

# Laser capsulotomy following cataract surgery: Comparing time to capsulotomy with implantation of two broadly used intraocular lenses

Yael Sharon<sup>1</sup>, Eitan Livny<sup>1</sup>, Michael Mimouni<sup>2</sup>, Dov Weinberger<sup>1,3</sup>, Irit Bahar<sup>1,3</sup>

**Purpose:** The aim of this study is to compare the length of time from uneventful cataract surgery using one of two common posterior chamber intraocular lenses (IOLs) (hydrophilic versus hydrophobic acrylic) to laser capsulotomy. **Materials and Methods:** Retrospective analysis of all patients who underwent neodymium: yttrium-aluminum-garnet laser capsulotomy between 2011 and 2014 following uneventful phacoemulsification surgery at a tertiary university-affiliated medical center. Medical records were reviewed for demographics, ocular comorbidities, operative details, postoperative follow-up, and findings of the precapsulotomy ophthalmologic examination. Parameters, including age, sex, laterality, visual acuity, surgeon's experience, and time from cataract surgery to capsulotomy, were compared between patients who received hydrophilic (SeeLens AF, Kibbutz Hanita, Israel) or hydrophobic (AcrySof SA60AT, Alcon Laboratories, Fort Worth, TX, USA) IOLs. **Results:** The cohort included 222 patients (255 eyes), of which, 107 were male and 115 female, of mean age  $73 \pm 8$  years. Mean interval from cataract surgery to laser capsulotomy was 24 months (range 2–70) and was significantly shorter in patients with SeeLens ( $23 \pm 13$  months) than AcrySof IOL implantation ( $28 \pm 13$  months,  $P = 0.04$ ). Lens type remained significant in multivariate analysis after including surgeon's experience and age as potential confounders ( $P = 0.04$ ). **Conclusion:** The hydrophilic SeeLens IOL is associated with a significantly shorter time interval from cataract surgery to laser capsulotomy than the hydrophobic AcrySof IOL.

**Key words:** AcrySof, intraocular lens, laser capsulotomy, posterior capsular opacification, SeeLens

Posterior capsular opacification (PCO), also known as a secondary cataract, is a complication of primary phacoemulsification surgery and commonly causes optic clarity disturbances and decreased visual acuity in pseudophakic patients.<sup>[1,2]</sup> PCO is attributed to postoperative proliferation and migration of residual lens epithelial cells within the posterior capsular bag<sup>[3,4]</sup> and is treated by neodymium: yttrium-aluminum-garnet (Nd:YAG) laser capsulotomy. Reported rates of patients requiring laser capsulotomy following cataract surgery range widely, from 2% to 50% of eyes, depending on the length of the postoperative period and a variety of factors that affect PCO development. Such factors include patients' age, ocular, and systemic diseases as well as surgical technique.<sup>[5–10]</sup> In addition, the design and material of the intraocular lens (IOL) implanted during cataract surgery plays an important role.<sup>[11–16]</sup> Several studies have found significantly lower rates of PCO and laser capsulotomy (2%–10%) in patients implanted with an acrylic hydrophobic IOL versus an acrylic hydrophilic IOL.<sup>[17–20]</sup> More specifically, the AcrySof hydrophobic IOL has been associated with a low risk of PCO.<sup>[16,17,19,21,22]</sup> Although Nd:YAG laser capsulotomy is effective and simple to perform, it poses a significant financial burden to the health-care system and may itself cause serious complications, such as IOL damage, intraocular pressure

elevation, lens subluxation, cystoid macular edema, retinal breaks, and retinal detachment.<sup>[23–25]</sup>

In selecting an IOL, the duration of time from cataract surgery to PCO formation is also an important factor and differs from one lens to another. The aim of this study was to compare the length of time to laser capsulotomy following implantation of two specific types of single-piece acrylic intraocular lenses (IOLs) widely used: The hydrophilic SeeLens AF IOL (Hanita Lenses, Kibbutz Hanita, Israel) and the hydrophobic AcrySof SA60AT IOL (Alcon Laboratories Inc., Fort Worth, TX, USA).

