Opacification of a CeeON 911A Silicone Intraocular Lens Caused by Deposits on the Optic without Asteroid Hyalosis

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Abstract: This study reports a case of calcific opacification on an implanted silicone intraocular lens (IOL) without asteroid hyalosis. A 72-year-old female was referred for blurred vision in her left eye. Her history showed she had undergone uneventful phacoemulsification with in the bag implantation of a silicone foldable hydrophobic IOL (CeeON 911A, Pharmacia Corporation) 39 months earlier. Under slit-lamp examination, multiple diffuse granular –appearing opacification in the optic were noted. The surgery for IOL explanation and replacement was performed because of significant visual disturbance. Crystals of calcium phosphate in brush form were found under light microscopy. It looked like the feather beside the brush. The scanning electron microscopy revealed a morphous crust-like layer on the curved posterior optic surface of the lens. The transmission detecting systems showed that the transmission rate of the opacified silicon IOL was near 0%. It may have decreased the visual acuity of the patient and limited her daily-activities and stereo-acuity. To our knowledge, this is the first report of surface calcification of a silicone IOL in the absence of asteroid hyalosis. Although the mechanism of calcification has not been determined, careful clinical follow-up of patients with implanted silicone lenses is necessary to determine if this phenomenon is rare and sporadic or if it is more widespread.
[Feng-Chi Lin, Han-Yin Sun, Ming-Liang Tsai, Jeng-Shuan Shiang, Shang-Tao Chien, Chi-Ting Horng. **Opacification of a CeeON 911A Silicone Intraocular Lens Caused by Deposits on the Optic without Asteroid Hyalosis.** Life Science Journal 2010;7(4):173-176]. (ISSN: 1097-8135).

KEY WORDS: silicon intraocular lens, opacified intraocular, asteroid hyalosis

I. INTRODUCTION

LONG- term biocompatibility of intraocular lenses (IOLs) is a major factor in successful cataract surgery. The post-operative complication of IOL opacification raises concerns about the biocompatibility of these lenses. Opacification were seen in PMMA lens [1], hydrophilic acrylic IOLs [2,3], and several silicone IOLs in eyes with asteroid hyalosis [4], which has been noted in previous surveys. Now we describe opacification of a silicone IOL 39 months after uneventful cataract surgery. To our knowledge, this is the first report of posterior surface calcification of a silicone IOL without asteroid hyalosis.

Case Report

A 72-year-old female was referred for blurred vision in her left eye. Her history showed she had undergone uneventful phacoemulsification within the bag implantation of a silicone foldable hydrophobic IOL (CeeON 911A, Pharmacia Corporation) 39 months earlier (June 2007). Over the next 3 years, the opacification increased. On examination, the best-corrected visual acuity was 6/60 in left eye. Her biocular stereopsis was only 800msec tested by Stereotest-Circles (Stereo Optical Co., Inc. USA). Slit-lamp examination revealed diffuse multiple granular deposits on the posterior surface of the IOL optic (Figure 1). Neither asteroid hyalosis nor any other vitreous condition was noted in the vitreous cavity. Under the impression of after-catarat, we performed the laser capsulotomy to polish the posterior capsule but failed. The irregular deposits also still persisted and our treatment did not improve her vision (Figure 2). Then we arranged to remove the opacified IOL through superior approach, and a PMMA lens with scleral fixation in the sulus position was performed at the same time. Two month later, the bare visual acuity of her left eye had improved to 20/25.

Results and Discussions

1. The explanted IOL was stored in a dry, sterile vial without fixatives. Care was taken not to manipulate the surface of the IOL optic with instrument before analysis.

The lens was then bi-sected. One half was analyzed by light microscopy and scanning electron microscopy. Photographs were also taken. Half of the calcified IOL was checked to determine the transmission rate (%) by transmission detecting system (Figure 3).

2. The optical surface of the opacified IOL was covered by multiple irregular granular black deposits (Figure 4).

3. Light photomicrographys (Nikon,Japan) showed the crystals of calcium phosphate in brush form beneath the IOL. We checked the shape of the feather beside the brush, and the morphology looked like monomers of calcium phosphate in brush form Figure 5.

4. The opacified IOL was analyzed under the low magnification scanning by electron microscopy (Hitachi,Japan). It revealed small round deposits on the curved shape surface of silicon IOL(Figure 6).

5. We found the irregular deposits forming amorphous crust-like layer on the posterior optic surface of the lens under high-magnification scanning electron microscopy (Hitachi,Japan)(Figure7).

6. We used the detecting system to compare the transmission spectrum of various types of IOL. Four types of IOL inclunding Akreos (Adapt acrylic lens, Baush & Lomb), SoFlex(Silicon fordable IOL, Baush & Lomb)、AMO- DL65T (PMMA IOL, Advanced medical Optics, Inc.)、CeeON 911A (Silicone foldable IOL, Pharmacia Corporation) were analyzed by transmission rate (%).

