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Update on a long-term, prospective study of capsulotomy and retinal detachment rates after cataract surgery

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Abstract

Purpose: To evaluate the retinal detachment (RD) risks and YAG capsulotomy (YAG) rates associated with different cataract approaches and intraocular (IOL) lens styles in a long-term, prospective clinical study.

Setting: Clinical practice of one ophthalmologist (G.O.) in Colorado.

Methods: A prospective cataloging of 1) surgical approach, date and complications, 2) IOL type, 3) axial length, 4) patient age and sex, 5) YAG and date, and 5) RD and date.

Results: Phacoemulsification (PE) had a lower risk of RD than intracapsular cataract extraction (ICCE)(0.4% vs. 5.4%; $P < 0.001$) and extracapsular cataract extraction (ECCE) (0.4% vs 1.6%; $P = 0.002$). While RD was significantly associated with YAG for ECCE (3.1% vs 1.0%; $P = 0.01$), no patient had an RD after YAG in the PE group. RD was strongly associated with axial length of 24.0 mm and greater ($P < 0.001$), age of 60 or less if axial length is 24.0 mm or greater (for ECCE, $P = 0.001$; for PE, $P = 0.01$) and for maleness (for ECCE, $P = 0.04$; for PE, $P = 0.02$).

Regarding IOL styles the Surgidev B20/20 ($P < 0.001$) and AcrySof MA60 ($P < 0.001$) had significantly reduced YAG rates, while the Cilco UPB 320GS had a significantly higher YAG rate ($P < 0.001$).

Conclusion: Cataract surgical approach and IOL style significantly impact YAG and RD rates. Maleness, being 60 or under, and especially having an axial length of 24.0 mm or greater require special scrutiny. Some YAG approaches may not put the patient at increased risk for RD.

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Synopsis:

Reviewing YAG and RD after cataract surgery, PE and some IOL styles were protective while maleness, axial length of 24.0mm or greater and age of 60 or less were risk factors. YAG was not a risk for RD after PE.

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Cataract surgery, retinal detachment and capsulotomy are three intertwined entities that have significant impact in regard to societal financial outlay and patient outcomes. So much has been published on the subject[1-11] that it may seem as though there is really little that is new to say, and reconfirming the obvious is a relatively moot point. Although this study is on the subject, it does represent an unusual twenty-two year prospective labor on the part of one ophthalmic surgeon who recorded all surgical procedures, surgical complications, axial lengths, intraocular lens (IOL) styles, capsulotomies and retinal detachments for this period of time. We last reported results from this effort through December 31, 1992[12] and we feel that an update does present interesting new information on this subject.

MATERIALS AND METHOD

All patients operated for cataract surgery with an IOL by one surgeon (G.O.) from January 1, 1976 to December 31, 1997 were included in this study. Follow up is inclusive of all patients through June 30, 1999.

The following results were prospectively recorded: 1) date of cataract surgery, 2) surgical approach, 3) surgical complications, 4) IOL type, 5) axial length, 6) sex of patient, 7) age of patient at the time of cataract surgery, 8) capsulotomy by YAG laser and date, and 9) retinal detachment and date.

This information was tabulated and compared using chi-square analysis.

RESULTS

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With six and a half additional years of information, there was no change in the 5.4% retinal detachment rate of those patients operated with intracapsular cataract extraction (ICCE) with intraocular lens insertion. The planned extracapsular cataract extraction (ECCE) stabilized with a retinal detachment rate of 1.6% (18 of 1099), which difference in comparison to ICCE was statistically significant ($P < 0.001$). The group with phacoemulsification (PE) and intraocular lens insertion, had a decreased incidence of retinal detachment from 6.5 years ago of 0.8% to 0.4% (6 of 1418) presently. This difference is statistically significantly less than both ICCE ($P < 0.001$) and ECCE ($P = 0.002$; Table 1).

One retinal detachment was associated with vitreous loss in 23 cases (vitreous loss rate of 0.9%). The retinal detachment rate for ECCE patients after YAG capsulotomy is 3.1% (12 of 391) versus 1.0% (7 of 708) without a capsulotomy, which difference is significant ($P = 0.01$). Interestingly, in the PE group to date, with six retinal detachments, none of these had a previous capsulotomy (Table 2).

Just as we previously reported, retinal detachment was strongly associated with axial length of 24.0 mm or longer. In fact, no retinal detachment occurred in a PE patient under 24.0 mm long ($P < 0.001$; Table 3). The male retinal detachment risk was also reconfirmed, both for ECCE ($P =0.04$) and for PE ($P =0.02$). Similarly, we reconfirmed being under the age of 60, only for axial lengths of 24.0 mm and more, as a retinal detachment risk factor. We found females significantly less likely to have eyes 24.0 mm or longer (males 229 of 533 or 41% and females 165 of 885 or 19%; $P < 0.001$; Table 4)

Regarding capsulotomy rates, the polymethylmethacrylate (PMMA) IOL styles were relatively consistent across the spectrum with the exceptions of the B20/20 lens (Surgidev) which has maintained a low capsulotomy rate of 20.4% in spite of consistently using a can opener capsulotomy ($P < 0.001$ compared to all other PMMA IOLs) and the UPB 320 GS (Cilco) with a high capsulotomy rate of 68.1%

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in which continuous curvilinear capsulorhexis (CCC) was used ($P < 0.001$ compared to all other PMMA IOLs).

