Corneal Inlay Complication Management
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Consultant or receive speaking fees or travel grants from:
- Ziemer
- Schwind
- AcuFocus
- ClerioVision
- Allergan
- Bausch & Lomb

Financial Disclosure

Patient Satisfaction
- Careful Patient Selection
- Diligent Counseling
  - Benefit of having the inlay myself
- Differentiate from LASIK healing
- Aggressively manage Dry Eye pre-op, intra-op, and post-op:
  - TearLab testing for everyone (my preference)
  - Punctal plugs pre-op for everyone
  - Treat any Blepharitis
  - Lubricate Heavily & Restasis® often indicated

My KAMRA Procedure Experience

My KAMRA Procedure

The KAMRA Corneal Inlay
1. I am binocularly balanced
2. Excellent stereopsis
3. I have great distance, intermediate and near vision
4. Treatment resistant to progression of presbyopia
5. High safety profile with removability

Patient Satisfaction - Key Factors
- Refractive target
- Femtosecond laser Selection & Pocket Settings
- Inlay Centering – Microscope & Technique
- Minimal manipulation
- Dry Eye Status
- Steroid taper
- Other factors ?

Patient Satisfaction: Personality of Patient

Inlay Surgical Procedure
- FOUR SURGICAL PROCEDURES:
  1. CLK: Combined LASIK KAMRA™
  2. PEK: Pocket Emmetropic KAMRA
  3. PLK: Post-LASIK KAMRA
  4. PLK2: Planned LASIK KAMRA – 2-Step
CLK Technique Abandoned

100% Pocket Procedures

Ziemer Z4 Femtosecond Laser

Takagi Coaxial Microscope and AcuTarget HD for Centration

KAMRA™ Inlay Placement

Pre-Op AcuTarget HD™ Measurements

Centering on 1st Purkinje Light Reflex

Ensure Fellow Dominant Eye Closed

Align Pocket with AcuTarget so OZ allows for placement and adjustment

- Dry Eye
- Fluctuating Vision
- Slow Visual Recovery
- More Difficult Centration

- Faster Visual Recovery
- Less Dry Eye
- More Stable Cornea
- Ability to place inlay deeper
- Flaps for LASIK remains at 100 microns

200-250μm Pocket

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Pocket inlay placement over the 1st Purkinje

If there is a significant difference > 400 microns between 1st Purkinje and pupil center, place inlay in between

The guideline for inlay placement is to target within 300 microns from desired position BUT I believe needs even greater precision

Target inlay placement over the 1st Purkinje

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Create Pocket at 200-250 microns, but extend 1-2mm past marking

Pocket Dissection

Maintain Corneal surface moisture but Pocket must remain dry

Grasping the Inlay

Grasp 3.0mm of KAMRA inlay leaving central hole exposed fully:

Grasp inlay “Dull Side Up”

Can use second instrument to open pocket to avoid introducing epithelial cells

Insert inlay past circular marking then withdraw to unfold leading inlay edge
The most common complaint post-KAMRA is Blurred Vision and delayed visual recovery. Even in patients where the KAMRA pocket procedure was exceedingly brief and smooth, key causes include:

1. Dry Eye
2. Inadequate Refractive Endpoint
3. Decentration

Common Complaints:
- The most common complaint post-KAMRA is Blurred Vision and delayed visual recovery.
- Even in patients where the KAMRA pocket procedure was exceedingly brief and smooth.
- Key 3 Causes:
  1. Dry Eye
  2. Inadequate Refractive Endpoint
  3. Decentration
Increased myopia typically indicates:
- Dryness, treat with aggressive lubrication, punctal plugs +/- Restasis®
- If post-LASIK, possible Regression

Increased Hyperopia typically indicates:
- Corneal Wound healing effect/Regression
- Examine for haze around inlay
- Examine topography for changes – Red Ring
- Manage with Steroids
Post-KAMRA Topography
- Typically no change with typical 200-250 micron depth pocket insertion
- Blue Ring – typically an indication of Dry eye, treat with Lubrication, may have increased myopia on refraction
- Red Ring – may be normal, may indicate shallower placement or most importantly, may indicate aggressive Corneal Wound Healing

Dry Eye Management
- TearLab Osmolality and Corneal assessment
- Pre-op 3 month Temporary punctal plugs
- Preservative free artificial tears
- Omega-3 fatty acids
- Restasis® BID beneficial in KAMRA patients, with more rapid effect than is typical with Dry Eye patients

Slit Lamp
- Cannot ascertain centration on Slit Lamp examination
- Most important aspects are:
  1. Monitor for evidence of Dry Eye
  2. Ensure that KAMRA Inlay edges are smooth and not rolled
  3. Ensure that no evidence of haze around KAMRA Inlay
  4. Ensure that no evidence of epithelial ingrowth