## Materials and Methods

The electronic database of a tertiary university-affiliated medical center was searched for all patients who underwent Nd:YAG laser capsulotomy from January 2011 to July 2014 following uneventful phacoemulsification surgery. Exclusion criteria were the presence of ocular pathologies other than senile cataract (e.g., corneal disease, uveitis, open or closed angle glaucoma, pseudoexfoliation syndrome, retinitis pigmentosa, proliferative diabetic

### Access this article online

#### Website:

www.ijo.in

#### DOI:

10.4103/ijo.IJO\_933\_16

### Quick Response Code:



<sup>1</sup>Department of Ophthalmology, Rabin Medical Center, Petach Tikva,

<sup>2</sup>Department of Ophthalmology, Rambam Medical Center, Haifa,

<sup>3</sup>Department of Ophthalmology, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

**Correspondence to:** Dr. Yael Sharon, Department of Ophthalmology, Rabin Medical Center, Beilinson Hospital, 39 Jabotinsky St., Petach Tikva 49100, Israel. E-mail: yaelpauker@gmail.com

**Manuscript received:** 05.12.16; **Revision accepted:** 29.01.17

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**Cite this article as:** Sharon Y, Livny E, Mimouni M, Weinberger D, Bahar I. Laser capsulotomy following cataract surgery: Comparing time to capsulotomy with implantation of two broadly used intraocular lenses. Indian J Ophthalmol 2017;65:144-7.

retinopathy, exudative age macular degeneration, and high myopia), history of intraocular surgery and evidence of intraoperative complications (e.g., capsulorhexis rim tear, incomplete continuous curvilinear capsulorhexis, zonular rupture, and posterior capsule rupture) or postoperative complications (e.g., iris synechiae, toxic anterior segment syndrome). Patients for whom data were missing or incomplete were excluded from the study. All cataract surgeries were performed at our medical center, by either senior surgeons (attending ophthalmologists) or 5<sup>th</sup>-year ophthalmology residents (junior surgeons), with a standard phacoemulsification, aspiration and implantation of an intraocular lens. Thorough rotation of the nucleus following hydroprocedures and thorough polishing before IOL implantation were performed in every cataract surgery, as it is a common practice in our institute. The type of lens selected for implantation between the two types available at our center, namely, the hydrophilic SeeLens or the hydrophobic AcrySof, was left to the discretion of the attending surgeon. Patients were encouraged to return to our medical center for examination if vision deteriorated at any time after surgery.

PCO was diagnosed on the basis of a subjective patient complaint of blurred vision and clinical findings on ophthalmological examination, including opacity in the central 3 mm area of the IOL optic. Positive findings of PCO and best-corrected visual acuity (BCVA) <6/9 served as the basis for the decision to treat. Patient- and procedure-related data were retrieved retrospectively from the medical files, as follows: Patients' age and sex, laterality, ocular comorbidities, date of cataract surgery, relevant details from the operative report completed by the surgeon immediately after surgery (including the name of the surgeon, lens type, and intraoperative complications), and findings on postoperative follow-up. Details from Nd:YAG laser, capsulotomy report was retrieved as well, including date of capsulotomy, BCVA, funduscopic examination with pupil dilatation, and slit-lamp assessment of PCO.

The study was approved by the local Institutional Review Board. This is a retrospective analysis and therefore, for this type of study, formal consent was not required.

Statistical analysis was performed with the SPSS statistical package, version 17 (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as a mean and standard deviation, minimum and maximum and categorical variables, as percent distribution. Pearson's Chi-square test was used to compare the mean values of categorical variables. Variables were compared between groups using unpaired Student's *t*-test. Backward elimination regression analysis was performed to determine predictors of time from cataract surgery to laser capsulotomy. For this purpose, independent variables with a significance level of <0.05 in univariate analysis were included. Snellen visual acuity values were converted to logMAR notation for analysis. The value of *P* < 0.05 was considered statistically significant.

