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Analysis of Opacified Hydrophilic IOLs After DSAEK

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Purpose

- Calcification of hydrophilic IOLs is a rare compliaction.[1]
- The injection of gas into the anterior chamber during DSAEK seems to increase the risk for opacifications.[2-4]
- Granular deposits below the anterior surface of the IOLs can be responsible for such a decrease in visual acuity that patients require IOL exchange.
- The composition of the deposits can be analyzed by means of x-ray spectroscopy.[1]

1.) Khoramnia R, Salgado JP, Auffarth GU, Schmidt S, Wegner A, Kobuch KA, Winkler von Mohrenfels C. Opacification of a hydrophilic intraocular lens 4 years after cataract surgery. A biomaterial analysis. *Ophthalmologe*. 2012 May;109(5):483-6.

2.) Dhital A, Spalton DJ, Goyal S, Werner L. Calcification in hydrophilic intraocular lenses associated with injection of intraocular gas. *Am J Ophthalmol*. 2012 Jun;153(6):1154-60.e1.

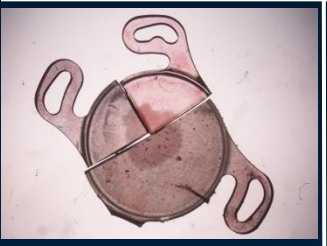
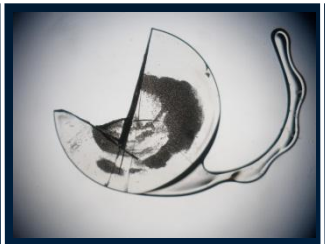
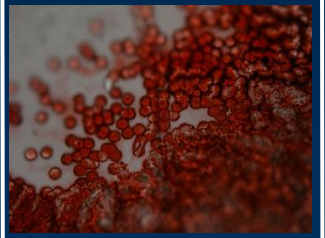
3.) Werner L, Wilbanks G, Ollerton A, Michelson J. Localized calcification of hydrophilic acrylic intraocular lenses in association with intracameral injection of gas. *J Cataract Refract Surg*. 2012 Apr;38(4):720-1.

4.) Schmidinger G, Pemp B, Werner L. Opacification of an intraocular lens : Calcification of hydrophilic intraocular lenses after gas tamponade of the anterior chamber. *Ophthalmologe*. 2013 Nov;110(11):1066-8.

Methods

- Six hydrophilic IOLs with opacification after DSAEK have been evaluated in this ongoing analysis so far.
- The explanted IOLs were cut in half.
- One half was stained (Alizarin red and von Kossa) and examined using light microscopy.
- The other half was examined using scanning electron microscopy.
- The composition of the deposits was analyzed by means of x-ray spectroscopy.

Results: Light microscopy

IOL 1	IOL 2	IOL 3	IOL 4	IOL 5	IOL 6
 Overview, Alizarin red	 Overview	 Overview	 Overview	 Overview	 Overview
 Alizarin red, orig. magnif. x 4	 Alizarin red, orig. magnif. x 4	 Unstained, orig. magnif. x 40	 Alizarin red, orig. magnif. x 10	 Alizarin red, orig. magnif. x 4	 Unstained, orig. magnif. x 4
 Alizarin red, orig. magnif. x 10	 Alizarin red, orig. magnif. x 40	 Alizarin red, orig. magnif. x 4	 Alizarin red, orig. magnif. x 40	 Alizarin red, orig. magnif. x 20	 Alizarin red, orig. magnif. x 4
 von Kossa, orig. magnif. x 40	 von Kossa, orig. magnif. x 40	 von Kossa, orig. magnif. x 20	 von Kossa, orig. magnif. x 40	 von Kossa, orig. magnif. x 20	 von Kossa, orig. magnif. x 20