It presented the transmission spectrum of the IOL covered from 320 nm to 750 nm. The transmission intensities are weak when the wavelength of light is less than 400 nm for these four types of IOLs. We found the higher transmission rate (almost 50%) of AMO- DL65T PMMA IOL and the lower transmission rate (nearly 0%) of opaficication of IOL CeeON 911A in the wavelength of visible light spectrum (Figure 8). It indicated that the lower transmission rate may induce the decreased visual acuity of this patient and the poor binocular steropsis may affect her daily activities.

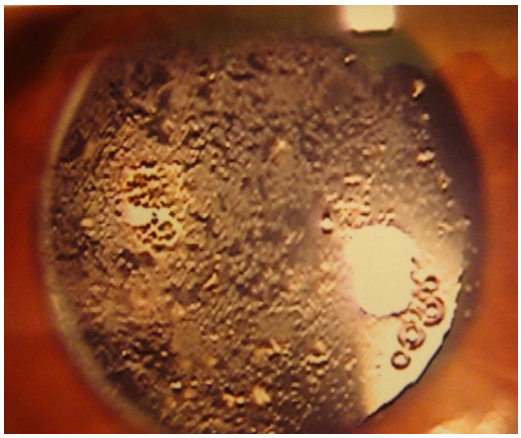

Figure 1. Opacification of Intraocular Lens under Slit-lamp Examination

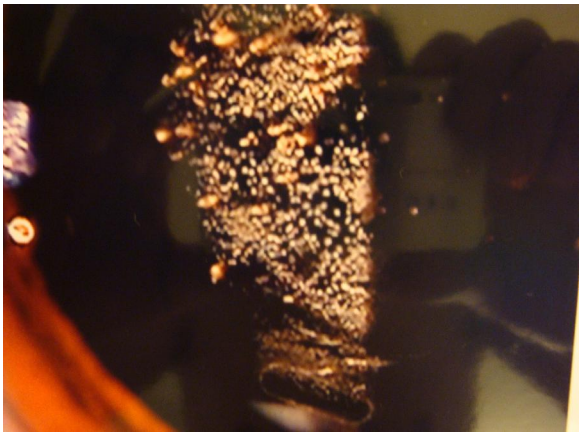

Figure 2. The Deposits of IOL Can Not Be Polished by Neodymium:yttrium-aluminum-garnet (Nd:YAG) Laser Treatment

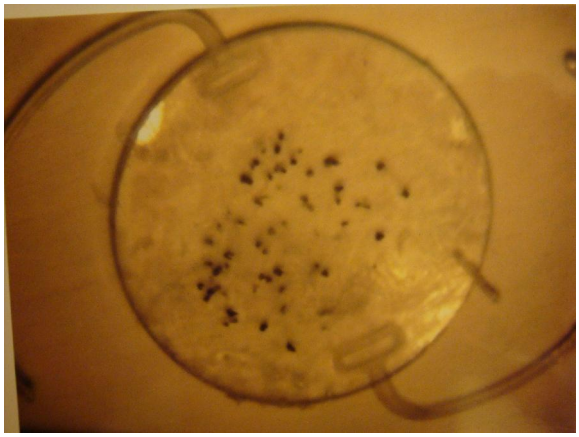

Figure 3. Multiple mutton-like black deposits on the posterior surface of the IOL after remove by surgery

This phenomenon of calcified silicon IOL was first reported by Foot [5] and Wackernagel et al. [6] since 2004. It often resulted in a clinically significant visual decrease long after the implantation, sometimes to a severity that required IOL explanation or exchange. Several types of late postoperative IOL were mentioned. Apple et al. reported a case of late postoperative degeneration of polymethyl methacrylate (PMMA) lenses [1]. Recent articles described some cases of late postoperative complications with hydrophilic IOLs caused by calcification [2-3]. However, intraocular lens calcification is not a common problem with silicone lenses. Since 2004, only a few cases of calcified silicone IOLs in eyes with asteroid hyalosis requiring explanation have been described in the literature [5-8].

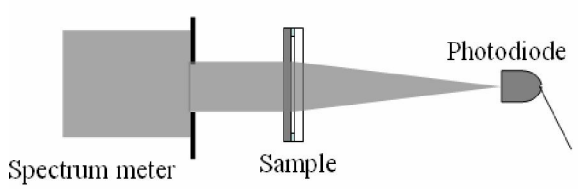

Figure 4. The measurement of transmission spectrum system

In 2010, Stringham et al [4] had a series of studies about the association between calcification of silicones lenes and asteroid hyalosis. In their study, there are 22 cases of calcification of silicone lenses involving 8 desings manufactured from different silicone materials described in the literature. There were noteworthy remarks in some eyes including vitreous hemorrhage, silicon oil retention with a small amount in the anterior chamber, low-grade postoperative endophthalmitis, SF6 gas retention in the anterior chamber to reattach a Descemet's stripping automated endothelial keratoplasty flap. However, they suggested the strong association between opacified silicon IOL and asteroid hyalosis.

