

Corneal Inlay Complication Management


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Financial Disclosure

Consultant or receive speaking fees or travel grants from:

- › Ziemer
- › Schwind
- › AcuFocus
- › ClerioVision
- › AMO
- › Allergan
- › Bausch & Lomb



Patient Satisfaction



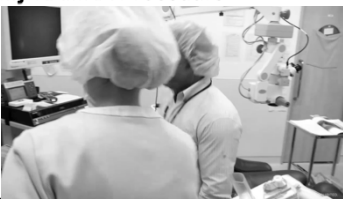

- › Careful Patient Selection
- › Diligent Counseling
 - Benefit of having the inlay myself
- › Differentiate from LASIK healing
- › Aggressively manage Dry Eye pre-op, intra-op and post-op:
 - TearLab testing for everyone (*my preference*)
 - Punctal plugs pre-op for everyone
 - Treat any Blepharitis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



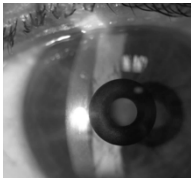
My KAMRA Procedure Experience





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 ?



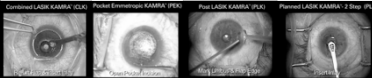


Patient Satisfaction: Personality of Patient

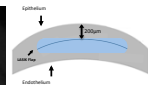
Inlay Surgical Procedure

› 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

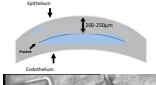
CLK Technique Abandoned



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

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100% Pocket Procedures



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

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Ziemer Z4 Femtosecond Laser



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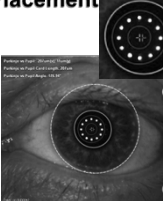
Takagi Coaxial Microscope and AcuTarget HD for Centration



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KAMRA™ Inlay Placement

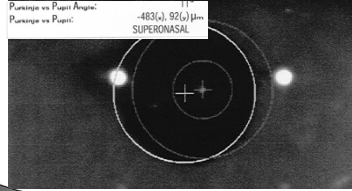
- ▶ Target inlay placement over the 1st Purkinje
- ▶ If there is a significant difference > 400 microns between 1st Purkinje and pupil center, place inlay in between
- ▶ The guideline for inlay placement is to target **within 300 microns** from desired position BUT I believe needs even greater precision



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Pre-Op AcuTarget HD™ Measurements

Purkinje vs Pupil Angles: -483(±), 92(±)µm
Purkinje vs Pupil: SUPERONASAL



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Centering on 1st Purkinje Light Reflex



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Ensure Fellow Dominant Eye Closed



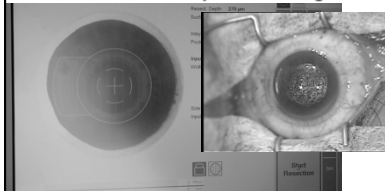
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Align Pocket with AcuTarget so OZ allows for placement and adjustment



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



The diagram on the left shows a circular cornea with concentric circles and a central crosshair. The clinical image on the right shows a close-up of a cornea with a circular pocket being created. A 'Dry' indicator is visible in the bottom right corner of the clinical image.


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A collage of four images showing different stages of the surgical procedure, including the patient's eye, the surgical microscope, and the surgeon's hands.

CRYSTAL CLEAR VISION

Pocket Dissection



A close-up image showing a surgical instrument being used to carefully dissect the corneal pocket.

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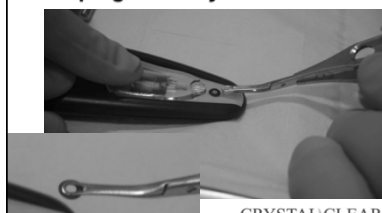
Maintain Corneal surface moisture but Pocket must remain dry



A close-up image showing a surgical instrument being used to maintain moisture on the corneal surface while the pocket remains dry.

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Grasping the Inlay



A close-up image showing surgical forceps grasping the KAMRA inlay.

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Grasp 3.0mm of KAMRA Inlay, leaving central hole exposed fully:



A close-up image showing the inlay being grasped. An inset image shows a circular hole with the text "Too Much Exposed" next to it, indicating the correct amount of exposure.

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Grasp Inlay "Dull Side Up"



A close-up image showing the inlay being grasped with the dull side facing up.

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



A close-up image showing a second instrument being used to open the pocket to avoid introducing epithelial cells.

