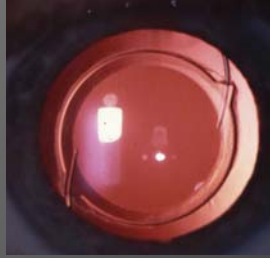


## Pseudophakic Dysphotopsia



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JSEI-UCLA

### Disclosure: Samuel Masket MD

- Consultant Fees – Alcon Laboratories
- Consultant Fees – PowerVision
- Consultant Fees – Ocular Therapeutix
- Consultant Fees – WaveTec
- Royalties – Haag-Streit
- Research Grant – Accutome
- Licensing Agreement – Morcher

### Dysphotopsia: Photic Phenomenon

Subjective (Undesired) Optical Image  
Associated with **Otherwise Uncomplicated  
Cataract/Monofocal IOL Surgery**

- Positive (PD) – light streaks, arcs, flashes, star bursts
- Negative (ND) – temporal dark shadow

# Incidence of Dysphotopsia

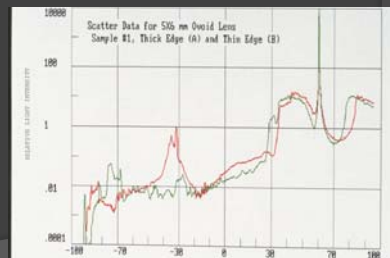
## Chief Cause of Dissatisfaction Following “Routine” Cataract Surgery – Olson

- Tester, et al (JCRS 2000) 49% overall ND/PD
- Bournas (Ophthalmologica 2007) 19.5% POD 1
- Osher (JCRS 2008) 15.2% POD1 3.2% 1 YR ND
- Sharma (ESCRS) 9.6% POD 1 1.6% POD 42 ND
- 30,000 – 100,000 New Pts/Yr US alone

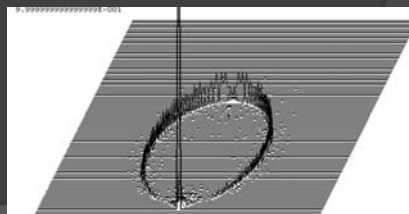
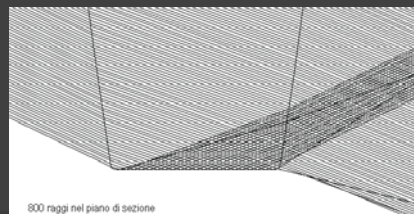
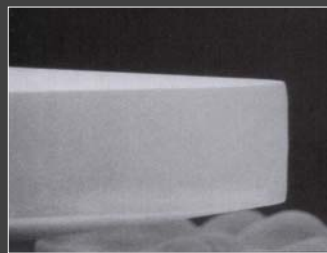
# Edge Induced Dysphotopsia

Not reported until use of ovoid PC IOLs

Masket, et al JCRS 1993

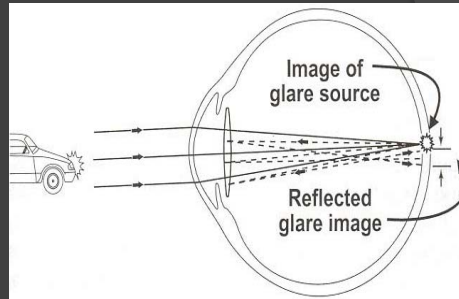


## Ray Tracing Analysis of Edge Types – Franchini JCRS 2/2003



## What Causes Positive Dysphotopsia?

Erie et al (JCRS 2001, 2003) demonstrated that internal reflections of nearly axial light by the posterior aspect of the front surface of the IOL cause positive dysphotopsia. The flatter the lens radius of curvature and the higher the index of refraction of the material, the worse the condition.



