ELECTRONIC CLINICAL CASE

Calcification of a hydrophilic acrylic intraocular lens: Case report with laboratory analysis

Calcification d’un implant intraoculaire acrylique hydrophile : cas clinique avec analyses physicochimiques

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Summary We analyzed a single-piece plate-type hydrophilic acrylic posterior chamber intraocular lens (IOL) that was explanted due to a progressive loss of vision, which occurred 6 years after uncomplicated phacoemulsification. Gross and light microscopy, as well as anterior segment optical coherence tomography (OCT) revealed granular deposits below the IOL surface. Light scattering, as measured with Scheimpflug photography and densitometry analyses was found to be increased; spectrophotometry demonstrated a decrease in the light transmittance of the explanted lens. The granular deposits within the IOL material were found to be composed of calcium by histochemical methods (alizarin red and Von Kossa stains). To our knowledge this is the only report of calcification of this IOL design.

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KEYWORDS
Intraocular lens; Hydrophilic acrylic; Calcification; Explantation; Anterior segment optical coherence tomography

MOTS CLÉS
Implant intraoculaire ; Acrylique hydrophile ; Calcification ;
Explantation ;
Tomographie à
cohérence optique du
segment antérieur
de la transmission lumineuse de l’implant. Les analyses histochemiques par le rouge d’alizarine
et la méthode de Von Kossa ont démontré que les dépôts granulaires dans le matériau de
l’implant étaient composés de calcium. À notre connaissance, il s’agit du premier cas de
calcification de cet implant.
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Introduction

Calcification of the intraocular lens (IOL) optic mate-
rial leading to lens opacity and reduced visual function
is a complication that has been observed in some
hydrophilic acrylic posterior chamber IOL designs [1–3].
This phenomenon has also been observed in silicon lenses
in association with asteroid hyalosis [4–6]. Studies of
explanted opacified hydrophilic acrylic IOLs by histochem-
ical methods such as alizarin red stain or Von Kossa stain,
as well as surface analyses confirmed the calcific nature
of the opacification process. These studies, and others
using anterior segment optical coherence tomography (OCT)
demonstrated deposition of granular calcium deposits within
the hydrophilic acrylic material, in a band at some dis-
tance from the IOL surface, or on the material surface [2,7].
Scheimpflug photography with densitometry analyses and
spectrophotometry has shown that the calcium deposits can
increase light scattering and decrease light transmittance
by the affected lenses [8].

The Genium Prepak is a hydrophilic acrylic posterior
chamber IOL that is pre-packaged in a specially-designed
sterile injector for delivering the implant into the capsu-
lar bag. This lens is manufactured by LCA Pharmaceutical
(Chartrres, France). The IOL consists of a single biconvex
optic surrounded by one leading haptic and two trailing hap-
tics arranged in a plate-type, triangular configuration.
The length of the lens, from the tip of the leading haptic to
the tips of the trailing haptics is 11.0 mm. Two optic sizes are
available: 5.5 mm and 6.0 mm.

Case report and laboratory analysis

A 79-year-old woman was referred to one of us (PR) for
IOL exchange in December 2011 because of late onset IOL
opacification in her right eye. Her current medications were
clonidine and bisoprolol hemifumarate/hydrochlorothiazide
for high blood pressure, bezafibrate for hyperlipidemia, and
chondroitin sodium sulphate for arthritis. She had under-
gone phacoemulsification with IOL implantation in the right
eye (OD) on January 19, 2005 under topical anesthesia with
no surgical complications. The IOL inserted was a Genium
Prepak AF15.5, with a dioptic power of +22.5 D. The same
surgery was performed on the left eye (OS) a few weeks later
under the same conditions and a Genium Prepak AF15.5
IOL, with a dioptic power of +21.5 D was implanted. The
postoperative course was uneventful. Postoperative visual
acuity in both eyes was LogMAR 0.00 J1 with a slightly
myopic correction. An Nd:YAG laser posterior capsulotomy
OD was performed in 2008. The patient complained of pro-
gressive blurry vision in January 2011. At that time the

Figure 1. Slit lamp photograph of the patient’s right eye prior
to explantation and lens exchange. The intraocular lens is well-
centered, but the optic is opacified.

best-corrected visual acuity (BCVA) was LogMAR 0.18 J2 OD,
and remained at LogMAR 0.00 J1 OS. At the time of referral
in December 2011, the BCVA OD was LogMAR 0.40 J3. Biomicro-
scopic examination revealed well-centered IOLs, fixated
in the capsular bag in both eyes. The right IOL exhibited a
diffuse milky opacification (Fig. 1). The left IOL remained
completely transparent. The endothelial cell count was
1600 cells/mm² OD and 1960 cells/mm² OS. Macular OCT
imaging was normal bilaterally. The patient underwent an
IOL exchange in the right eye in January 2012 with anterior
vitrectomy and insertion of a 3-piece Acrysof IOL (Alcon Lab-
oratories, Fort Worth, TX, USA) in the sulcus under general
anesthesia. The postoperative course was uneventful with
complete visual recovery to a BCVA OD of 0.00 LogMAR.