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Insert Inlay past circular marking then withdraw to unfold leading inlay edge



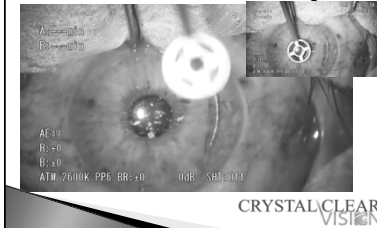
A close-up image showing the inlay being inserted past the circular marking and then withdrawn to unfold its leading edge.

CRYSTAL CLEAR VISION

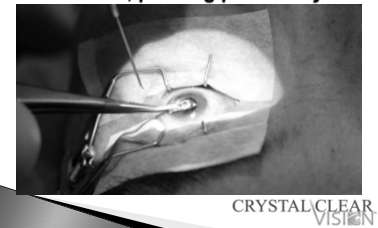
Two techniques: Align Inlay with edge of Nasal circular mark, or 0.5mm nasal



Centration Marking: Double Circle 1.6mm and 3.8mm for accuracy



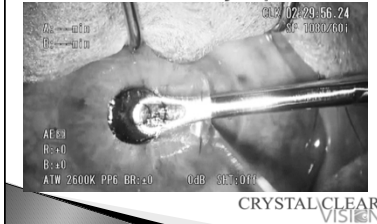
Once aligned with marking, hold for 10 seconds, pushing posteriorly



Insert over 3 seconds, Withdraw over 30 seconds, keeping wrist low



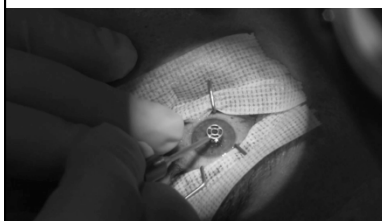
Withdraw very slowly, Stop after 1-2mm to ensure inlay in position



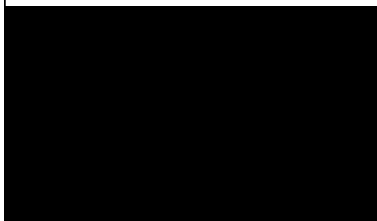
Close forceps upon withdrawal to prevent wound gape and trauma



VIDEO



VIDEO



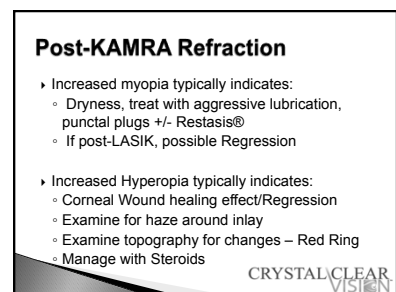
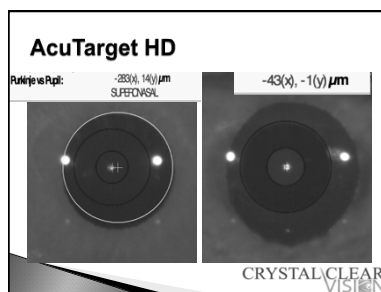
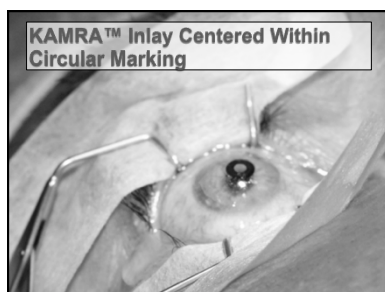
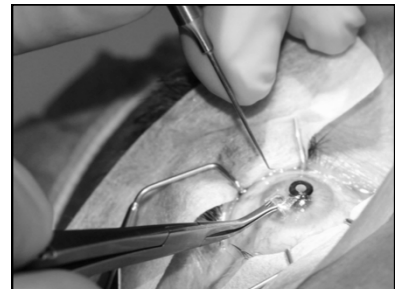
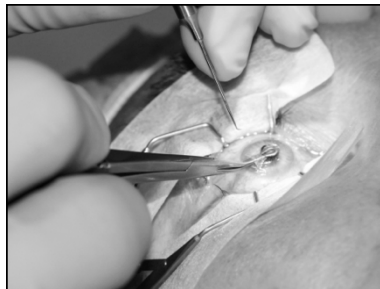
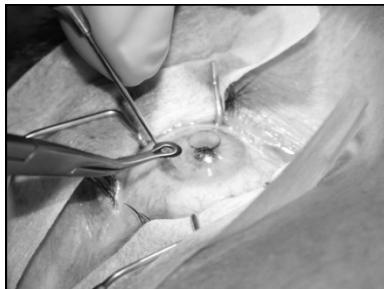
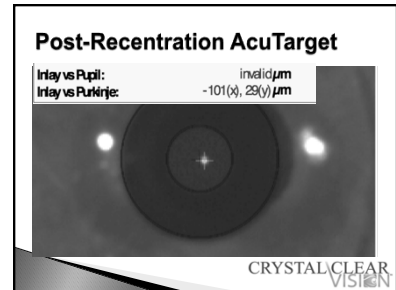
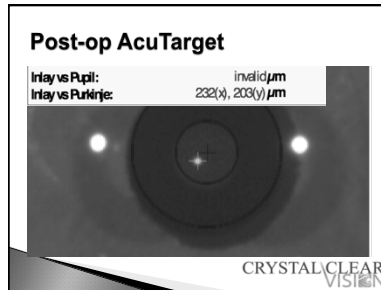
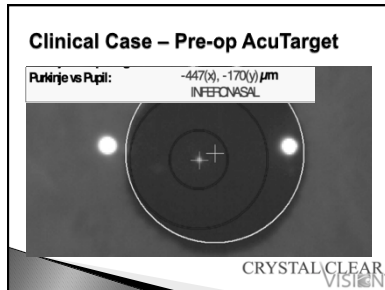
Common Complaints