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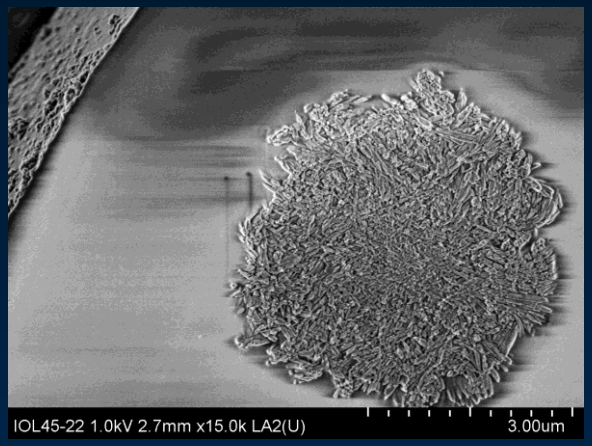
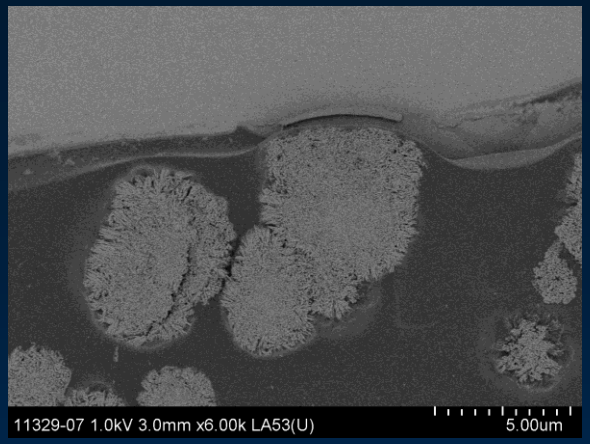
Results: Scanning Electron Microscopy