The results with the AcrySof (Alcon Laboratories, Fort Worth, Texas) lens appear very impressive with a one-year capsulotomy rate of 5.4%, a two-year rate of 6.3% and a three-year rate of 10.3%. Comparing the three-year rate with the UPB 320 GS which is the only PMMA IOL with a similar follow-up both of which had CCC, the AcrySof is significantly better ($P < 0.001$; Table 5).

DISCUSSION

While the previous study suggested that there might be a YAG capsulotomy effect on retinal detachment, it was noted that six of the seven most recent retinal detachments after YAG capsulotomy and ECCE occurred when the patient was dilated at the time of capsulotomy. This prompted a change to small capsulotomies with undilated pupils (in all cases with an axial length of 24.0 mm or longer) and with minimal energy used. Amazingly, in our PE group, the evidence to date would suggest that YAG capsulotomies are protective! While we certainly would not make this claim from this one study, what we can say is that we may have to rethink the generally accepted claim of an increased retinal detachment risk after capsulotomies. Not dilating the pupil decreases energy used, size of the capsulotomy and may buffer the fluid shock waves in ways that are protective. Laser instruments have also improved with greater delivered accuracy and efficiency. We still want to avoid any secondary procedure simply because of societal cost; however, if just from the medical legal standpoint and patient informed consent, it would be nice to know if an increased risk of retinal detachment is still a real concern. We doubt it is for most practices today.

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Additionally, we had no cases of clinical cystoid macular edema or intraocular pressure problems in any patient after YAG capsulotomy in the PE group**.** We, therefore, suggest the risk is, indeed, minimal with conservative YAG capsulotomy in the vast majority of patients.

The main factor that we found associated with retinal detachment is an axial length greater than 24.0 mm. For eyes greater than 24.0 mm axial length, an additional risk factor was age of 60 or under. A male under age 60 with an axial length greater than 24.0 mm long, with or without YAG capsulotomy, had a 7.5% incidence of retinal detachment after PE compared to a zero risk for those without these three risk factors! Gender difference with a higher risk for males was only noted when looking at all patients. Interestingly, females were significantly less likely to have an axial length of 24.0 mm or greater. This alone could be the reason males are at greater risk for retinal detachment. This was all similar in degree in our previous report and, therefore, we strongly feel all three factors, especially when combined, deserve careful informed consent and meticulous retinal review and follow-up.

It has long been debated whether or not intraocular lenses have specific long-term impact on the incidence of posterior capsular opacification (PCO). In this study, PMMA was relatively consistent at about a 50% capsulotomy rate with many years of follow-up with few interesting exceptions. The Surgidev B20/20, an angulated, very stiff, all-PMMA IOL had a 13+ year capsulotomy rate of 20.4%, which was highly significantly better than the other PMMA IOLs, even though they had shorter follow-up.[1] Interestingly, the Cilco UPB320GS has had the shortest follow-up and yet has a significantly higher capsulotomy rate. We feel the amount of posterior pressure maintaining 360° of capsular contact is the important differentiating factor here. Many consider CCC as important in PCO prevention. In this case, can-opener was used with the Surgidev B20/20 and CCC with the Cilco UPB 320GS. This indicates lens design is much more important than whether CCC is used!

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The AcrySof acrylic IOL with its squared-off edge has raised a lot of hope in regard to its PCO advantage. With a 3-year capsulotomy rate of 10.3% highly significantly better than the Cilco UPB 320 GS as the only PMMA lens implanted at about the same time period, it is apparent AcrySof has a definite PCO advantage. We doubt it will be any better than the B20/20 after 13+ years, however, which is consistent with the idea that the AcrySof PCO edge is also due to mechanical factors. Nishi, et al,[13] for example, was able to duplicate the AcrySof effect with a squared-edge PMMA IOL. Other IOL designs will take advantage of this biomechanical advantage. Some second-generation silicone IOLs have also recently been shown to have impressive advantage over PMMA with a long-term visual acuity and PCO edge similar to AcrySof.[14] This effect was documented without a squared-off edge and certainly without the stiffness of the B20/20 suggesting a biomaterials effect. This PCO advantage certainly is not documented for all silicone IOL materials[15] and it is, therefore, a mistake to lump silicones together. Unfortunately, this study does not have a silicone lens group for comparison.