- ▶ 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:**

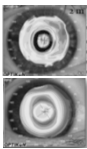
1. Dry Eye
2. Inadequate Refractive Endpoint
3. Decentration

CRYSTAL CLEAR VISION



Post-KAMRA Topography

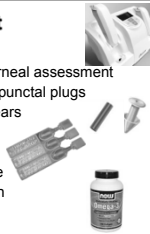
- Typically no change with typical 200-250 micron depth pocket insertion
- Blue Ring – typically an indication of Dry eye, treat with Lubrication, may have increased myopia on refraction
- Red Ring – may be normal, may indicate shallower placement or most importantly, may indicate aggressive Corneal Wound Healing



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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



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Slit Lamp

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

CRYSTAL CLEAR VISION

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:**
 - Dry Eye
 - Inadequate Refractive Endpoint
 - Decentration

CRYSTAL CLEAR VISION

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

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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

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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

CRYSTAL CLEAR VISION

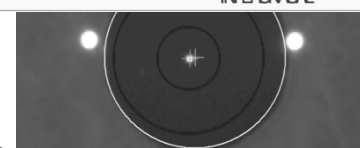
Centration

- In past, if vision remains blurry at one month, we typically verify centration under Takagi microscope and AcuTarget HD
- Today, we are placing patients at AcuTarget HD immediately post-op and verifying centration and if clinically significant (amount or direction) we will move KAMRA inlay immediately based upon findings
- Our centration target today is within 100 microns.

CRYSTAL CLEAR VISION

Real Estate Developer PRE-PEK

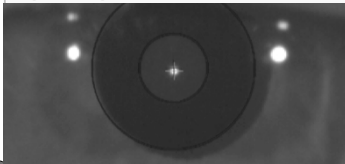
Pupil vs Pupil: -161(x), -33(y) μm
INFERNASAL



CRYSTAL CLEAR VISION

Real Estate Developer POST-PEK

Inlay vs Purkinje: $-20(x), 65(y) \mu m$



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Patient Cases

» Unhappy KAMRA Patient

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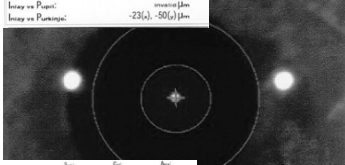
Patient A.G

- Firstly, father of Sondra's son's girlfriend...i.e. his future Father In Law. Age 57
- Performed PLK2: 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

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A.G. CASE study Complaining of Poor Reading: Post-Op AcuTarget

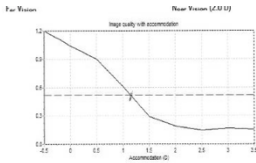
Inlay vs Purkinje: $-23(x), -50(y) \mu m$



