

○ ○ **David J. Apple, MD Laboratories for Research on Ophthalmic Devices Salt Lake City, Utah**




DJ Apple, MD

Apple Korps 1972-2008 („210“)

Research Fellows from Germany

- G.U. Auffarth, MD
- M.P. Holzer, MD
- E. Imkamp, MD
- G. Kleinmann
- U. Legler, MD
- Irmí Neuhann, Md
- Ute Nicolei, MD
- Seung Jeong Lim, MD
- H. Sandoval, MD
- J. Schmidbauer, MD
- M.R. Tetz, MD
- Th. Wesendahl, MD

DJ Apple, MD

 **John A. Moran Eye Center**

**Findings on IOL Calcification:
A new Classification**

David J. Apple Laboratories for Ophthalmic Devices Research
2902 Brownell Ave, Sullivan's Island, South Carolina

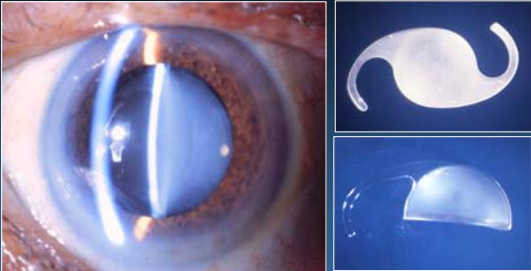
DJ Apple, MD

Neuhann IM, Kleinmann G, Apple DJ.

A new Classification of Calcification of Intraocular Lenses

Ophthalmology, 2007

DJ Apple, MD



DJ Apple, MD

○ ○ **Hydrogel (Hydrophilic acrylic) Opacifications:**

Partial Listing of Manufacturers:

- Bausch and Lomb (B and L)
- Cibavision
- Medical Developmental Research (MDR)
- Ophthalmic Innovations International (OII)
- International Ophthalmic Devices (IOD)
- Mediphakos

and multiple sub-distributors

DJ Apple, MD

Classification of IOL Calcification

1. Primary
2. Secondary

David J. Apple, MD Laboratories
for Ophthalmic Devices Research

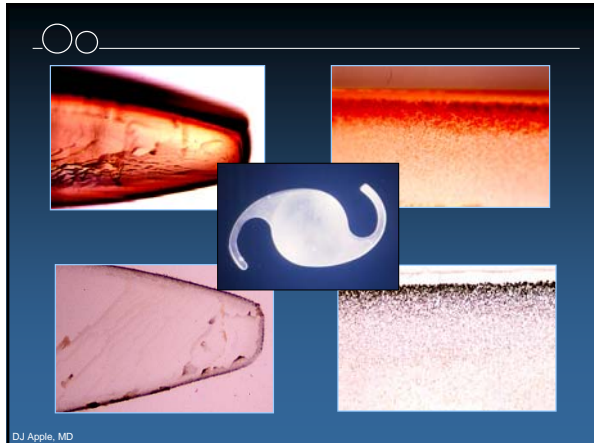
DJ Apple, MD

Classification of IOL Calcification

1. Primary

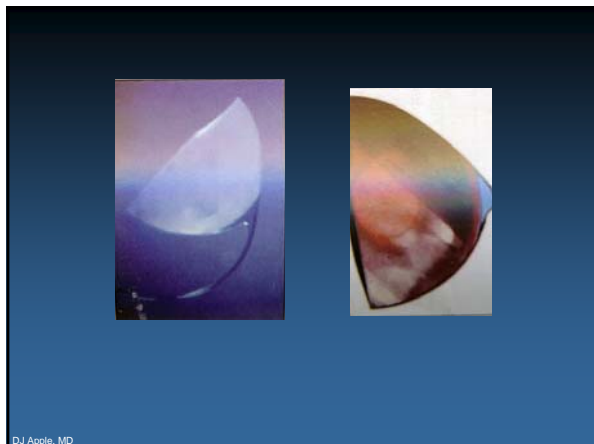
David J. Apple, MD Laboratories
for Ophthalmic Devices Research

DJ Apple, MD



Primary calcification: The IOL should be
withdrawn or modified

DJ Apple, MD



IOL Calcification

Primary—Problem with IOL
Material/Fabrication

- MDR
- OII
- Others

Secondary

- Pre-existing Disease or
Intraoperative Conditions

DJ Apple, MD

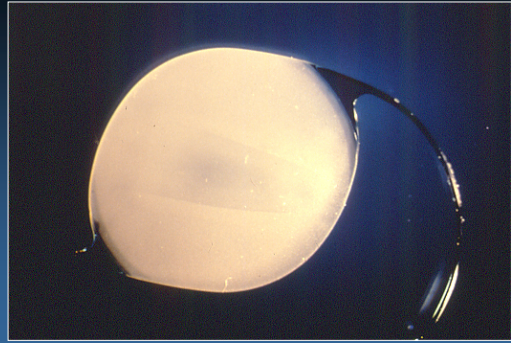


Classification of IOL Calcification

2. Secondary

David J. Apple, MD Laboratories
for Ophthalmic Devices Research

DJ Apple, MD



DJ Apple, MD

Some Causes of Secondary Calcification

- Any condition associated with breakdown of the blood aqueous barrier
- Diabetes
- Uveitis
- PHPV
- Surgical, eg., Broken Capsule

DJ Apple, MD

Secondary calcification is by definition **not** IOL related; it may occur with virtually all IOL designs implanted under various adverse circumstances.