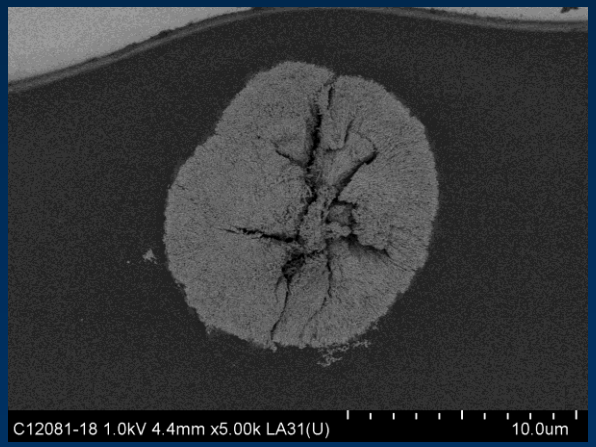


IOL 1

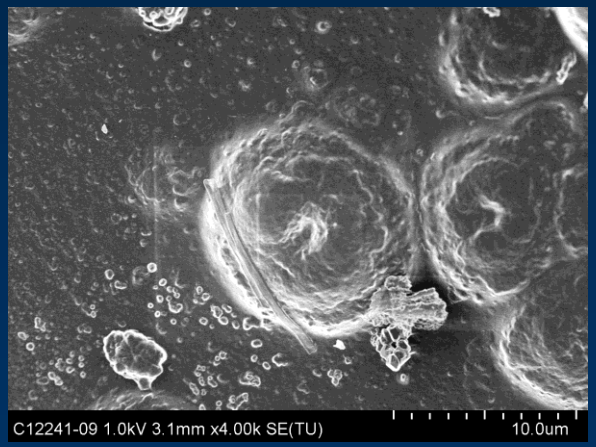


IOL 2

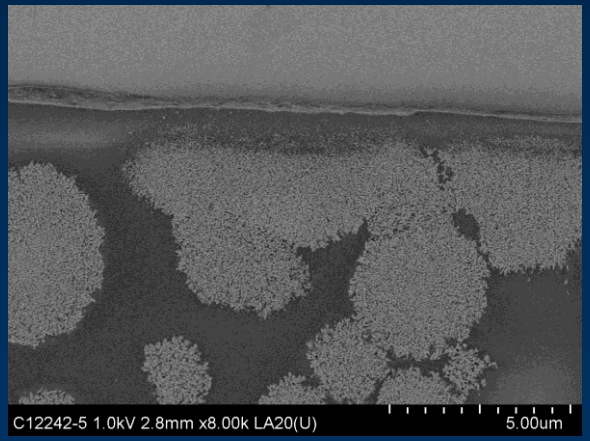
IOL 3



IOL 4



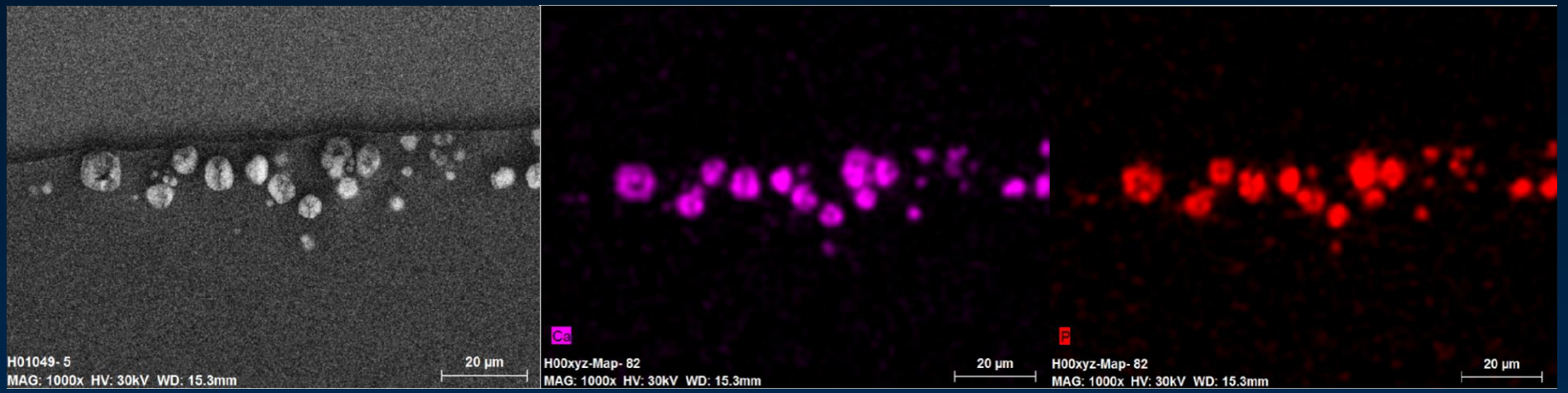
IOL 5



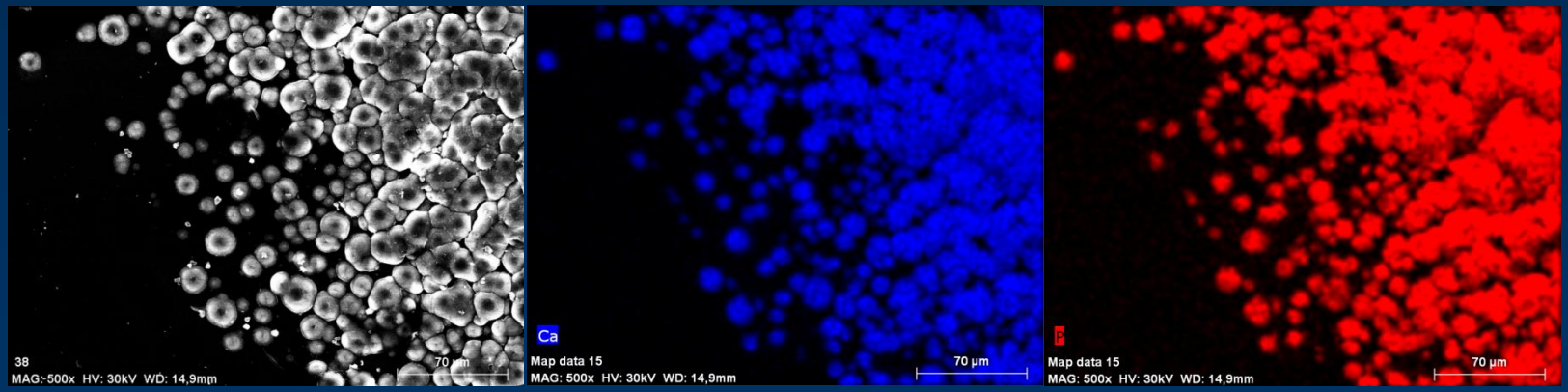
IOL 6

Numerous fine, granular deposits within the optic of the IOL, which were distributed in a line parallel to the anterior surface of the IOL.