Asteroid hyalosis is a vitreous disease chacterized by brilliant reflecting particles (so called asteroid bodies) floatering in an apparently normal vitreous body. Bergren et al. demonstrated a significant association between asteroid hyalosis with diabetes, systemic arterail hypertension, and atherosclerotic vascular disease [9]. Its prevalence was approximately 1%, and usually appearing unilateral without predispostion to gender or race. Their presence dose not cause any impairment to vision [9,10]. Topilow et al. reported that asteroid hyalosis enmeshed within normal vitreous collagen fibrils and that some were attended by macrophages or multinucleated epithelioid cells. Transmission electron microscopy disclosed irregular calcified material and complex lipids within the asteroid bodies [11]. Miller et al. found that x-ray micro-analysis confirmed the presence of calcilum and phosphorus in the asteroid bodies [12]. Recently, an electron spectroscopic imaging study conducted by Winkler et al. confirmed a homogeneous distribution of calcium, phosphorus, and oxygen within the asteroid bodies [13]. Therefore, they may represent a continuous supple of calcium or be an indicator of a continuous supply of this mineral to the vitreous.

Figure 5. The type of crystals of calcium phosphate in brush form was found under light microscopy. It looked like the feather beside the brush.

When the barrier function of the posterior capsule was damaged by laser capsulotomy, the calcium and phosphate originated from the vitreous in eyes with asteroid hyalosis may have cross the posterior capsule and precipate on the posterior IOL surface [14].It seems that direct contact between the posterior IOL surface and the vitreous, promoted by the laser posterior capsulotomies, accelerated the process of calcium precipitation [4,7].

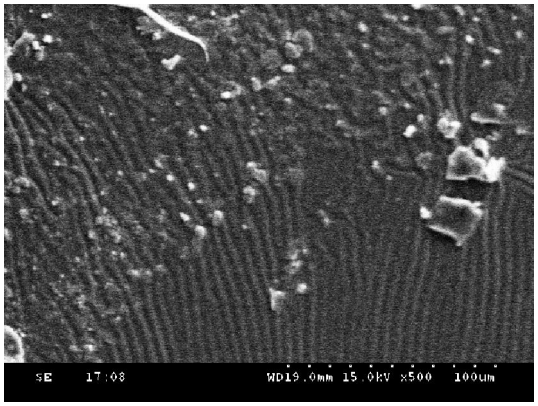

Figure 6. Low-magnification scanning electron photomicrography revealed small deposits on the curved-shape surface of silicon IOL

There is, therefore, increasing evidence that the material opacifying silicone IOLs is derived from the asteroid bodies because its composition was similar to that of hydroxyapatite (calcium and phosphate). It is, however, still unclear why only a few cases have been observed since silicone IOLs of various designs have probably been implanted in many patients with asteroid hyalosis. The small number of cases makes it difficult to prove a correlation.

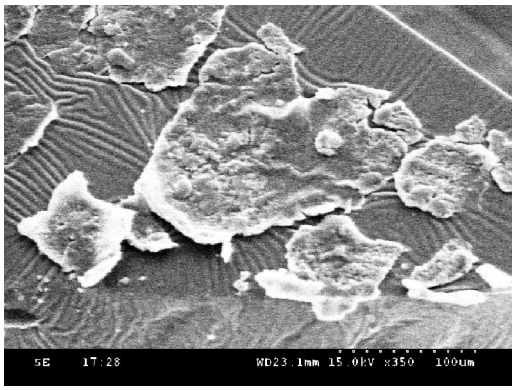

Figure 7. The deposits forming amorphous crustlike layer on theposterior optic surface of the lens under high-magnification scanning electron photography.

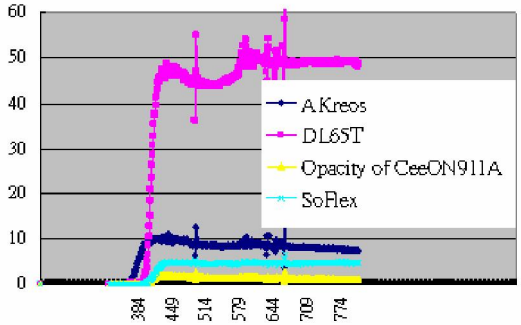

Figure 8. The transmission spectrum of IOL covered from 320 nm to 750 nm. The transmission intensities are weak when the wavelength of light is less than 400 nm for these four types of IOL.

In 2005, Werner et al. [7] described a patient with bilateral asteroid hyalosis. A 3-piece silicon IOL in one eye was explanted because of calcification. It is interesting to note that the hydrophobic acrylic lens implanted in the contralateral eye showed no opacities. The authors suggested that IOL in asteroid hyalosis is not associated with acrylic lenses.

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