It is not a blade!

**Study design (Cont'd)**

All patients were examined pre & post operatively for:

- I. UCVA
- II. BSCVA
- III. Autorefraction and cycloreffaction(cyclo pre only),
- IV. Corneal topography(TMS4),
- V. Corneal tomography (allegretto occulizer),
- VI. IOP,
- VII. ORA,
- VIII. And Pachymetry.

**Study design (cont'd)**

- i. Contraindications for refractive intervention include peripheral corneal vascularization, thin host tissue, wound ectasia and significant graft override or malapposition.
- ii. The patient should have a minimal corneal thickness of at least 500  $\mu\text{m}$ .
- iii. The possibility of graft rejection was considered and addressed by the use of topical steroids post operatively.

**Pre op**

1. Pre op myopia -3.50 to -7.75D
2. Pre op astigmatism -3.00 to -6.00D
3. Pre op UCVA CF 3mtr to 0.30
4. "The attempted spherical equivalent correction ranged between 60 to 90% of the measured pre op refraction."

**Post op**

- i. Myopia -0.75 to -1.75 D
- ii. Astigmatism -1.25 to -2.25
- iii. UCVA 0.40 TO 0.90

**Discussion**

- I. In 3 month follow up 75 to 92% reached the attempted correction ( $\pm 1.00$  D).
- II. (Mean increase is 4 lines) 3 months.
- III. And in 1 year follow up all of the examined eyes (31 out of 40) gained at least 3 lines on snellin acuity tests.

- IV. No pt has lost one line of his original visual acuity.
- V. One eye exhibited peripheral flap epithelial in growth which didn't require any flap re lifting.

**Data analysis**

Se pre op vs post op (Figure 3-6).

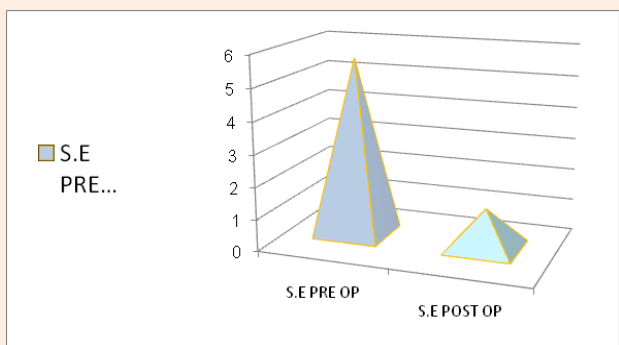


Figure 3: Data Analysis: Se pre op vs post op.

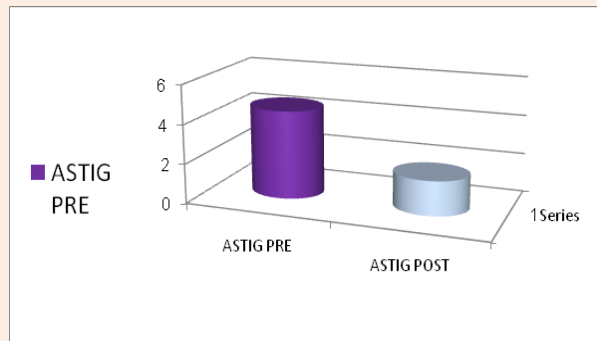


Figure 4: Data Analysis: astig pre vs astig post.

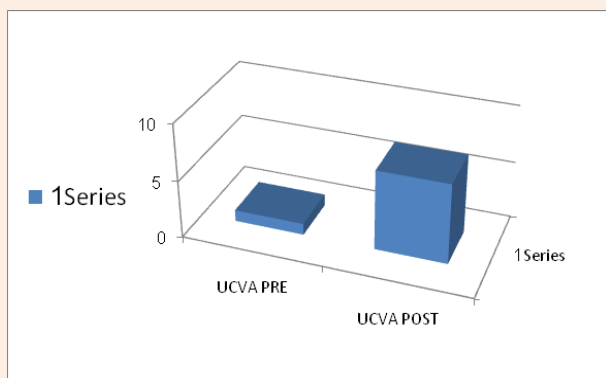


Figure 5: Data Analysis: UCVA pre vs UCVA post.

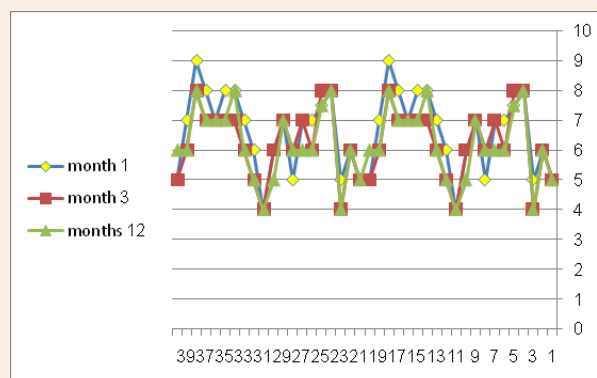


Figure 6: Effective procedure for pt with myopic astigmatism post PKP.

**Conclusion**

- i. Femto lasik is an effective procedure for pt with myopic astigmatism post PKP.
- ii. It is also relatively a safe procedure with minimal complications regarding the surgery itself and the graft.
- iii. However; more work should be done regarding the endothelial cell count and topographic changes over years.

**Take home message**

- I. Talk to the patient.
- II. Determine his needs, expectation
- III. Use the best and safest technology available to serve the best outcomes.