## Industry Response to PD

- ◉ Modify square edge – reduce thickness, anterior edge round
- ◉ Leave IOL edge unpolished or frosted
- ◉ Move more optical power to anterior IOL surface, less to posterior surface
- ◉ Opt for materials with lower I/R
- ◉ Reduce surface reflectivity? (albedo)

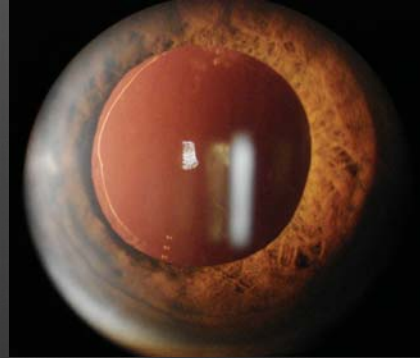
## Negative Dysphotopsia

- ◉ Temporal Dark Arc
- ◉ Davison JCRS 2000
- ◉ Etiology Disputed
  - Holladay – “Enigmatic Penumbra” – IOL Edge, IOL material, PC depth
  - Masket & Fram – Relationship of IOL to capsule bag
- ◉ Review the Suppositions and the Evidence
- ◉ No objective tests, only PROs
- ◉ There are no absolutes with ND

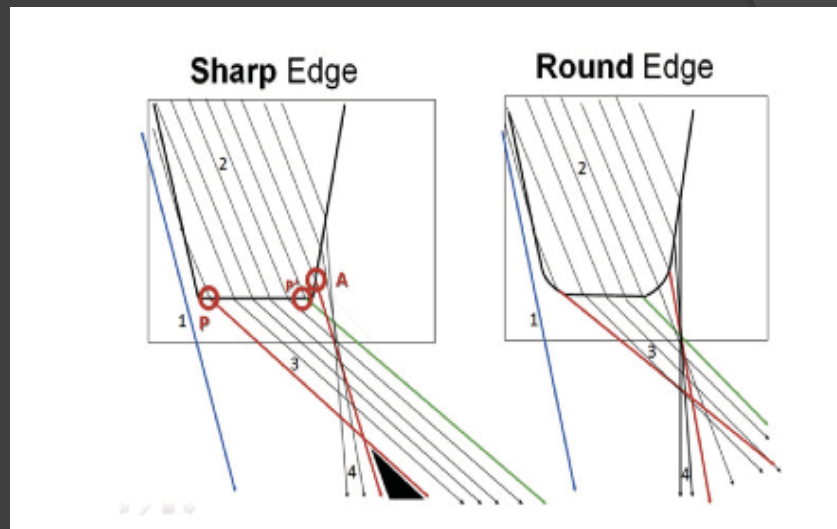


## Negative Dysphotopsia – Things That We Know and Agree To

- ⊗ Stimulated by temporal peripheral light source
- ⊗ May be blocked by the hand “ND salute” or thick eyeglass frame
- ⊗ Symptoms worse when pupils constricted, better when dilated
- ⊗ Associated only with “anatomically perfect surgery”
- ⊗ Symptoms may be unioocular despite similar anatomy



Holladay, et al JCRS 7/2012



## What Causes ND?

### SUPPOSITION

- ⊗ High Index of Refraction, square edged acrylic IOL
- ⊗ AcrySof - Alcon



### EVIDENCE

- ⊗ Trattler et al JCRS 4/05
- ⊗ 3 cases of bilateral ND: one eye of each patient had AcrySof IOL other eye different design/material
- ⊗ All cases in the bag

# What Causes ND?

## SUPPOSITION

- ⊗ High Index of Refraction, square edged acrylic IOL
- ⊗ AcrySof - Alcon



## EVIDENCE

- ⊗ Nevarez et al JCRS 4/05
- ⊗ 2 cases of ND associated with Z9001 Tecnis silicone IOL
- ⊗ Both cases in the bag

# What Causes ND?

## SUPPOSITION

- ⊗ High Index of Refraction, square edged acrylic IOL
- ⊗ AcrySof - Alcon



## EVIDENCE

- ⊗ Vamossi et al JCRS 3/09
- ⊗ 5 cases of ND associated with varied hydrophobic and hydrophilic IOLs
- ⊗ All cases in the bag