	Sur	Cr	Acc
Mean	-0.500	-0.250	1.15
Stdev			

CRYSTAL CLEAR VISION

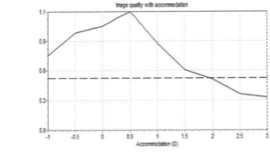
A.G. Low Accommodative Amplitude



OOAS Accommodative Range (D): 1.00

CRYSTAL CLEAR VISION

Typical KAMRA Patient with Good Accommodative Amplitude



OOAS Accommodative Range (D): 2.00

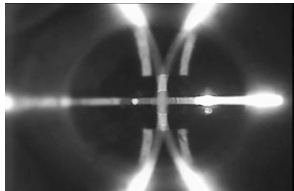
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If Patient Plano & had PEK

- No pre-KAMRA LASIK
- 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

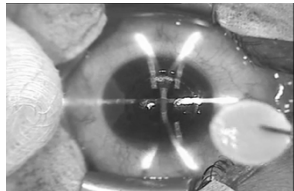
CRYSTAL CLEAR VISION

Hyperopic TransPRK over KAMRA

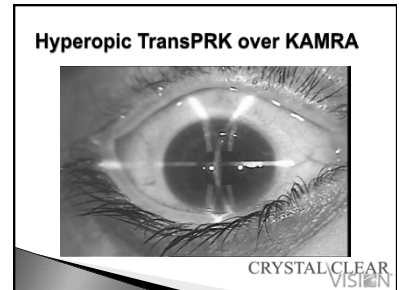
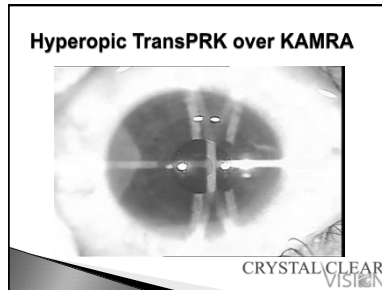
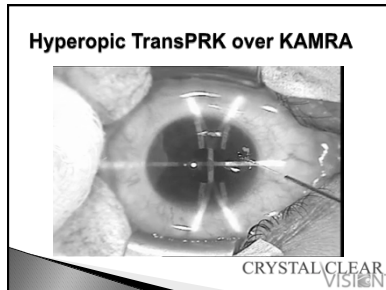


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Hyperopic TransPRK over KAMRA



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Centration Cases

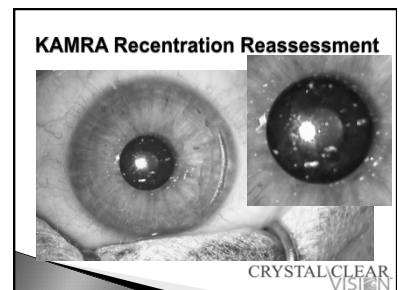
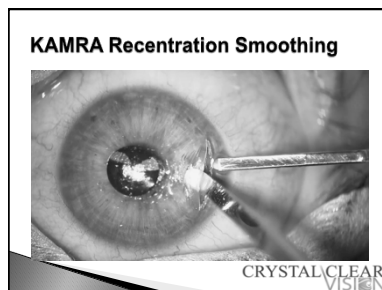
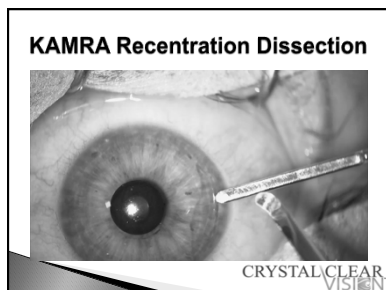
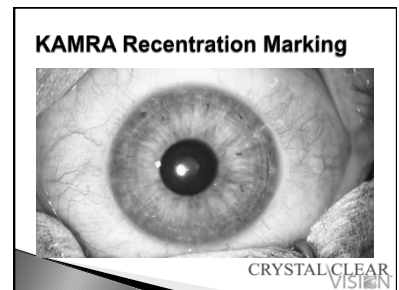
- General teaching has been that placement must be within 300 microns of target but there are a number of issues
- Target is felt to be Visual Axis unless Angle Kappa greater than 400 microns, then midway
 - We ALWAYS use Visual axis even if > 600 microns
 - We ALWAYS use our Takagi microscope for fixation and allow AcuTarget HD to guide us