The explanted IOL was sent to the laboratory at the John
A. Moran Eye Center intact in the dry state. There was a
cut extending from the periphery of the optic to its center
between the two trailing haptics that had been made during
explantation. The optic and haptics were moderately
opacified and there was a mild amount of dried material on
the IOL surface. Gross photographs of the lens were taken
(Fig. 2).

The IOL was examined with light microscopy, where dried
ophthalmic viscosurgical device (OVD) and balanced salt
solution (BSS) crystals were noted on the optic surface. Mu-
tiple, small granular deposits were noted within the optic
material and also within the haptics. There were also a few
cellular deposits on the lens surface.

The IOL was hydrated in distilled water and placed
in a model eye for imaging with anterior segment
OCT (Visante, Zeiss, Jena, Germany), and Scheimpflug
photography with light scattering measurements (EAS-1000, Nidek, Tokyo, Japan). Anterior segment OCT showed sub-surface densities within the IOL optic (Fig. 3A). Scheimpflug photography showed a high level of light scattering occurring close to the optic surfaces (Fig. 3B). The highest value measured was 223 computer compatible tapes (CCT), in a scale from 0 (black) to 255 (white). Light transmittance was then measured through the optic of the explanted IOL using a Perkin-Elmer Lambda (Waltham, MA, USA) 35 UV–vis spectrophotometer (single-beam configuration with a Lab Sphere RSA-PE-20 integrating sphere). For this, the IOL was placed inside a cuvette filled with BSS. Fig. 4 plots the percent light transmittance through the explanted IOL and a control hydrophilic acrylic IOL over the wavelength interval from 350 nm to 850 nm. The average light transmittance in the visible light spectrum was 92.5% for the explanted lens, and 97.3% for the control lens.

Following imaging, the IOL was stained with alizarin red (Fig. 5C). This confirmed that the granular deposits were, at least in part, composed of calcium. An optic cylinder was cut from the center of the optic and stained with the Von Kossa method, which confirmed the presence of calcified granules within a subsurface band inside the IOL optic material, and also demonstrated the present of calcified granules in the center of the optic (Fig. 5D).

Discussion

There are a variety of causes of postoperative opacification or discoloration of IOLs, which are dependent on the material composition of the IOL in addition to other aspects of the manufacturing process, as well as surgical factors, patient factors, packaging and other variables. The causes of IOL opacification/discholoration include chemical exposure, systemic medications, silicone oil deposition, calcification and material degeneration [1].

Granular deposition of calcium within the IOL material has been observed in a number of hydrophilic acrylic designs [3]. Surface calcification has been reported to occur on silicone lenses that have been implanted in eyes with asteroid hyalosis and in some hydrophilic acrylic lens designs [2,4–6]. Calcification has not been reported to occur in hydrophobic acrylic or poly(methyl methacrylate) (PMMA) lenses. Catanese et al. published a case of an IOL with intraoptic opacification, which they described as glistennings [9]. They presented an OCT image which is similar to Fig. 3A. We have analyzed cases of IOLs explanted because of a pattern of optic opacification very similar to that of Catanese et al. They were represented by explanted
single-piece hydrophilic acrylic IOLs with intraoptic calcified granules; the calcific nature of the granules was confirmed by different methods for calcium [10, 11]. We believe the case of Catanese et al. actually corresponds to optic calcification of a hydrophilic acrylic lens and not glistenings. When present, glistening are usually homogeneously distributed throughout the optic of the lens [7,12]. Optic opacification due to calcification usually results in significant decrease in visual function, requiring explantation. In some cases, the visual acuity may remain unchanged, and the complaints are dominated by disability glare. This may be because calcification significantly increases light scattering in the affected IOL [8,13], although it may only reduce light transmittance in the visible spectrum by about 5%, as was the case with the Genium Prepak explant that we analyzed [8]. Clinically, it can sometimes be difficult to distinguish surface calcification, intraoptic calcification, posterior capsular opacification (PCO) and other causes of postoperative opacification and vision loss. Anterior segment OCT and/or Scheimpflug photography may be useful in telling these entities apart [7,8]. PCO can be managed with Nd:YAG laser posterior capsulotomy whereas other causes of opacification may require a lens exchange. It is therefore important to identify the etiology of the optic opacification and vision loss accurately prior to treatment.

Conclusion

We analyzed an explanted Genium Prepak hydrophilic acrylic posterior chamber IOL that was explanted due to opacification and vision loss. A dense band of calcified granular deposits was identified beneath the surface of the IOL material. To the best of our knowledge, this is the only report on late postoperative calcification of this lens design, and we are not aware of other cases. Awareness of this potential complication and imaging/analyses methods that may assist in the diagnosis are warranted.

Disclosure of interest

The authors declare that they have no conflict of interest concerning this article.
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