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Dry Eye
- Patients often state their eye does not feel dry, but lubrication must be stressed regardless
- Small aperture optics means central dry eye spot creates significant blur
- Even inadequate tear film means quality of vision through 1.6mm aperture will be variable & blurred when focusing for reading
- Women who are peri-menopausal more at risk
- Restasis® beneficial even when TearLab osmolality normal
- Dryness & edema improve over 3-4 weeks

Refractive Endpoint
- Even small degrees of Hyperopia and Cyl may have significant impact on reading vision
- AcuTarget HD nicely reads accommodative amplitude, which varies significantly between patients from 1.00D to 2.50D
- Patients who are -0.50D to -0.75D are therefore in best range for reading
- LASIK indicated for even small degrees of pre-op hyperopia AND refractive endpoint verified at 1 week to 1 month before Pocket KAMRA procedure, longer if high Rx

Centration
- Some patients sensitive to 100 micron decentrations, 300 microns is not magic, although it was the same for excimer ablations prior to eye trackers. Small aperture optics very different.
- Furthermore, decentrations that are superior are less well tolerated
- Placement between pupil center and visual axis best tolerated, but if decentration is nasal to visual axis, then poorly tolerated

Real Estate Developer PRE-PEK
- Futuro vs Past: `1612`; `333` pm
- INFOVISAL
Firstly, father of Sondra’s son’s girlfriend — i.e., his future Father-In-Law. Age 57

Performed PK: Pocket at 250 microns, followed by LASIK immediately after, then inserted KAMRA Inlay after 3 days

Refraction was +1.00D OU treated, targeted Plano in dominant and -0.50D in the KAMRA eye

POST-OP: KAMRA eye: 20/30 UCVA with -0.50D 20/20 BUT Reading only 20/40 (J4)

No Dry Eye, Normal Tear Osmolality and Tear Film

Once KAMRA inlay in situ, cannot use femtosecond laser to create corneal flap

If inadequate reading, plan Hyperopic PRK

Ensure KAMRA inlay in good position as hyperopic ablation will center over inlay aperture

Use additional mitomycin 0.02% as PRK can activate keratocytes with Inlay in place need to avoid. Typically, 15 second application, with KAMRA inlay, 30 seconds minimum
General teaching has been that placement must be within 300 microns of target but there are a number of issues.
- Target is felt to be Visual Axis unless Angle Kappa greater than 400 microns, then midway
- We ALWAYS use Visual axis even if > 600 microns
- We ALWAYS use our Takagi microscope for fixation and allow AcuTarget HD to guide us
55 Year Old Male

Refraction:
-0.50D Post LASIK Nov 24th 2013
-KAMRA Dec 2nd, 2013

Month 2: No Dry Eye

UCDVA: 20/40
UCNVA: 20/60

Month 4:
UCDVA: 20/30
UCNVA: 20/40

Much happier with his vision

Vision at 1 month:
-UCDVA improved by 1 line 20/25
-UCNVA improved by 2 lines to 20/25 (J2)

Even though original placement within 300 microns, patient sensitive to small decentration in both amount and direction
Patient S.S. – Large Angle Kappa
- 51 year old Male
- LASIK for Rx - +3.50
- Patient centered on 1st Purkinje
- Post-op: Happy - Day 1
- Refraction -0.50D
- Uncorrected Distance Vision 20/30
- Reading J1
- Referred his wife for KAMRA the following week

Patient B.K. – Pre-Op AcuTarget

Patient B. K. – Post-op Fixation

Patient B.K. – AcuTarget HD Post Insertion – Inferior Decentration

Inferior Decentration

Marking for Recentration

Anterior Dissection

B. K.

Anterior Smoothing: 100s of Microns
Only occurs in 4% of patients following all inlays
Similar pathophysiology to early PRK
3% of 4% respond to topical steroids
Steroid Regimen:
- Predforte QID x 2 weeks, then re-evaluate
- Expect refractive shift back to myopia:
  - If YES: Taper steroids over 3 months
  - If NO: Discontinue steroids and remove Inlay

First Stage LASIK Procedure
- LASIK 100 micron flap for Astigmatism even +0.25D
to target -0.50D to -0.75D
- Day 1 Wow Factor
- Understand Presbyopia

Second Stage Pocket KAMRA Procedure
- At 1 week, Confirm Refractive Endpoint
- Ziemer Pocket at 250 microns, with insertion of KAMRA inlay

Preferred PLK2 approach
- Today our optimal Staging is LASIK followed by Pocket KAMRA Procedure at 1 week
  - Achieves the LASIK “Wow” factor
  - Better ensures refractive stability
  - Better patient appreciation of presbyopia
  - Better tolerated by patients, each step is 6 minutes 1 week apart
  - Better surgically for centration
  - Key benefit is inserting the KAMRA Inlay into a Quiet Eye

Summary
- Corneal inlay surgery is very different from LASIK and needs to be managed accordingly, for many it is more like PRK.
- Each patient is unique in their recovery but in general:
  - Only 20% of our patients experience very fast vision recovery within hours to days
  - Most patients recover vision over 3-4 weeks
  - Improved technique and instruments will improve KAMRA Wow factor!