Results: Element Mapping



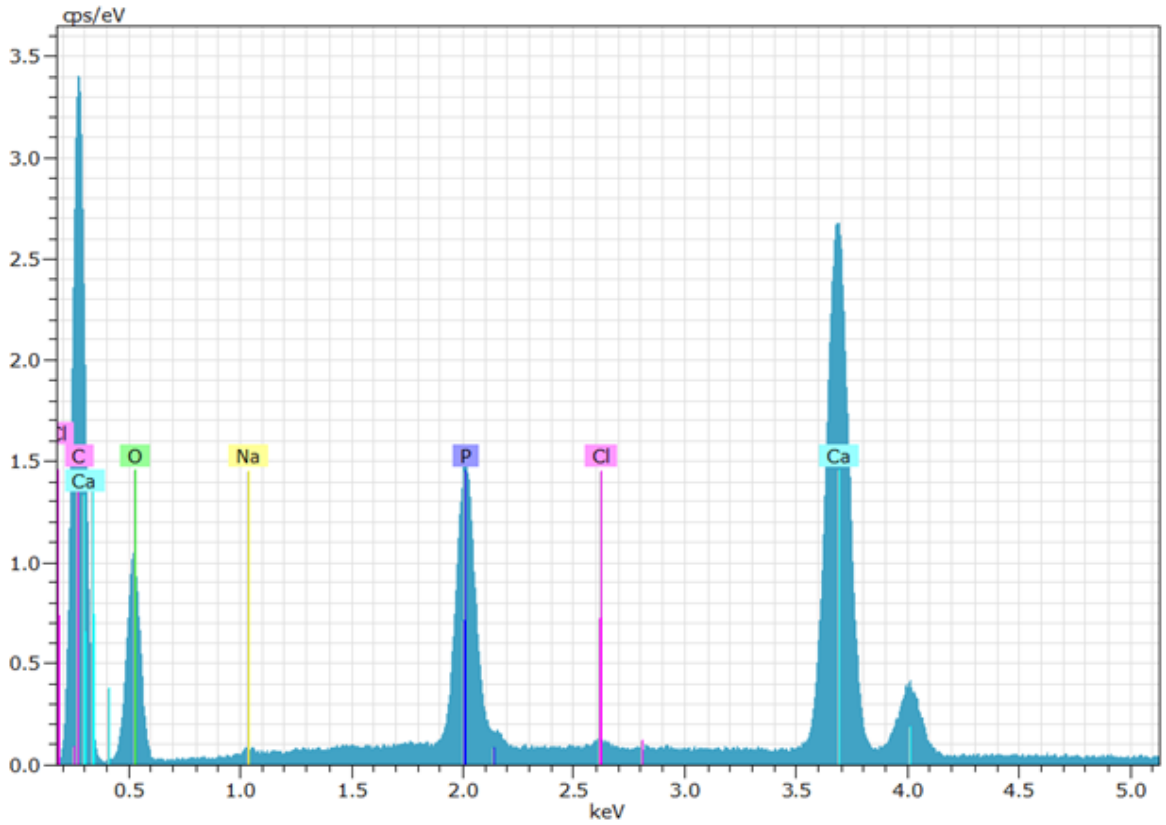
IOL 4



IOL 5

Results: X-Ray Spectroscopy

IOL 5



Element	Series	unn. C [wt.%]	norm. C [wt.%]	Atom. C [at.%]	Error (1 Sigma) [wt.%]
Carbon	K-series	58.55	58.55	68.25	7.00
Oxygen	K-series	32.28	32.28	28.25	4.34
Phosphorus	K-series	2.38	2.38	1.08	0.12
Calcium	K-series	6.53	6.53	2.28	0.22
Chlorine	K-series	0.04	0.04	0.02	0.03
Sodium	K-series	0.22	0.22	0.14	0.05
	Total:	100.00	100.00	100.00	

Calciumphosphate

Discussion

- The cause for calcification of IOLs has not yet been determined.
- Opacifications are often localized in the pupillary area of the IOLs.
- The surface of the IOLs might be affected by the gas bubble → development of a crystallization nucleus[1]
- The altered blood-aqueous barrier might co-act to trigger secondary IOL calcification.[2]

1.) Schmidinger G, Pemp B, Werner L. Opacification of an intraocular lens : Calcification of hydrophilic intraocular lenses after gas tamponade of the anterior chamber. *Ophthalmologe*. 2013 Nov;110(11):1066-8.

2.) Dhital A, Spalton DJ, Goyal S, Werner L. Calcification in hydrophilic intraocular lenses associated with injection of intraocular gas. *Am J Ophthalmol*. 2012 Jun;153(6):1154-60.e1.

Summary

- The injection of gas into the anterior chamber during DSAEK seems to increase the risk for opacifications.
- Calciumphosphate can be stained using Alizarin red or von Kossa.
- The exact chemical composition of the deposits can be assessed using X-ray spectroscopy.

Summary

- The incidence of opacifications of hydrophilic IOLs after DSAEK does not seem to be very high.

- Nevertheless, the implantation of a hydrophilic IOLs does not seem to be the ideal solution in patients who might require corneal surgery later on.[1]

- An IOL exchange and the associated risks could be avoided in such patients by use of hydrophobic IOLs.[1]

1.) Schmidinger G, Pemp B, Werner L. Opacification of an intraocular lens : Calcification of hydrophilic intraocular lenses after gas tamponade of the anterior chamber. *Ophthalmologe*. 2013 Nov;110(11):1066-8.

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