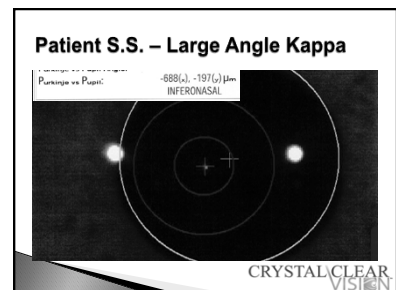
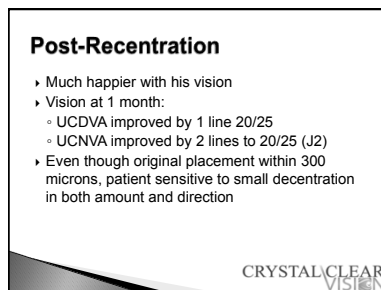
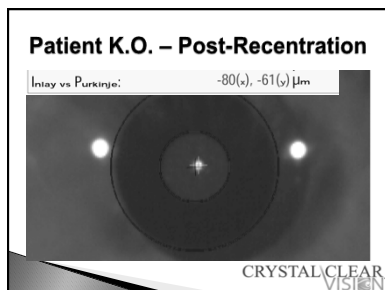
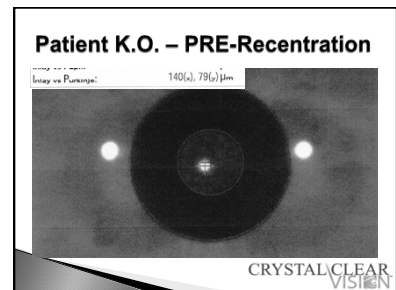
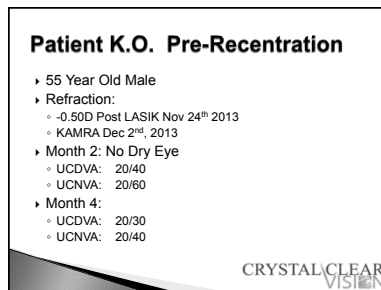
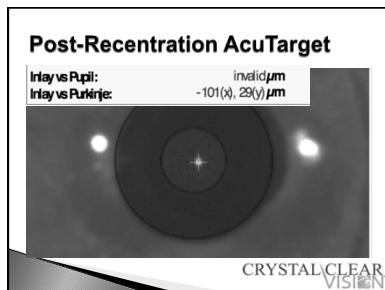
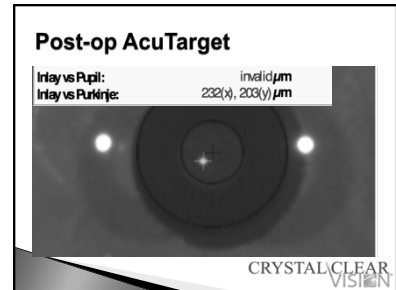
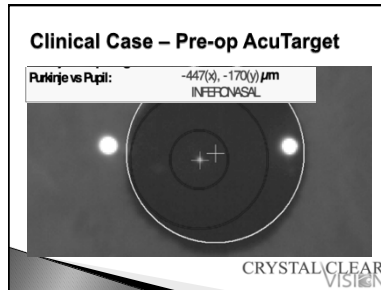
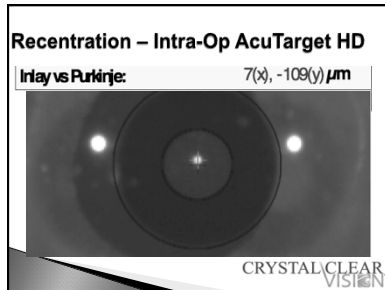
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Recentration – Pre-op AcuTarget HD

Iris vs Purkinje: 138(x), -283(y) μ m

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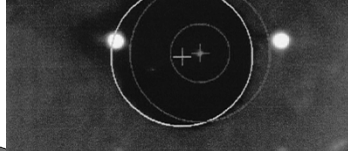
Patient S.S. – Large Angle Kappa