# What Causes ND?

## SUPPOSITION

- ⊗ High Index of Refraction, square edged acrylic IOL
- ⊗ AcrySof - Alcon



## EVIDENCE

- ⊗ ND associated with all AcrySof models, SI 30, SI 40, All Tecnis models, Crystalens, AO 60, LI 61AO, AQ 2010V, Collamer Plate, Silicone Plate, SofTec HD, SofTec HDO
- ⊗ No clear data on IOL type and ND incidence

# What Causes ND?

## SUPPOSITION

- ⊗ High Index of Refraction, Square Edged Acrylic IOL

- ⊗ AcrySof - Alcon



## EVIDENCE

- ⊗ Burke et al JCRS 9/14
- ⊗ 5/5 cases of ND cured when in the bag IOLs were exchanged for AcrySof IOLs in the sulcus
- ⊗ All cases originally had IOLs in the bag

# What Causes ND?

## SUPPOSITION

- ⊗ ND induced by expanded depth of posterior chamber after cataract surgery

- ⊗ Holladay et al JCRS 7/12

- ⊗ Mamalis (Editorial) JCRS 3/10

## EVIDENCE

- ⊗ Vamosi et al JCRS 3/10
- ⊗ No difference in iris to optic distance in ND cases vs control group
- ⊗ IOL bag/bag exchange failed to reduce ND
- ⊗ IOL bag/sulcus exchange successful

# What Causes ND?

## SUPPOSITION

- ⊗ High Index of Refraction, square edged acrylic IOL

- ⊗ AcrySof - Alcon



## EVIDENCE

- ⊗ Masket, Fram JCRS 7/11
- ⊗ 3 cases of ND with AcrySof IOL exchanged for in the bag silicone round edged IOLs: No change in ND symptoms

# What Causes ND?

## SUPPOSTION

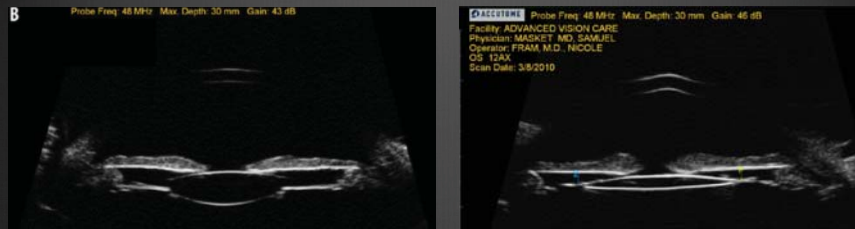
- ⊗ ND induced by expanded depth of posterior chamber after cataract surgery

## EVIDENCE

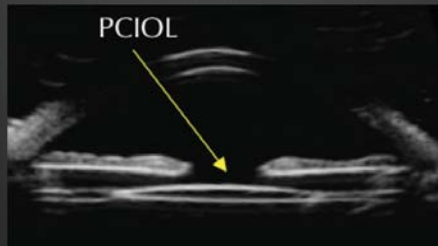
- ⊗ Masket, Fram JCRS 7/11



# UBM Evidence



- ⊗ Top 2 ND
- ⊗ Bottom no ND



# What Causes ND?

## SUPPOSTION

- ⊗ ND induced (transiently) by temporal clear corneal incision
- ⊗ Osher JCRS 2008
- ⊗ Holladay et al 7/2012

## EVIDENCE

- ⊗ Cooke JCRS 4/2010
- ⊗ Masket JCRS 4/2005
- ⊗ ND with superiorly placed incisions



# What Causes ND?

## SUPPOSTION

- ⊗ ND induced (transiently) by temporal clear corneal incision
- ⊗ Osher JCRS 2008
- ⊗ Holladay et al 7/2012