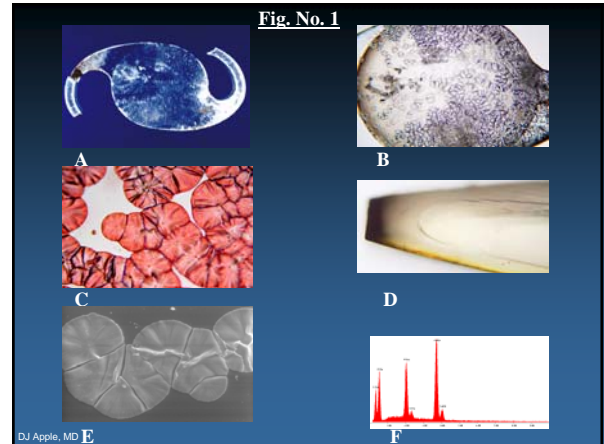
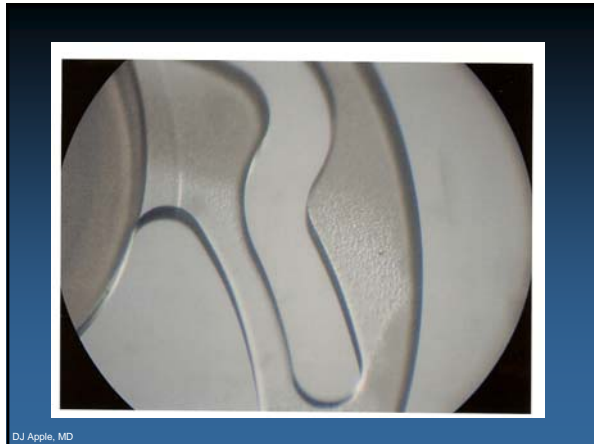
DJ Apple, MD



DJ Apple, MD



DJ Apple, MD



Is there a role for hydrophilic acrylic materials for IOLs?

MODERN well-designed, well-manufactured and well-implanted hydrophilic acrylic IOLs can be desirable in certain clinical situations. But, what about calcification?

D.J. Apple, MD

Microanalysis of Opacified Hydrophilic Acrylic Intra Ocular Lenses (Aqua-Sense)

H. Porooshani, R. Williams, M. Batterbury

D.J. Apple, MD

Comparison of Calcification of Three Intraocular Lens Materials, Hydrophilic and Hydrophobic Acrylic, and Silicone

Roger F. Steinert, M.D.
 Vice-chair Clinical Ophthalmology
 Director of Cornea, Refractive and Cataract Surgery
 University of California, Irvine

Rakhi Jain, Ph.D.

D.J. Apple, MD

Calcification Study

Purpose: To compare IOLs of different materials in the same model system of IOL calcification

Method: 3 IOLs per group implanted subcutaneously for 10 weeks in New Zealand White rabbits

Lens analysis:

- Scanning electron microscopy (SEM) of central portion of IOL at 500X
 - Identifies surface morphology (deposits, pits, nodules)
- Energy-dispersive x-ray spectroscopy (EDX) of central portion of IOL
 - Elements release X-rays with unique amounts of energy
 - Identifies elemental composition of sample
 - EDX sampled at same place on optic as SEM photo

D.J. Apple, MD

Hydrophilic Acrylic IOLs

Phosphorus (P) peak present
Calcium (Ca) peak present for both IOLs
No nitrogen (N) peak*

Pits, nodules and deposits on the surface of the IOL optic

Acri-Smart IOL

SEM

Akreos Fit IOL

SEM

*No nitrogen in EDX suggests deposits are not cellular

Hydrophilic Acrylic IOLs

Phosphorus (P) peak present
Calcium (Ca) peak present for both IOLs

Pits, nodules and deposits on the surface of the IOL optic

Rayner Centerflex IOL

SEM

Corneal IOL

SEM

DJ Apple, MD

Hydrophobic Acrylic IOLs

No phosphorus (P) or calcium (Ca) peaks for either IOL

No pits, nodules or deposits on the surface of either IOL optic

Clariflex silicone IOL
Silicon (Si) peak due to silicon in IOL

EDX

SEM

AR40e acrylic IOL
Fluorine (F) peak due to fluorine in IOL

EDX

SEM

DJ Apple, MD

D. Apple, Salt Lake

DJ Apple, MD

Rayner Centreflex and B&O Akreos

No reported primary calcification

Rare but significant secondary calcification

DJ Apple, MD

Classification of IOL Calcification

1. Primary
2. Secondary

Thank You!

David J. Apple, MD Laboratories
for Ophthalmic Devices Research

DJ Apple, MD