In conclusion, an ophthalmologist in a medium-size town with a homogeneous population can do significant clinical research with impact on our understanding of the complications associated with cataract surgery. The weakness of this study is the same as we outlined in our previous report: Complications were only known if the patient came back for follow-up; however either active files exist or the patients are deceased in over 95% of all patients operated! We feel this is not a valid concern and it could in no way diminish our provocative conclusion that YAG capsulotomy done with an undilated pupil for axial lengths greater than 24.0 mm and minimal energy is not a risk factor for retinal detachment. We look forward to other studies in regard to this conclusion.

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Table 1: Retinal detachment rates for intracapsular cataract extraction (ICCE), planned extracapsular cataract extraction (ECCE) and phacoemulsification (PE) all with intraocular lens insertion

	# Cases	**Follow up (years)**	**# (%) with Retinal Detachment**
ICCE	222	18-22	12 (5.4%)[1,2]
ECCE	1099	8-18	18 (1.6% [1,3]
PE	1418	1-8	6 (0.4%).[2,3]

1. $P = < 0.001$
2. $P = < 0.001$
3. $P = < 0.002$

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Table 2: Retinal detachment rates associated with YAG laser capsulotomy (YAG) for patients after planned extracapsular cataract extraction (ECCE) and phacoemulsification (PE) both with intraocular lens insertion

	# Cases	**# (%) with Retinal Detachment**
ECCE		
Without YAG	708	7 (1.0%)[1]
With YAG	391	12 (3.1%)[1]
PE		
Without YAG	996	6 (0.6%)
With YAG	422	0 (0%)

1. $P = 0.01$

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Table 3: Retinal detachment associated with axial length greater than 24.0 mm in patients undergoing cataract surgery by extracapsular cataract extraction (ECCE) and by phacoemulsification (PE) both with IOL insertion.

	Axial length <24.0 mm		**Axial length >24.0 mm**	
	Number Patients	**Retinal Detachment # (%)**	**Number Patients**	**Retinal Detachment # (%)**
ECCE	784	4 (0.5%)[1]	315	15 (4.8%) [1]
PE	1024	0 [2]	394	6 (1.5%) [2]

1. $P < 0.001$
2. $P < 0.001$

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Table 4: Retinal detachment rates associated with sex and age under 60 at time of surgery for patients undergoing cataract surgery by extracapsular cataract extraction (ECCE) and phacoemulsification (PE) both with intraocular lens insertion.

		Axial Length <24.0 mm		Axial length > 24.0 mm	
		≤ 60	**> 60**	**≤ 60**	**>60**
1. ECCE	**Male (399)**	43	237	21	98
	Detachments	0	4(1.7%)	2(9.5%)	5(5.1%)
	Female (651)	44	487	26	94
	Detachments	0	1(0.2%)	5(19.2%)	1(1.1%)
2. PE	**Male (533)**	24	280	40	189
	Detachments	0	0	3(7.5%)	2(1.1%)
	Female (885)	34	686	16	149
	Detachments	0	0	0	1(0.7%)
3. All patients	**Male (932)**	67	517	61	287
	Detachments	0	4(0.8%)	5(8.2%)	7(2.4%)
	Female (1536)	78	1173	42	243
	Detachments	0	1(0.09%)	5(11.9%)	2(0.8%)

1. For gender comparison $P = 0.04$ for ECCE; 0.02 for PE and 0.003 for all patients.
2. For age of 60 and under and axial length > 24.0 mm compared with over 60 and axial length > 24.0 mm $P = 0.001$ for ECCE; 0.01 for PE and < 0.001 for combined.

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Table 5: Rate of laser capsulotomy (YAG) for selected lens styles.

LENS	PROCEDURE	YEARS USED	TOTAL USED	YAG (%)
PMMA (Surgidev 20B)	ECCE	1983-1985	138	40 (30%)
PMMA (Surgidev B20/20)	ECCE	1984-1986	167	34 (20.4%)[1]
PMMA (Cilco 851)	ECCE	1986-1987	226	90 (39.8%)
PMMA (Cilco MC51/251)	ECCE except 10 cases of Phaco	1988-1992	483	232 (48.0%)
PMMA (Alcon M220)	Phaco	1991-1992	91	51 (56.0%)
PMMA (Cilco UPB 350 PNS)	Phaco	1992	89	45 (50.6%)
PMMA (Cilco UPB 320 GS)	Phaco	1992-1995	427	291 (68.1%)[2]
AcrySof MA60	Phaco	1 year results	738	40 (5.4%)
AcrySof MA60	Phaco	2 year results	490	(6.3%)
AcrySof MA60	Phaco	3 year results	233	24(10.3%)[3]

1. $P < 0.001$ (compared to other PMMA IOL styles)
2. $P < 0.001$ (compared to other PMMA IOL styles)
3. $P < 0.001$ (compared to Cilco UPB 320 GS as the only PMMA IOL with similar follow-up)

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