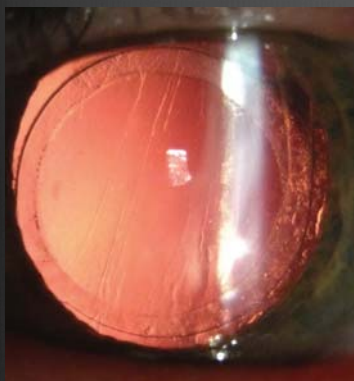
## EVIDENCE

- ⊗ ND HAS NEVER BEEN REPORTED WITH RK,AK, HEX K, ALK LASIK, PKP, DSAEK OR ANY OTHER CORNEAL INCISIONS

# What Causes ND? Summary of the Evidence

- ⊗ ND not induced solely by high I/R square edged IOLs
- ⊗ ND not induced solely by acrylic IOLs
- ⊗ ND not induced with ciliary sulcus IOLs
- ⊗ ND not induced with ACIOLs
- ⊗ ND not induced by deepened posterior chamber
- ⊗ ND not induced by corneal incisions
- ⊗ ND noticed early after surgery and dissipates in most cases

# Supposition: ND Reduces Over Time Owing to Ant Capsule Haze



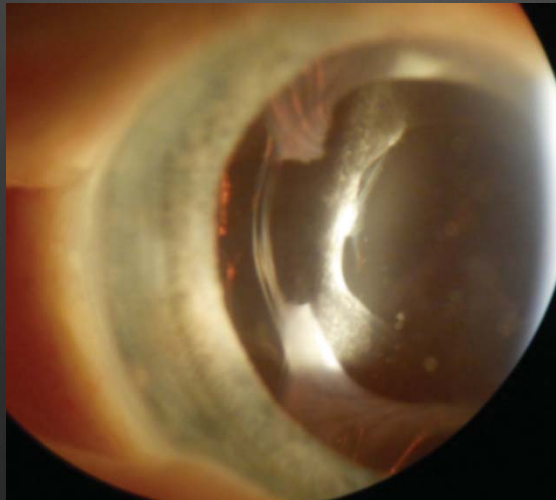
## Evidence

Nd:YAG Laser Anterior Capsule Relaxing Incisions (nasal side)

- ⊗ Folden, et al JCRS 7/13
  - ⊗ 5/6 improved or cured
- ⊗ Cooke, et al JCRS 7/13
  - ⊗ 1/1 case cured

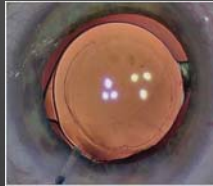


# Folden JCRS 7/2013



## What Does Induce ND? Literature Consensus:

The common pathway for Negative Dysphotopsia is ANY "in the bag" IOL with the anterior capsulotomy edge overlying the optic



Negative Dysphotopsia is prevented, relieved, or improved when the IOL optic edge overlies the anterior capsulotomy

Anterior capsulotomy - IOL interface appears to be a source of ND

## The Anterior Capsule and ND



Reverse (Anterior) Optic Capture is (virtually) universally successful

# Negative Dysphotopsia: Surgical Experience - 45 Eyes

“Reverse Optic Capture”

Primary - 10/11\*

Secondary 15/16

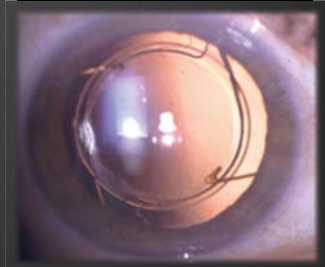
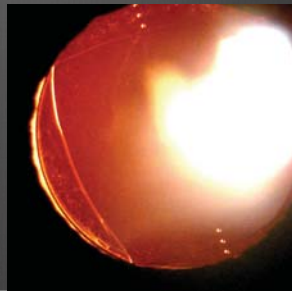
IOL Exchange - Bag to sulcus