- ▶ 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

CRYSTAL CLEAR VISION

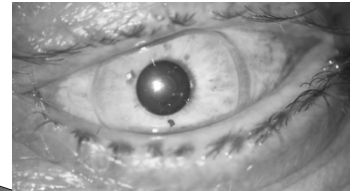
Patient B.K. Pre-Op AcuTarget

Purkinje vs Pupil: 11°
 Purkinje vs Pupil: -483(°), 92(°) μm
 SUPERONASAL



CRYSTAL CLEAR VISION

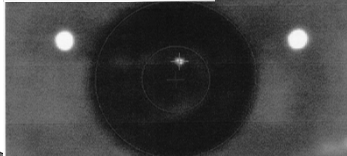
Patient B. K. – Post-op Fixation



CRYSTAL CLEAR VISION

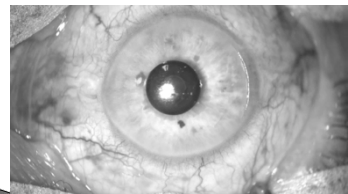
Patient B.K. – AcuTarget HD Post Insertion – Inferior Decentration

Intay vs Pupil: 72(°), -494(°) μm
 Intay vs Purkinje:



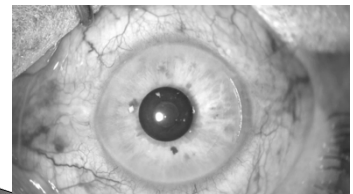
CRYSTAL CLEAR VISION

Inferior Decentration



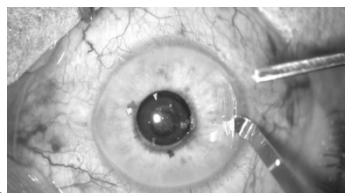
CRYSTAL CLEAR VISION

Marking for Recentration



CRYSTAL CLEAR VISION

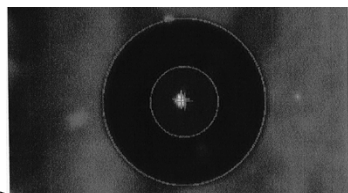
Anterior Dissection



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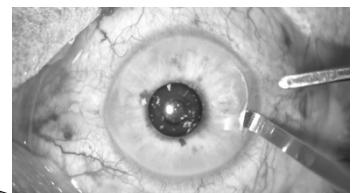
B. K.

Intay vs Pupil: 32(°), -114(°) μm
 Intay vs Purkinje:

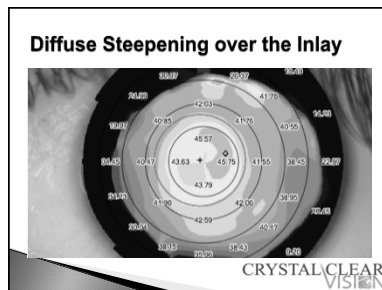
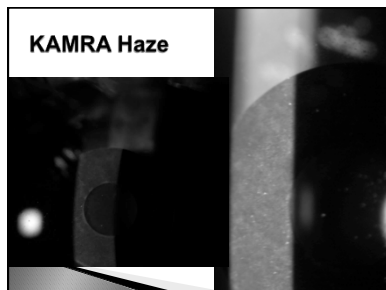
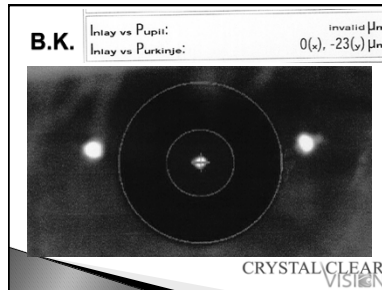
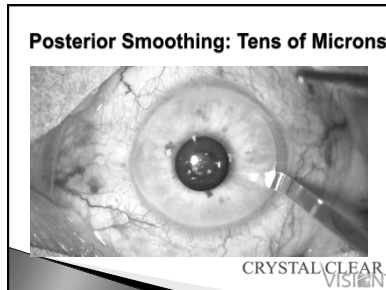


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Anterior Smoothing: 100s of Microns



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Management of Hyperopic Shift

- 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 2weeks, then re-evaluate
- Expect refractive shift back to myopia:
 - If YES: Taper steroids over 3 months
 - If NO: Discontinue steroids and remove Inlay

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PLK2: Most Patients Staged 2 Step LASIK then Pocket KAMRA procedure

First Stage LASIK Procedure	Second Stage Pocket KAMRA Procedure
<ul style="list-style-type: none"> • LASIK 100 micron flap for Ametropia even +0.25D to target -0.50D to -0.75D • Day 1 Wow Factor • Understand Presbyopia 	<ul style="list-style-type: none"> ▸ At 1 week, Confirm Refractive Endpoint ▸ Eye Quiet ▸ Ziemer Pocket at 250 microns, with insertion of KAMRA inlay

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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

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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!**

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