## Results

The study group included 222 patients (255 eyes), 107 (48%) male and 115 (52%) female, of mean age 73 ± 8 years at the time of laser capsulotomy. A comparison between the hydrophilic (SeeLens) and hydrophobic (AcrySof) IOL groups

is depicted in Table 1. The SeeLens group was generally older (72.04 ± 8.55 versus 67.38 ± 7.59, *P* = 0.003) and a lower percentage of these lenses implanted by experienced surgeons (83% vs. 100%, *P* = 0.006) than the AcrySof group. There were no significant differences between both lenses in terms of gender or BCVA at presentation.

The mean interval between cataract surgery and laser capsulotomy was 24 ± 13 months (range 2–70 months). There was no significant difference between experienced and nonexperienced surgeons in terms of the time interval (24.1 ± 13.7 versus 23.6 ± 12.1, *P* = 0.81).

The time interval was significantly shorter for surgeries with SeeLens (23.3 ± 13.5 months) than AcrySof implantation (28.2 ± 13.0 months, *P* = 0.04) [Fig. 1]. In backward elimination regression analysis with age at cataract surgery, with surgeon's experience and lens type as independent variables and time from cataract surgery to laser capsulotomy as the dependent variable, only lens type remained statistically significant (*P* = 0.04).

## Discussion

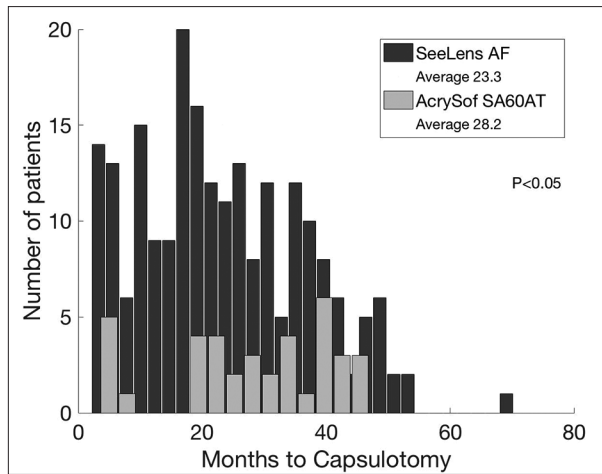
This study compares the time interval to Nd:YAG laser capsulotomy following uneventful cataract surgery with implantation of one of two commonly used hydrophilic or hydrophobic acrylic posterior chamber IOLs. To the best of our knowledge, there are no published studies comparing this single-piece acrylic hydrophilic IOL (SeeLens AF) with other IOLs.

The results showed that compared to the single-piece acrylic hydrophobic lens (AcrySof SA60AT), the widely used hydrophilic lens (SeeLens AF) was associated with a statistically significant shorter time span between uneventful cataract surgery and laser capsulotomy. The overall mean time elapsed between cataract surgery and laser capsulotomy was 24 months (range 2–70 months), which is in-line with the follow-up time reported in previous prospective studies.<sup>[16,17,20]</sup> Importantly, the mean interval was significantly shorter, by almost 5 months, for implantations of the hydrophilic lens compared to the hydrophobic lens [Fig. 1]. Since we used a

**Table 1: Comparison of SeeLens AF and AcrySof SA60AT parameters**

Parameter	SeeLens AF (n=217)	AcrySof (n=38)	<i>P</i>
Age at cataract surgery	72.04±8.55	67.38±7.59	0.003
Male (%)	49.47	40.63	0.35
Right eye (%)	53.46	39.47	0.11
Senior surgeon (%)	83.0	100	0.006
BCVA at presentation with PCO*	0.24±0.20	0.22±0.19	0.50
Time from surgery to PCO (months)	23.3±13.5	28.2±13.0	0.04

Values are presented as *n* (%) or mean±SD. \*LogMAR notation. Dependent variable is time from surgery to PCO (months). In backward elimination regression analysis that included lens type, senior/junior surgeon and age at cataract surgery as independent variables, the only variable that remained significant was lens type (*P*=0.04). BCVA: Best-corrected visual acuity, PCO: Posterior capsule opacification, SD: Standard deviation