3/4\*

Overall benefit 28/31\* eyes

Bag/bag exchange 0/3

Piggyback IOL 8/11



## Treatment: Malfunctioning PCIOLs

**Multifocal  
PCIOLs**

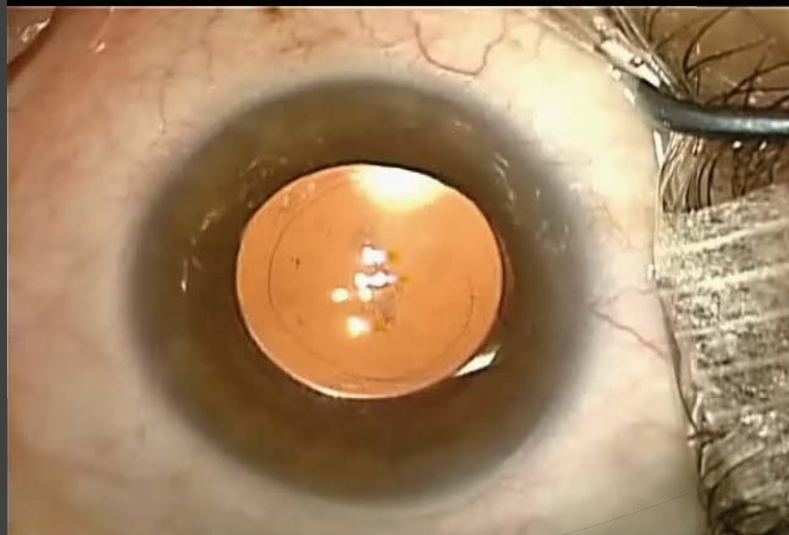
Removal and  
Replacement with  
monofocal

**Positive  
Dysphotopsia**

- Pharmacological treatment
- Removal and replacement for different IOL material

**Negative  
Dysphotopsia**

- Reverse (anterior) optic capture
- Sulcus placed IOL



# Masket™ Anti-Dysphotopic IOL

US Patent # 8652206B2

Allow IOL to be bag placed

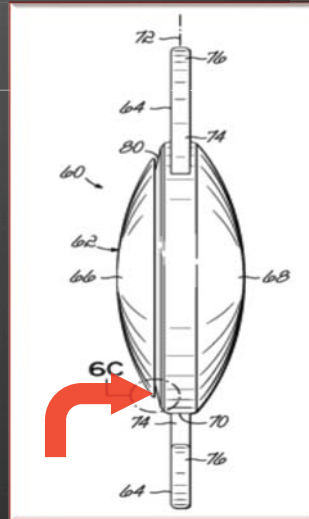
Allow for any haptic design

Allow for any edge design

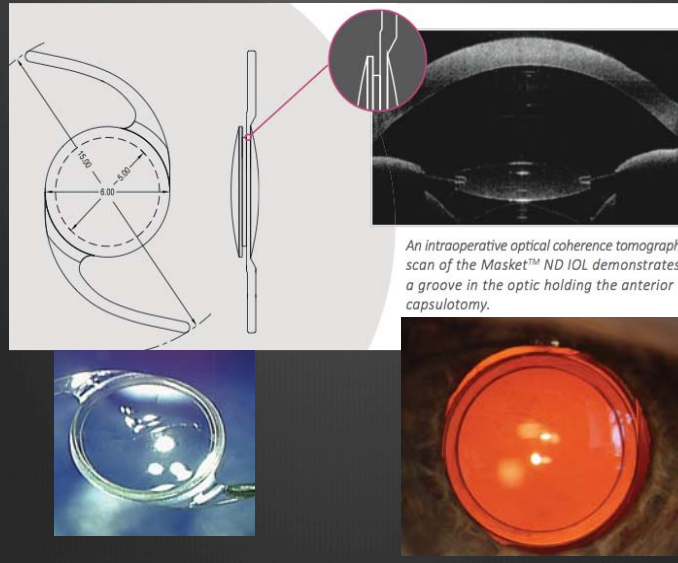
Allow for toric, MF, etc.

Allow for near routine surgery

Groove on anterior optic surface allows optic to overlap capsulotomy



## Masket™ Anti NDIOL - Morcher 90S – CE Marked



## Initial Clinical Results – 20 Cases

B Dick and Tim  
Schultz – 8

Findl – 5

Tobias Neuhann – 4

Jorge Alio – 2

Gunther Grabner – 1

No ND/PD