**Figure 1:** Histogram of number of patients per time interval between cataract surgery and laser capsulotomy for the two types of intraocular lenses, including means of each lens

retrospective study design, the “real-life” interval between cataract surgery and laser capsulotomy was unlimited, as opposed to prospective studies in which the follow-up time is predefined. This statistically significant difference in the time interval between the two lenses may also be related to higher laser capsulotomy rates found in previous studies after implantation of hydrophilic versus hydrophobic IOLs.<sup>[17-21]</sup>

The lack of a statistically significant difference in BCVA before laser capsulotomy by type of lens implanted suggests the severity of PCO was similar between the two groups.

In this study, different surgeons with varying experience performed the cataract surgeries. Therefore, our results may be generally applicable to other public tertiary medical centers. At the same time, this factor may act as a possible confounder; since the surgeries were performed by multiple surgeons, analysis of the outcome of surgery may not be free of bias. To account for possible bias, we divided the operating surgeons into two groups by expertise and adjusted the results accordingly. In contrast to the study of Fong *et al.*<sup>[7]</sup> that found a correlation between surgical experience and laser capsulotomy rates, we did not find a correlation between surgical experience and time from cataract surgery to capsulotomy regardless of the type of IOL used.

The main value of this study lies in the finding of a significantly shorter time interval from cataract surgery to laser capsulotomy with the acrylic single-piece SeeLens hydrophilic lens, versus the AcrySof hydrophobic lens, a relationship that has not been previously investigated.

As described in an earlier retrospective study by Johansson,<sup>[18]</sup> the quality and reliability of the data depend on the functionality of the public health-care system within which the study is performed and the possibility of over- or under-treatment. Our public health system is appropriate for this study, with a relatively short waiting list for capsulotomy (maximum 3 months), long follow-up, no-cost patient treatment, and no incentives for the treating ophthalmologists.

However, this study was limited by its retrospective design. Further randomized prospective studies are needed to evaluate the long-term impact of using these IOLs as opposed to other

types of lenses in clinical practice in terms of the risk of PCO development.

An additional limitation of this study was that PCO was assessed by a clinical examination of the treating ophthalmologist without the use of a classification system. However, in all patients, PCO caused significant enough visual disturbances that prompted individuals to seek medical attention and was deemed clinically significant by the treating ophthalmologist. The design of this study did not allow for the comparison of risk factors and evaluation of laser capsulotomy rates in all the patients in our medical center. In addition, because laser capsulotomy was the primary endpoint, we were unable to track every patient who underwent laser capsulotomy after cataract surgery. Therefore, patients with PCO who attended other medical centers or did not seek medical help were not detected. Nevertheless, it is plausible that the majority of patients with PCO causing significant visual disturbances would seek medical care and return to their providing medical center. Furthermore, following cataract surgery at our medical center, patients are routinely instructed to return for examination if at any time they find their vision has deteriorated. Systemic factors, such as diabetes, were not incorporated into this study; however, patients with ocular pathologies other than senile cataract were excluded from the study. Furthermore, the current study’s findings apply only to the specific lenses tested and may not apply to other hydrophilic or hydrophobic lenses.

## Conclusion

Duration from uneventful cataract surgery to laser capsulotomy in patients with no ocular comorbidities is significantly shorter with implantation of the acrylic hydrophilic IOL, SeeLens AF, than with the acrylic hydrophobic IOL, AcrySof SA60AT. The unique finding of this study is the shorter time from cataract surgery to laser capsulotomy after implantation of the hydrophilic lens, in comparison to the hydrophobic lens, a finding that was not reported before. Future prospective studies comparing PCO grading of different lenses and SeeLens AF with masked observers before performing laser capsulotomy may be of interest to explore additional characteristics of these lenses.

## Acknowledgment

The authors would like to thank Jenna Gaska, from Princeton University, for editorial assistance in the preparation of the manuscript.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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